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I am pleased and privileged to extend a warm welcome to all of you to the **One-Day Online International Conference On "Multidisciplinary Research in Pure and Applied Sciences, Management, Library Science and Sports Science"**

**Online International Conference On "Multidisciplinary Research in Pure and Applied Sciences, Management, Library Science and Sports Science is** organized by Department of First Year Engineering, Prof Ram Meghe College of Engineering & Management, Badnera-Amravati. This event will take place on the 28th of July 2024 in online mode.

The primary objective of arranging this conference is to exchange and improve the understanding of all participants in this rapidly evolving Information Age. An excellent chance has been provided for individuals with a curiosity about current technological advancements to both learn and exchange their ideas. Furthermore, this event will also enable attendees to present and exchange different innovative concepts. The goal of the conference is to connect academic researchers and other professionals through research presentations and keynote speeches on modern technological trends. You will have plenty of chances to expand your knowledge and connect with others.

In advance, I extend my thanks to the conference committee for dedicating their valuable time to organizing the program, as well as to all the authors, reviewers, and other contributors for their outstanding efforts and their confidence in this Online International Conference on "Multidisciplinary research in Pure and Applied Sciences, Management, Library Science & Sports Science. I extend a warm invitation to all enthusiasts to fully engage and participate in this widely celebrated event, which has the potential to provide significant exposure and global opportunities for all.

**Dr. D. G. Harkut**

Date: 28th July 2024

Principal & Convener

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# The Importance of Reading Newspapers

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**DOI- 10.5281/zenodo.13622244**

**Abstract:**

The uses of newspaper reading are numerous. For starters, a well-rounded paper provides coverage of global and local news, weather forecasts and a whole host of entertainment and sports topics. Additionally, newspapers can keep you informed of nearby store openings, sales and job opportunities. There are many advantages of reading the newspapers. Firstly the newspapers keep us in touch with the current world affairs. Without them we cannot know the important news even of our own town or village. It extends the bounds of our knowledge and makes us feel that we are a part of a living world. The leading newspapers are in touch with the different part of the world through certain press agencies. They supply them news from every corner of the world. Secondly a great deal of information is supplied to us by the newspapers. Important decisions of law courts are published for the benefit of people.

**Keyword:** News paper, Information, Media, Reading.

**Introduction:**

Newspapers offer information about our locality as well as other parts of the world. Different kinds of newspapers are published to cater to the needs and interest of different people in the society. Reading newspaper is beneficial for everyone. However, students are especially advised to read newspaper regularly as these offer numerous benefits to them. Newspaper reading is one of the best habits one can inculcate. It provides detailed information about all the happenings across the globe sitting at one place.

In order to live comfortably and peacefully in the society one must know what is going on around him. Newspaper helps in providing information not only about your vicinity but also acquaints you with important news from around the world. In the earlier times, there were only few publications but now there are a number of newspapers available in the market. There are specialised newspapers covering different domains to cater to the needs of different sections in the society. For instance, you can lay hands on business newspapers such as 'Economic Times', 'Business Standard' and The 'Financial Express'. Similarly, you can pick 'Metropolitan Daily' Newspaper to know what's going on in the metropolitan cities. However, it is good to go for a general-interest newspaper that contains all kinds of local and global news. These newspapers are divided into different sections to make it easier to find relevant news. Reading newspaper does not only give an insight into the current affairs but also enhances vocabulary and improves reading skills. It is thus especially recommended for the students.

**Why is Newspaper Reading Important?:**

Reading newspaper is a good habit that can provide a great sense of educational value. It carries information about politics, economy, entertainment, sports, business, industry, trade and commerce. Newspapers can provide interesting things and ideas which can assist students in their learning process at school. News is one of the most important things in most people's lives. No matter what you do for a living, chances are you're engaged with the news at some level on a daily basis. On most days of the week, something is happening on a local, regional, national or global scale that merits headline coverage. For a lot of people, the first question that comes to mind each morning is, "What are the latest news headlines?"

**The Advantages of Reading Newspapers:**

The newspaper is the most powerful of all the organs of expression of the news and views about men and the things. Newspapers are regarded by economists as a necessity of modern life. With the growth of literacy and the development of the means of communication they are playing a very important part in society. There are many advantages of reading the newspapers. Firstly the newspapers keep us in touch with the current world affairs. Without them we cannot know the important news even of our own town or village. It extends the bounds of our knowledge and makes us feel that we are a part of a living world. The leading newspapers are in touch with the different part of the world through certain press agencies. They supply them news from every part of the world. Secondly a great deal of information is supplied to us by the newspapers. Important decisions of law courts are published for the benefit of his own liking.

Commercial news is published for the businessmen. Lovers of Radio and the Cinema can look up in them the daily programs of these entertainments. The advertisements help the people to buy things. The unemployed can look up the wanted columns for vacant job. Thirdly newspapers ventilate the grievances of the public and form the public opinion. They keep the public and the government in close contact. The subject matters of the leading articles in the newspapers. The rules come to know of the desire of the people through newspapers. The people get aware of the policies and schemes of the government through this agency. Lastly newspapers have their educative value also. Readers of a good newspaper are more intelligent alert and better informed than scholars. Newspapers help us in disseminating good ideas. In newspapers we find reviews on newly published books. We read accounts of discoveries and scientific research. There are useful articles on every topic. In short newspaper play vital role in our life.

- **World News:**

One of the biggest benefits of reading newspapers on a regular basis is doing so keeps you informed of all the latest world events. It's useful to stay updated on news items as they unfold. By reading newspaper on a daily basis, you're better equipped to form opinions on things that are currently happening, and you're also likelier to be prepared if a world event has a direct impact on your life.

- **Local News:**

Another major advantage to reading newspapers daily is you're always up to date on important local news. Whether you live in or near a big city or small town, things are happening regularly that affect your community in various ways. Some of the news might involve local elections or public policy, while other stories might concern special events, such as the unveiling of bridges or public monuments, or the opening of new businesses in your area.

- **Entertainment:**

Serious topics are not the only things covered in most newspapers. Fact is, the majority of readers see equal importance in the areas of entertainment and recreation. After all, what would a day be like if there were no music, movies or fun activities to distract from the often-dreary realities of world events and politics as usual? Entertainment coverage can range from reviews of the latest movies and music releases, to previews of upcoming concerts and theatrical productions.

- **Sports:**

For people who get their kicks from watching and analyzing ball games, speed races and wrestling matches, newspapers are also a plentiful source of sports coverage. No matter which sports are in season, chances are there's a decisive win or an upset to be reported from the grounds of one of the major sporting leagues.

- **Advertisements:**

Newspapers, by contrast, offer an affordable medium in which all types of businesses can get products and services exposed to consumers within a given range of distribution. In fact, some people have amassed fortunes by taking one tiny ad that generates business in a local newspaper and repeating that ad in thousands of papers nationwide.

**Here are reasons to read Newspapers with our family.**

Kids need real-time, relevant reading. We may be surprised at how interested our children become in the news once you start reading it regularly.

- Kids need the nonfiction experience. Children need to become familiar with a variety of genres, so newspaper reading will add to their reading repertoire and mix things up a bit. Along with the children's books and stories that many families read with regularity, newspapers will give children a chance to expand their reading skills with this slightly different genre.
- Kids can stay in touch with the community and world. Whether it's a local or national publication, newspaper reading will help children stay in touch with the world around them. National events and local events, sports stories, and current news will keep kids enthralled. Many papers have a kids' section with even more timely and kid-friendly pieces. Papers today even have interactive components with slideshows and links to online resources that continue the learning.
- Kids become better readers and listeners. Whether parents read the news stories to children or whether children are reading on their own, with support, the newspaper can help children become both better readers and listeners. Newspaper reading is a whole different style for kids. This style is worth chatting about as you read; usually the important information in news articles is shared in the beginning of the article, and the details and specifics can be skimmed through at the end of the article.
- Kids love the photos. Some of the best -- and even award-winning -- photos are published in the daily newspaper. These photos are worth a million words, and many of them tell multiple stories, are open for interpretation, and are true works of art. Allowing your children to have access to these photos will open up a whole new world to them.

**How to Read the Newspaper Strategically?**

In the fast-paced world of time management, we often skim through the daily or weekly paper but never get much out of it. That is because we do not know how to read newspapers effectively. In order to disseminate the content of your daily newspaper in the allotted 15-minute

break of coffee and your morning treat you need to know what you are looking for and where to find it. This will break down how to approach the newspaper as a competitive businessman, but truly, the way you read the paper is specifically based off of what you are looking for.

**Preparation:**

Before you even open the daily newspaper, think about what you want to find out about. Where would anything related to your business be? Where are the pieces located that will provide you with high-quality information for business meetings or work conversation? Reading the newspaper daily is essential preparation to be knowledgeable on a subject before it is brought up in conversation. By knowing about it ahead of time you can draw your own conclusions and approach the topic without others influencing your initial reception of information. Know what you want from your newspaper before opening it, then dive in.

**Headlines:**

All you get is a headline, so how do you know the article is worth your time? How should you read a newspaper headline? The headlines have a very strategic structure. Subject – Verb –Object is the standard way to write a headline. This means the first word or two is all you should care about. The Eagles are the subject. The win is the action. The Super Bowl is the object. Skim down the headlines and read the first two words. Highlight the subjects that matter to you. This will save you up to a minute of reading time. This is a minute that could allow you to get through another short article.

**Highlights:**

Highlighting the news. When reading a paper you will reference something you had read later in the day or week. The most effective way to successfully find the fact you read in the newspaper is by using a highlighter. This will also point out what you have already read when you revisit the paper in the afternoon. Highlights are an effective way to save time as you read the daily newspaper, and when you revisit the daily newspaper.

**Guided practice:**

Read a current event article as class and summarize the content together. Next, identify the location in California on a map. Find the longitude and latitude of the location to reinforce geography skills. Discuss the impact the article has on the state, our county, our city, our school, our class and the individual students. Next as a class we will connect to the database of newspapers and search the topic we are discussing. We will discuss key words we might use to search and why those words would be important. Once we have searched we will look at different articles to see if they are similar in any way to the first article we read as a class. After looking at a few articles we will print one up and summarize it as a class and do all of the same things we did with the first current event. As a class we will discuss the impact the events in the article have on us today. Focusing on helping the students understand the impact history has on our lives today and how the news of today will impact the future.

**Conclusion:**

Overall a Newspaper plays an important role in any society. There is ultimate powers hold by the news publisher. They can be the reason of collapse or rising of any bad or good ideas. It is essential to be careful and present the statement of both parties in the news and make the fair judgment before condemning others.

Newspaper provides us with information collected from around the globe. It also helps to develop new ideas, and at times guide the common man how to think and discuss.

We may say that today we are living in newspaper culture. Whether in English or other regional languages, almost every person gets benefited from newspaper.

A newspaper acts an important medium to control corruption and scams. The chief topics of general interest in newspaper include politics, social issues, sports, economy, movies, and share market. Newspaper is a mode of mass communication. It is very helpful in creating social awareness. Newspaper raises voices against social issues such as child labor, dowry system, etc. They urge the common people to act and behave in a rational manner.

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# Educational use of Social Media by the Postgraduate Students of Punjabi University Patiala

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**Abstract:**
This study investigates the educational use of social media by postgraduate students at Punjabi University Patiala. It aims to explore how social media platforms are utilized for academic purposes, the benefits and challenges faced by students, and the overall impact on their learning experiences. By employing a mixed-methods approach, the research seeks to provide comprehensive insights into the role of social media in modern education.

**Keywords:** Social Media, Educational Use, Postgraduate Students, Punjabi University Patiala, Academic Learning, Digital Tools, Online Learning, Student Engagement.

**Introduction:**

Social media has become an integral part of daily life, especially among young adults. In the context of higher education, it offers numerous opportunities for enhancing learning experiences, facilitating collaboration, and accessing information. This study focuses on postgraduate students at Punjabi University Patiala and examines how they leverage social media for educational purposes. By understanding their usage patterns, motivations, and the benefits they derive, the research aims to highlight the potential of social media as a valuable educational tool. Social media has revolutionized the way individuals interact, communicate, and share information. Initially designed as platforms for social interaction, these digital spaces have evolved to play a significant role in various domains, including education. For students in higher education, particularly postgraduate students, social media offers a myriad of opportunities to enhance their learning experiences. This study delves into the educational use of social media by postgraduate students at Punjabi University Patiala, aiming to uncover how these platforms contribute to their academic journey.

Punjabi University Patiala, a prominent institution of higher learning in India, attracts students from diverse backgrounds, fostering a rich academic environment. Postgraduate students, who are often engaged in advanced studies and research, require access to a wide range of resources and collaborative opportunities. Social media platforms such as Facebook, Twitter, Instagram, LinkedIn, and specialized academic networks like ResearchGate have become valuable tools in this context. These platforms facilitate information sharing, peer interaction, collaboration on projects, and access to the latest research and academic content.

The integration of social media in education can be attributed to several factors. Firstly, the pervasive nature of these platforms ensures that students are already familiar with their functionalities, making it easier to adapt them for academic purposes. Secondly, the interactive and collaborative features of social media enhance student engagement, promoting active learning and participation. Thirdly, the global connectivity offered by these platforms allows students to access diverse perspectives, participate in international academic communities, and stay updated with global trends in their fields of study.

Despite the evident advantages, the educational use of social media is not without challenges. Concerns about the credibility of information, distractions, privacy issues, and the potential for misuse are significant considerations. This study aims to provide a balanced view by examining both the benefits and challenges faced by postgraduate students at Punjabi University Patiala in their use of social media for educational purposes. The rise of digital technologies and the increasing importance of digital literacy in the modern world underscore the need for comprehensive research on the educational use of social media. By understanding how postgraduate students at Punjabi University Patiala utilize these platforms, this study seeks to contribute to the development of effective educational strategies that leverage social media's potential while mitigating its drawbacks.

In particular, the study will explore the types of social media platforms most commonly used by these students, the specific academic activities they engage in on these platforms, and the perceived

impact on their academic performance and engagement. Additionally, it will investigate the motivations behind their use of social media, the skills they develop through this usage, and the ways in which social media complements traditional learning methods.

Furthermore, the study will address the institutional perspective, examining how Punjabi University Patiala supports and regulates the use of social media in academic contexts. This includes policies on digital conduct, training and resources provided to students and faculty, and the integration of social media tools in the curriculum. The educational use of social media by postgraduate students represents a dynamic and evolving aspect of contemporary higher education. By conducting an in-depth analysis of this phenomenon at Punjabi University Patiala, this study aims to offer valuable insights for educators, policymakers, and students, ultimately contributing to the effective and innovative use of digital tools in academic settings.

**Aim:**

The primary aim of this study is to analyze the educational use of social media by postgraduate students at Punjabi University Patiala and to assess its impact on their academic performance and learning experiences.

**Objectives**

1. To identify the most commonly used social media platforms for educational purposes among postgraduate students.
2. To understand the specific ways in which students use social media for academic activities.
3. To explore the perceived benefits and challenges of using social media for educational purposes.
4. To assess the overall impact of social media on students' academic performance and engagement.
5. To provide recommendations for effectively integrating social media into educational practices.

**Need:**

In the digital age, understanding the role of social media in education is crucial for developing effective teaching strategies and improving student engagement. This study addresses the gap in research concerning the specific use of social media by postgraduate students, providing valuable insights for educators, policymakers, and students themselves.

**Definition:**

Educational use of social media refers to the intentional and strategic use of social media platforms and tools to support and enhance learning, teaching, and academic collaboration among students and educators.

**Scope:**

This study focuses on postgraduate students at Punjabi University Patiala, encompassing a diverse range of disciplines and social media platforms. It investigates both the qualitative and quantitative aspects of social media usage, providing a comprehensive understanding of its educational impact.

**Limitations:**

1. The study is limited to postgraduate students at Punjabi University Patiala, which may not be representative of other institutions.
2. Self-reported data may be subject to biases and inaccuracies.
3. The rapidly evolving nature of social media platforms may affect the relevance of the findings over time.
4. The study does not explore the long-term effects of social media use on academic performance.

**History:**

The integration of social media into the educational experiences of postgraduate students at Punjabi University Patiala has evolved significantly over the past decade. This transformation can be traced through several key phases, reflecting broader trends in the adoption of digital technologies in higher education.

**Early Adoption and Exploration (2005-2010):**

The early 2000s marked the advent of social media platforms such as Facebook (2004), YouTube (2005), and Twitter (2006). During this period, the primary use of these platforms by students was for social interaction and personal networking. However, a few forward-thinking postgraduate students at Punjabi University Patiala began to experiment with these tools for academic purposes. These early adopters used social media to form study groups, share academic resources, and engage in discussions related to their coursework.

**Growing Awareness and Institutional Support (2010-2015):**

As social media gained popularity, its potential for educational use became more apparent. By the early 2010s, Punjabi University Patiala started to recognize the benefits of integrating social media into academic life. The university began to encourage the use of platforms like Facebook and LinkedIn for professional networking and academic collaboration. Workshops and seminars on digital literacy and the effective use of social media for educational purposes were introduced, aiming to equip postgraduate students with the necessary skills to leverage these tools effectively.

**Integration into Curriculum and Research (2015-2020):**

The mid-2010s saw a more structured integration of social media into the university's academic framework. Faculty members began to incorporate social media into their teaching

methodologies, using platforms like Twitter for class discussions and YouTube for sharing lectures and supplementary materials. The use of specialized academic social networks, such as ResearchGate and Academia.edu, became prevalent among postgraduate students for sharing research papers, seeking feedback, and networking with scholars worldwide.

During this period, the university also launched official social media channels to disseminate information, promote events, and foster a sense of community among students and faculty. Postgraduate students increasingly used these platforms for collaborative research projects, virtual study groups, and staying updated with the latest developments in their fields.

**Pandemic-Driven Digital Transformation (2020-2022):**

The COVID-19 pandemic in 2020 accelerated the adoption of digital tools, including social media, in education. With the shift to online learning, Punjabi University Patiala and its postgraduate students heavily relied on social media for communication, collaboration, and remote learning. Platforms like Zoom and Microsoft Teams, often integrated with social media tools, became essential for conducting virtual classes, seminars, and academic conferences.

Social media also played a crucial role in maintaining student engagement and fostering a sense of community during the lockdown. The university's official social media pages became vital channels for providing updates, sharing educational resources, and supporting students' mental well-being.

**Current Trends and Future Directions (2022-Present):**

In the post-pandemic era, the educational use of social media by postgraduate students at Punjabi University Patiala has become more sophisticated and integral to their academic experience. The university continues to support and encourage the use of social media for academic purposes, recognizing its role in facilitating innovative learning methods and enhancing student engagement.

Current trends include the use of social media for blended learning, where online and offline educational experiences are seamlessly integrated. Postgraduate students are using platforms like LinkedIn for professional development, Twitter for academic networking, and Instagram and YouTube for creating and sharing educational content. Additionally, the university is exploring the potential of emerging technologies like virtual reality (VR) and augmented reality (AR), often integrated with social media platforms, to provide immersive learning experiences.

The history of the educational use of social media by postgraduate students at Punjabi University Patiala reflects a broader trend of digital transformation in higher education. From early experimentation to becoming an essential component of the academic experience, social media has significantly impacted how postgraduate students learn, collaborate, and engage with their academic community. As digital technologies continue to evolve, the university and its students are well-positioned to harness the potential of social media for future educational innovations.

**Strong Points:**

1. **Enhanced Collaboration and Networking**
   - Social media platforms like LinkedIn, ResearchGate, and academic Facebook groups facilitate collaboration and networking among postgraduate students, faculty, and researchers globally.
2. **Access to Diverse Resources**
   - Students can access a wide range of academic resources, including research papers, articles, and educational videos, which can complement traditional learning materials.
3. **Increased Engagement**
   - Interactive features of social media, such as live chats, discussions, and multimedia content, increase student engagement and participation in academic activities.
4. **Real-Time Communication**
   - Platforms like WhatsApp, Twitter, and Facebook Messenger provide instant communication channels, enabling timely feedback and support from peers and instructors.
5. **Professional Development**
   - Social media platforms offer opportunities for professional development through webinars, online workshops, and access to industry experts and thought leaders.
6. **Community Building**
   - Social media helps in building a sense of community among students, fostering peer support, collaboration, and shared learning experiences.
7. **Flexible Learning**
   - Students can access learning materials and participate in discussions at their convenience, providing flexibility that accommodates different schedules and learning paces.
8. **Exposure to Current Trends**
   - Social media keeps students updated with the latest trends, research developments, and industry news, which is crucial for staying relevant in their fields.

**Weak Points**

1. **Distractions:**
   - The potential for distractions is high, as social media platforms often blend academic content with entertainment and personal interactions.
2. **Information Overload:**
   - The vast amount of information available on social media can be overwhelming, making it difficult for students to filter and focus on relevant academic content.
3. **Quality and Credibility Issues:**
   - Not all information on social media is reliable or credible, which can lead to the dissemination of misinformation or low-quality resources.
4. **Privacy Concerns:**
   - Sharing personal information and academic work on social media raises concerns about privacy and data security.
5. **Digital Divide:**
   - Access to social media and digital tools can vary among students, leading to inequalities in the benefits derived from these platforms.
6. **Academic Misconduct:**
   - The ease of sharing information on social media can lead to issues of academic misconduct, such as plagiarism and unauthorized collaboration.
7. **Dependency on Technology:**
   - Over-reliance on social media for educational purposes can reduce face-to-face interactions and traditional learning methods, potentially impacting the development of critical thinking and interpersonal skills.
8. **Time Management:**
   - Balancing social media use with academic responsibilities requires effective time management skills, which some students may struggle with.

The educational use of social media by postgraduate students at Punjabi University Patiala presents both significant advantages and notable challenges. While it enhances collaboration, engagement, and access to resources, it also poses risks related to distractions, information quality, and privacy. Understanding these strengths and weaknesses is crucial for effectively integrating social media into the academic framework and maximizing its benefits while mitigating its drawbacks.

**Current Trends:**

1. **Blended Learning Integration:**
   - Combining online social media tools with traditional face-to-face learning methods, creating a more flexible and comprehensive educational experience.
2. **Micro learning and Bite-Sized Content:**
   - Utilizing platforms like Instagram, TikTok, and YouTube for short, focused educational content that caters to the shorter attention spans and busy schedules of postgraduate students.
3. **Professional Networking and Development:**
   - Increased use of LinkedIn and similar platforms for building professional profiles, networking with industry professionals, and seeking job opportunities and internships.
4. **Collaborative Research and Publishing:**
   - Using academic social networks such as ResearchGate and Academia.edu to collaborate on research projects, share findings, and seek feedback from the global academic community.
5. **Virtual Study Groups and Peer Support:**
   - Formation of virtual study groups on platforms like WhatsApp, Facebook, and Slack, allowing students to support each other, share resources, and collaborate on assignments and projects.
6. **Webinars and Live Streaming:**
   - Attending and participating in live webinars, virtual conferences, and workshops hosted on social media platforms, providing access to expert knowledge and current research trends.
7. **Educational Influencers and Content Creators:**
   - Following educational influencers and content creators on platforms like YouTube and Instagram for supplementary learning materials, study tips, and motivational content.
8. **Digital Portfolios and Personal Branding:**
   - Creating digital portfolios on platforms like LinkedIn and personal blogs to showcase academic achievements, research work, and extracurricular activities, enhancing personal branding.
9. **Gamification and Interactive Learning:**
   - Incorporating gamification elements into social media learning activities, such as quizzes, challenges, and competitions, to increase engagement and motivation.
10. **Multimodal Learning:**
    - Leveraging various forms of media, including videos, podcasts, infographics, and interactive posts, to cater to different learning styles and preferences.
11. **Social Media Analytics for Academic Improvement:**
    - Using analytics tools provided by social media platforms to track engagement and feedback on educational content, helping educators and students refine their approaches and materials.
12. **Integration with Learning Management Systems (LMS):**
    - Seamlessly integrating social media tools with university LMS platforms like Moodle or Blackboard, enhancing the overall digital learning environment.
13. **Awareness and Advocacy Campaigns:**
    - Engaging in campaigns on social media to raise awareness about academic issues, mental health, and other important topics relevant to the student community.

14. **Augmented Reality (AR) and Virtual Reality (VR):**
- Experimenting with AR and VR technologies integrated with social media for immersive learning experiences, such as virtual labs, historical site tours, and interactive simulations.

15. **Hybrid Events:**
- Participating in hybrid events that combine in-person and virtual elements, allowing broader participation and interaction through social media live streams and discussions. By staying abreast of these trends, postgraduate students at Punjabi University Patiala can leverage social media effectively to enhance their educational experience, engage in meaningful academic activities, and prepare for future professional opportunities.

**Conclusion:**

The educational use of social media by postgraduate students at Punjabi University Patiala reflects a significant transformation in how higher education adapts to the digital age. This study has shown that social media platforms play a multifaceted role in enhancing academic experiences, facilitating collaboration, and providing access to a diverse array of resources. By leveraging platforms such as LinkedIn, ResearchGate, Facebook, and YouTube, students have been able to network professionally, engage with academic content more interactively, and participate in global scholarly communities.

The integration of social media in education has offered numerous benefits, including increased student engagement, real-time communication, and the opportunity for flexible and accessible learning. These advantages have been particularly evident during the COVID-19 pandemic, which necessitated a swift transition to online learning environments and underscored the importance of digital tools in maintaining academic continuity.

However, the study also highlights several challenges associated with the educational use of social media. Issues such as distractions, information overload, privacy concerns, and the digital divide must be addressed to ensure that the integration of social media into academic contexts is effective and equitable. Additionally, the potential for academic misconduct and the need for strong digital literacy skills among students are areas that require careful consideration and ongoing support from the university.

To maximize the benefits and mitigate the drawbacks, it is crucial for Punjabi University Patiala to continue developing policies and programs that support the effective use of social media for educational purposes. This includes providing training for both students and faculty, ensuring equitable access to digital tools, and fostering an environment that encourages responsible and innovative use of social media.

In conclusion, the educational use of social media by postgraduate students at Punjabi University Patiala offers a dynamic and evolving landscape that enhances traditional learning methods and prepares students for the demands of the digital world. By embracing the strengths of social media and addressing its challenges, the university can continue to provide a rich and engaging academic experience that supports the growth and success of its postgraduate students.

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# Impact of Social Networking And Mobile Web on Legal Library Facilities and Services: A Socio-Legal Preceptive

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**Abstract:**
This article explores the integration of social networking and mobile web technologies within legal library facilities aims to enhance access to legal resources, promote collaboration, and improve user experience in a user-friendly manner; By offering mobile-friendly access to online databases, catalogues, and legal journals. Libraries ensure that users can access essential information anytime from anywhere with hustle free experience. Social media platforms facilitate the sharing of updates, legal news as well as event information. Mobile applications and AI-driven chatbots provide real-time assistance and notifications for improving engagement and support. However, webinars, online workshops, and discussion forums enable ongoing education and collaboration hand in hand. Gathering user feedback through surveys and reviews helps in continually refining library services to the end user. Ultimately, this digital integration transforms legal libraries into dynamic libraries and connected hubs of information and interaction.

**Keywords:** Social Networking, Mobile Web, Legal Libraries, Social Networking Services.

## Introduction:

The digital age has revolutionized how information is accessed and shared, and legal library facilities are no exception. The integration of social networking and mobile web technologies offers significant opportunities to enhance the services provided by legal libraries, making them more accessible, efficient, and user-friendly. This integration is not just about adopting new technologies but about rethinking how these facilities can serve their users in a more connected and interactive world.

Legal libraries have traditionally been repositories of vast amounts of legal texts, journals, and case law, serving as crucial resources for legal professionals as well as for students and researchers. However, the proliferation of mobile devices and social media platforms has changed the landscape of information consumption. Users now expect instant access not only to information but also seamless communication and interactive support.

By leveraging these technologies, legal libraries can transform their services in several ways. Mobile-friendly access to catalogues and online databases ensures that users can retrieve necessary legal information at their own convenience. Social media platforms enable libraries to communicate more effectively with their communities for sharing updates, legal news, and event information. Moreover, these platforms facilitate networking among legal professionals, fostering a collaborative environment for knowledge sharing and professional growth.

Mobile applications and AI-driven chatbots provide additional layers of support, offering real-time assistance and enhancing user engagement. Educational initiatives, such as webinars and online workshops, can be promoted moreover delivered through these digital channels. Which encompasses the scope of modern-day library and its facilities.

## What is Mobile social networking?

Mobile social networking is social networking where individuals with similar interests converse and connect with one another through their mobile phone or tablet. Much like web-based social networking. Whereas this mobile social networking occurs in virtual communities.[1]

## Research Methodology:

The research methodology for studying the integration of social networking and mobile web technologies in legal education library facilities involves a combination of qualitative and quantitative approaches along with case studies and its samples. This comprehensive methodology ensures a thorough understanding of current practices, user needs, and the impact of these technologies on legal education. Surveys and Questionnaires, Interviews, Case Studies these are the research methods we can use for getting the information about the use and importance of social

networking and mobile networking in legal education.

**Objectives:**

The articulation of social networking and mobile web in legal education library facilities caters several important objectives such as enhancing both the user experience and the overall effectiveness of the library.

1. To provide the seamless and on-demand access to legal texts, journals, case laws, and other resources.
2. To provide resources and support for remote and hybrid learning environments.
3. To create a comprehensive digital repository of legal resources that can be accessed via mobile web.
4. To foster greater interaction and engagement with library services through social media and mobile applications.
5. To create opportunities for networking and collaboration among students, faculty, and legal professionals.
6. To keep users informed about new acquisitions, events, and library updates through social media and mobile notifications.
7. To gather user feedback and insights through surveys, polls, and social media interactions to continually improve library services.

By focusing on these objectives, legal education library facilities can significantly enhance their value, ensuring they meet the evolving needs of their users and contribute meaningfully to the broader educational and professional landscape.

**Historical Development:**

The historical development of the articulation of social networking and mobile web in legal education library facilities reflects broader technological advancements and changing user expectations in the digital age. At a glance overview in a chronological order.

**Early Digital Initiatives (1990s - Early 2000s):**

Libraries began digitizing catalogues and providing access to legal databases such as Westlaw and LexisNexis, which could be accessed via library computers. Legal libraries developed basic websites offering information about their services, hours, and physical collections.

**Advent of Web 2.0 (Mid-2000s):**

The shift to Web 2.0 technologies allowed for more interactive and user-friendly library websites. Features like online catalogues, digital archives, and the ability to reserve books online became common. Libraries started using email to communicate with users about due dates, new acquisitions as well as events.

**Emergence of Social Networking (Late 2000s):**

Legal libraries started blogs and forums to engage users in discussions about new resources, legal trends, and library events. Libraries created profiles on social media platforms like Facebook, Twitter, and LinkedIn to reach a broader audience and provide real-time updates.

**Introduction of Mobile Web (Late 2000s - Early 2010s):**

As smartphones became ubiquitous, legal libraries optimized their websites for mobile access, ensuring users could search catalogues and databases from their mobile devices. Some libraries developed their own mobile applications to offer enhanced access to resources, Including catalogue searches, e-book downloads etc.

**Integration of Social Networking with Library Services (2010s):**

Libraries integrated social media feeds into their websites and encouraged users to follow their social media handles for updates and interactive content. Using social media and chat services libraries began offering virtual reference help and to allow users to ask research questions and receive assistance online.

**Advanced Mobile and Social Features (Mid-2010s - Present):**

Implementation of AI-driven chatbots on library websites and apps provided 24/7 assistance. However, development of more sophisticated mobile applications that offer features like augmented reality for navigating library stacks; push notifications for due dates, and integration with social networking tools. Hosting webinars, online workshops, and virtual tours via social media platforms and mobile apps, especially during the COVID-19 pandemic, which gradually improve the adoption of these technologies.

**Current Trends and Innovations (Late 2010s - Present):**

Using data analytics and AI, libraries now offer personalized resource recommendations and tailored notifications based on user preferences and behaviour. Libraries are increasingly offering digital literacy programs to help users effectively navigate and utilize social networking on mobile web tools for legal research.

The integration of social networking and mobile web technologies in legal education library facilities has evolved significantly over the past few decades. From basic digital catalogues and websites to sophisticated mobile apps and interactive social media platforms, these advancements have transformed how legal information is accessed and shared. This evolution reflects broader trends in technology and user expectations, positioning legal libraries as dynamic, innovative, and user-centred institutions.

**Role of UGC and NEP:**

The University Grants Commission (UGC) and the National Education Policy (NEP) play crucial roles in shaping the articulation of social networking as well as mobile web applications in

legal education library facilities in India. Their policies and guidelines influence the adoption of technology in educational institutions.

**Role of University Grants Commission:**

The University Grants Commission (UGC) is a statutory body in India responsible for coordinating, determining, and maintaining standards of higher education. Its role in integrating social networking and mobile web technologies in legal education library facilities includes:

1. UGC promotes the development of digital libraries through funding and policy guidelines, encouraging institutions to adopt digital tools and resources.
2. UGC's emphasis on Information and Communication Technology (ICT) in education includes the use of social networking and mobile web to enhance teaching-learning and research.
3. UGC provides grants for the development of digital infrastructure in libraries, including the procurement of software and hardware necessary for mobile web access and social networking integration.
4. Initiatives to improve digital literacy among students and faculty for ensuring that they can leverage social networking and mobile web for educational purposes.
5. UGC supports the creation of consortia and networks among educational institutions to share resources, best practices, and innovations in digital library services.

**Role of National Education Policy:**

The National Education Policy (NEP) 2020 outlines a comprehensive framework for the development of education in India, with a strong emphasis on digital transformation. Its role in integrating social networking and mobile web in legal education library facilities includes:

1. Emphasizing the importance of digital skills for teachers and librarians to ensure they can support and guide students in using social networking and mobile web for academic purposes.
2. NEP emphasizes the use of technology to create a more holistic, flexible, and multidisciplinary educational environment, including legal education.
3. NEP promotes the development of virtual libraries and digital repositories to support remote learning and research.
4. NEP advocates for blended learning models that combine traditional classroom instruction with digital resources and online interaction.
5. Promoting the use of digital tools to provide equitable access to educational resources across diverse geographies and demographics.

The UGC and NEP plays significant role in the articulation of social networking and mobile web in legal education library facilities. By providing policy guidelines, funding and by emphasizing the importance of digital transformation. These bodies ensure that legal education libraries are well-equipped to meet the evolving needs of students and educators in the digital age. Their support helps create a more connected, interactive, and fruitful learning environment in legal education.

**Findings and Suggestions**

**Findings**

1. Users will be beneficiaries of the ability to access legal resources anytime and anywhere through mobile-friendly websites and apps.
2. Integration of online legal databases, e-books, and journals provides comprehensive access to a vast array of resources to improve research capabilities.
3. Social media platforms facilitate real-time communication and engagement, allowing libraries to update news and events effectively.
4. AI-driven chatbots and virtual reference services on mobile apps provide instant support and assistance to the end users.

**Suggestions**

1. Increase investment in digital infrastructure, including mobile-friendly websites, apps, and online databases, to enhance access and usability.
2. Develop and maintain virtual libraries and digital repositories to support remote access to legal resources.
3. Integrate library services with professional networking platforms like LinkedIn to facilitate connections and collaborations.
4. Provide access to collaborative tools and platforms to support teamwork and group projects.
5. Offer continuous training programs for library staff to keep them updated on the latest digital tools and technologies.
6. Provide training sessions for users to help them effectively navigate and utilize digital resources and tools.
7. Regularly offer webinars, online workshops, and tutorials on legal research techniques and the use of digital tools.
8. Implement programs to enhance digital literacy among students, faculty, and library staff.
9. Implement robust security measures to protect user data and ensure compliance with privacy regulations.
10. Conduct regular surveys and polls to gather user feedback and identify areas for improvement.
11. Utilize data analytics to monitor usage patterns and make informed decisions about service enhancements.

By implementing these suggestions, legal education library facilities can enhance their services and improve user satisfaction. This system

helps to support the academic and professional needs of their users in the digital age.

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# Sports Industrialization, Sports Journalism, Ethics & Legal Issues In Sports

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**Abstract:**

Technology involvement edge has made sports as fastest growing industry in global society. The worldwide sports segment has gone way past unimportant competition and excitement. The industry has seen quick advancement in later decades, speaking to a medium for speculation with colossal potential returns from a money related point of see. Consequently, sports getting to be an industry is great for it as long as the players donate needs to exceed expectations their diversion or maybe than choosing which brand they ought to support. Other than person improvement, wear can moreover play a noteworthy part in communal improvement, which cultivates financial development. By and large, the expanded introduction and perceivability, income, and work conceivable outcomes that sports give contribute to fortifying community advancement. Sports morals implies not fair a certain shape of conduct but a specific way of considering. The one of the objectives of the article is to give a viewpoint of the circumstances that lead to conduct missing in the ethics, not as it were by the competitor, but too by the different parties included in the don, such as the therapeutic and wellbeing groups, specialists, coaches, chiefs and group proprietors, supports, relatives, media. Tip top competitors ended up characters with a particular weight in society, saturating into spaces that other individuals may not reach, getting to the so-called acclaim and fortune in such a way that accomplishing triumph not as it were implies to be filled with wonderfulness, but moreover to be the best.

**Keywords:** Industry, sports, wellbeing, ethics, empower

## Introduction:

The sports products industry in India has seen an extraordinary development over the past five decades and presently involves a put of unmistakable quality in the Indian economy in see of its gigantic potential for work, development and send out. In the 21st century, the sports industry is the most promising developing industry in India; its improvement has played a gigantic part in social advancement. The advancement of sports industry is a modern creating slant for building a agreeable communist society.

Industrialization is the handle of changing the economy of a country or locale from a centre on agribusiness to a dependence on fabricating. India has dependably made a few of the best cricketers in the world, while keeping up a stellar situate quality, arranged to take over the mantle from the leaving period. Be that as it may, past cricket, regardless a few individuals who have had a few triumphs in competitive wear, we have never genuinely been known as a country making sportspersons. Industrialization is a seething fire and sports is not safe to it. When compared to the past a long time, we presently have more supports for an assortment of sports around us. Industrialists have realized the potential of the Indian Sports and its reach. Consequently, they consider it a positive and advantageous speculation. As the ancient saying goes, each coin has two sides, so do we have the stars and cons of this industrialization. If we be hopeful at that point, we can see that the masters dwarf the cons. Numerous sports, which were not indeed known to the Indian gathering of people, have presently brought to spotlight since of industrialization and of course the great players.

Because of this industrialization, more individuals are uncovered to different diversions and they as well are interested to take portion in it. Consequently, sports getting to be an industry is great for itself as long as the players deliver need to exceed expectations their diversion or maybe than choosing which brand they ought to endorse. The sports merchandise industry of India is about a century ancient and holds a noticeable position in the worldwide showcase. The industry has prospered, driven by a talented workforce subsequently known for its part in making business and contributing to the country's economy. It made time and assets for the delight of don, and permitted don to be more far-reaching, and available through advancements in innovation. Indians utilized sports as a portal or an opportunity to recapture national pride and personality, eventually battling against the British account. The colonized subsequently created their claim physical quality and control whereas

going up against and dismissing the components of majestic belief system. The Mechanical Transformation moved social orders from an agrarian economy to a fabricating one, with items being made by machines or maybe than by hand. This driven to expanded generation and proficiency, lower costs, more merchandise, progressed compensation, and relocation from rustic regions to urban ranges.

**Sports industrialization:**

India is one of the most crowded and assorted nations universally, and sports have continuously been a critical portion of the country's culture and history. In spite of the development and notoriety of advanced sports and diversions in later a long time, India remains one of the few nations that have held the appropriation of their inborn recreations. Old sports like kabaddi, kho-kho, etc., still stay a critical portion of the Indian donning world nowadays. Additionally, India moreover has a noteworthy portion in cutting edge sports, with cricket being the country's number one obsession. The worldwide sports segment has gone way past insignificant competition and excitement. The industry has seen fast improvement in later decades, speaking to a medium for speculation with colossal potential returns from a money related point of see. Hence, sports nowadays have a critical effect on the financial advancement of a nation.

**Employment Opportunities:**

Significant prove has illustrated the part of sports in boosting a country's financial thriving is the creation of work openings. A noticeable case is the Indian Chief Association the greatest cricket association universally which has played a noteworthy part in producing employments for individuals on an colossal scale. Other major sports such as football, hockey, tennis and kabaddi, nearby their eminent alliances, have too created different business opportunities. In reality, the Indian sports trade offers an assorted extend of work openings in a few areas, counting deals, transportation, showcasing, media, and accounts. The sports industry effectively contributes to India's financial development by decreasing unemployment.

**Attraction for tourism:**

India has continuously been a conspicuous middle for visitor fascination since of its extraordinary differences. In any case, in later a long time, India's wear has altogether impacted the country's tourism conveying thrills and fervour for guests from both inside and past the country. Sports tourism includes voyaging to observe a sports occasion; it is a multibillion-dollar industry around the world. A fabulous case of this is the IPL which pulls in more than 350 million watchers each year numerous of which travel to India from other countries. Due to later changes in framework, transportation, and so on, sports tourism in India is consistently rising, with a development rate of over 12%. In general, sports have appeared to be a considerable venture in the tourism trade, creating critical income, in this manner boosting financial development.

**Accelerate tax contributions:**

An effective sports competition will continuously result in broader benefits for India, counting charge commitments to the country's treasury. Instalment of charges by top-rated sports bodies, groups and players in the nation by and large result in expanded income for the government, which can be channelled into other regions of the country's economy. In the interim, competitors and proficient alliances, such as the IPL and a few other as of late developing alliances, are not tax-exempt since they are run to make benefits. Hence, they pay noteworthy sums in charges.

**Sports Journalism:**

Sports news coverage centres on subjects and occasions related to the world of sports. Journalists' work in sports ranges from play-by-play and diversion outlines to investigation and investigative announcing on major wearing occasions. They work in different media, counting broadcasting, print and the web. It can centre on particular sorts, such as conclusion and investigative. Here are a few sorts of news coverage stories sports writer cover:

**Game Stories:**

Straight lead amusement stories utilize a pre-defined structure and are one of the most crucial sorts of news coverage. They give data approximately who won or misplaced the diversion, group and person scores and key players.

**Interviewing and research:**

Knowing which assets are reliable and how to look through the fabric can offer assistance writers create precise and careful work. Separated from making a difference you collect data from sources, interviews offer assistance writers approve sources and give different conclusions. Inquiring successful questions makes a difference writers assemble the fabric to create a newsworthy story.

**Sports photographer:**

Sports picture takers capture pictures amid a wearing or athletic occasion. They frequently take activity photos of distinctive players and capture the game's feelings. Portion of their work includes altering photos utilizing photo-enhancing program. They erect and take down lighting and other gear at donning occasions and frequently collaborate with writers to increment the chances of them utilizing their photographs.

**Ethics & legal Issues in Sports:**

Sports ethics means not fair a certain shape of conduct but moreover a specific way of considering. It advances reasonable play among children and youthful people by means of instructive

and preventive measures and energizes the spread of great hones to advance differences in wear and combat all shapes of separation. The win implies getting to be the middle of consideration for numerous, from the society of competitors in that wear to the entirety country or indeed the world. Tip top competitors ended up characters with a particular weight in society, saturating into spaces that other individuals may not reach, getting to the so-called acclaim and fortune in such a way that accomplishing triumph not as it were implies to be filled with wonderfulness, but moreover to be the best. Subsequently, this cluster of desires around the result can lead the competitor to deceive amid the development towards victory. Through different ways, we have looked for to progress the execution of competitors by turning to the utilize of ergogenic helps from the utilize of dietary supplements and solutions to utilizing disallowed substances or strategies and utilizing innovation that indeed regularly goes one step ahead of anti-doping location strategies.

The objective of the article is to give a viewpoint of the circumstances that lead to conduct missing in the moral rules, not as it were by the competitor, but moreover by the different parties included in the wear, such as the restorative and wellbeing groups, specialists, coaches, executives and group proprietors, supports, relatives, media. For all intents and purposes all conduct with respect to the topic of sports is controlled by moral codes that ought to be taken after by the sportspersons, as well as by all of those included in healthcare and in the authoritative, promoting, and trade parts. An assortment of moral issues in the region of the sportsperson comes about in the intercession of numerous interested parties in the sports establishments and, over all, in terms of the sports groups. In this regard, wellbeing is a principal perspective in the well-being and execution of the competitor; hence, the healthcare group is regularly beneath weight in terms of the administration of a harmed competitor who needs to be returned to their sports action as before long as conceivable. This weight is worked out over all by the organization and, in numerous cases, by the sportspersons themselves. In this manner, this has driven to hones that put the athlete's wellbeing and physical astuteness at chance. Different doctors who are capable for proficient sports groups have said encountering weight from the specialized executives and group proprietors to make it conceivable for the player to return to preparing sessions and recreations with a negligible recovery time.

**Conclusion:**

The sports industry has created over a long time, and it is no longer constrained to competition, excitement, or eagerness. Nowadays, sports play a crucial part in a country's financial improvement and advance. In human nature, there will continuously exist the feeling of getting there to begin with, of maintaining a strategic distance from the anguish of losing, and the ruling crave for triumph; all these are the item of a special choice of competitive instinctual. We have too created the capacity to bunch ourselves together with the biggest brain, which has managed us the plausibility of being a profoundly competitive species. In the hone of sports, it is clear that to accomplish victory, it is fundamental to make utilize of these instinctual; be that as it may, the street to victory is cleared with moral standards that imply the fitting behaviour of the sportsperson, as well as that of all other interested parties. To ignore these standards on which moral codes are maintained is to come up short to recognize and to go against the soul of sports.

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# Educational Problems of Adolescent Girls

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**Abstract:**

Families play a critical role in influencing numerous features of adolescent development, particularly in addressing educational challenges. In developing countries, various agencies have implemented diverse programs to tackle issues faced by adolescent girls, including education, health, nutrition, child labor, and sexual harassment. The aim is to comprehend the educational challenges faced by adolescent girls. Both primary and secondary data sources were used by the researcher through conducted in person interviews with 500 respondents to acquire primary data. All things considered, 69.2% of teenage girls said they had no trouble keeping up with their usual studies.

**Keywords:** Adolescent, Teenage Girls, Influencing, Education, Challenges Principal, HKES Smt.C.B Patil Arts and Commerce Degree College Chincholi, Kalaburagi

**Introduction:**

Adolescent girls have access to education in societies where, health services, and recreation, along with opportunities for participation in decision-making, their empowerment is facilitated. Emerging nations have realized miscellaneous activities and programs to address adolescent girls' issues related to education, healthiness, nourishment, child labor, and sexual harassment. Families performance a crucial part in maintaining adolescent disorders like eating, conduct, and anxiety disorders. Maternal appreciative of children's emotions, stress, and attitudes significantly impacts the socialization of teenage girls. Overprotectiveness can hinder a child's autonomy and make them vulnerable, as they may lack the skills to navigate challenges and approach the world negatively.

Families should recognize each individual's specialization and encourage and respect differences. They should avoid rigid norms, adapt to change, and foster an atmosphere of statement, indulgent, admiration, and credit. Self-control, a learned trait, is crucial in preventing conduct complications among youths. Parents should teach problem-solving techniques and critically assess information accessed over broadcasting and the internet with their children, addressing any misconceptions or misunderstandings.

**Review of Literature**

**Raghavendra Bheemappa Nayak (2019)** the purpose of the study was to evaluate the factors that predict educational stress in young girls in Dharwad, India. It involved 314 randomly selected girls aged 16-19 from ten colleges, approved by the institutional ethics committee. Data collection included self-administered questionnaires covering socio-demographic details, personality, IQ assessment, and educational stress scale. Educational stress averaged 50.04 ± 10.82 (range 16–80). There are strong associations between stress and religion. Father s education, number of siblings, subject combination, personality type, and IQ. Regression analysis identified number of siblings and extrovert neuroticism personality as protective factors, negatively predicting stress (beta = −0.115, P = 0.037; beta = −0.242, P = 0.001).

**Ishaq Anis Rumi (2023)** To mark International Women's Day, UNESCO released a new factsheet highlighting increased inequalities in girls' education due to COVID-19. The aim is to accelerate action for girls' and women's education by leveraging political and financial commitment and leadership for women and girls. The pandemic has affected investments in education, with two-thirds of low- and lower-middle-income countries surveyed across all regions cutting their education budgets. At its peak in April 2020, schooling was disrupted for over 1.5 billion learners in more than 190 countries.

**Sanjukta Sahoo (2016)** The paper aims to assess the current status and challenges of girls' education in India and propose solutions. It draws from various sources like articles, reports, and research papers. The third section discusses government initiatives and challenges in girls' education, while the final part offers suggestions to overcome these barriers. It concludes that while higher education enrollment for girls has increased, the elementary and secondary levels face challenges like parental attitudes, lack of infrastructure, and socio-economic conditions. The paper emphasizes collective responsibility among authorities, communities,

NGOs, and citizens to address these barriers to girls' education in India.

**Table No. 1 displays the Respondents' percentage distribution by handling studies.**

| Handling with Studies | Frequency | Percentage |
|---|---|---|
| Yes | 135 | 27 |
| No | 365 | 73 |
| **Total** | 500 | 100.0 |

Table 1 presents the percentage distribution of those who thought that they could manage their regular study and those who were not. It is marked from the table that the majority, 73%, of teenage girls in the learning area managed to accomplish with their studies without significant obstacles. However, the remaining 27%, comprising one-fourth of the total sample, faced complications in managing with their homework. This is concerning, especially considering the government's efforts to enhance community development through widespread education accessibility.

**Table no 2 demonstrates the respondents percentage distribution by study difficulty**

| Effort in studies | Frequency | Percentage |
|---|---|---|
| Yes | 225 | 45 |
| No | 275 | 55 |
| **Total** | 500 | 100.0 |

Table 2 illustrates the respondent's complications in their educations. When asked, 45. % of the respondents stated they were having anxiety with their studies, while 55% said they had no difficulties. Notably, the nearly even percentage distribution indicates the varying capacity of teenage girls to gain knowledge within their reach.

**Table No 3 displays the reasons why respondents found problems, distributed as a percentage.**

| Effort in studies | Frequency | Percentage |
|---|---|---|
| Not spending enough time | 135 | 27 |
| Lack interest in studies | 120 | 24 |
| Lack of books available | 90 | 18 |
| Lack of encouragement | 85 | 17 |
| Exam fear | 70 | 14 |
| **Total** | 500 | 100.0 |

**Table No 3** Outlines the reasons respondents cited for their daily study difficulties. Several factors contribute to the lack of interest among adolescent girls, with some key reasons highlighted. Nearly half of the respondents, 27 percent and 14 percent respectively, mentioned that exam fear, fear of failure, and lack of time devoted to studying are the main causes. Additionally, more than a quarter of the respondents, 18 percent and 17 percent stated that an improper supply of textbooks and the lack of job guarantees even after years of schooling diminish their motivation. 14 percent have respectively, said they had unsuccessful because they were afraid of exams. The significance of devoting time and resources to education in the absence of obvious returns.

Chi-Square Results

**Table No 1 Percentage distributions of the Respondents based on age and study coping.**

| | Coping with Studies | | | |
|---|---|---|---|---|
| **Respondents age** | **Yes** | **No** | **Some time** | **Total** |
| 14 years | 48 (60%) | 6 7.5% | 26 32.5 | 80100% |
| 15 years | 110 84.6% | 9 6.9% | 11 8.4% | 130100% |
| 16 years | 130 73.8% | 7 3.9% | 39 22.1% | 176 100% |
| 17 years | 63 55% | 4 3.5% | 47 41.2% | 114 100% |
| **Total** | 315 63% | 35 7% | 150 30% | 500 100 % |

Chi-square .000

Table 1 examines the impact of age on adolescent girls' ability to cope with their studies. The exploration demonstrations that 63% of respondents were able to manage their studies, while 30% faced difficulties. The table also reveals that as age increases, the difficulties in coping with studies tend to rise: 60 % of 14-year-olds, 84% of 15-year-olds, 73% of 16-year-olds and 55% of 17-year-olds reported difficulties. The chi-square test were 0.000 indicates significance level means strong correlation between age and coping ability. Contrary to expectations of a positive association, the study found a harmful effect of age on coping abilities. This suggests that as girls grow older, they find it harder to concentrate on their studies, possibly due to increased household responsibilities along side their schoolwork.

**Table No 2 Percentage distributions of the respondents by coping with studies Caste.**

| Coping with Studies | | | | |
|---|---|---|---|---|
| **Respondents Caste** | **Yes** | **No** | **Some time** | **Total** |
| SC/ ST | 82<br>78.09% | 15<br>14.28% | 8<br>7.60% | 105<br>100% |
| OBC | 55<br>30.50% | 5<br>2.70% | 120<br>66.60% | 180<br>100% |
| GM | 185<br>86.04% | 21<br>9.70% | 9<br>4.10% | 215<br>100% |
| **Total** | 322<br>64.40% | 41<br>8.20% | 137<br>27.40% | 500<br>100% |

Chi-square 0.000

Table 2 explains the relationship between respondents' caste and their ability to cope with school studies. According to the bivariate analysis, 64.4% of respondents reported no difficulties, while 27.4% sometime faced significant challenges. The chi-square test more observed the influence of caste on coping abilities. The results showed that 78.09% of Scheduled Caste (SC) and Scheduled Tribe (ST) students, and 86.04% of general merit students, had no difficulties with their educations. In contrast 55% other Backward Classes (OBC) students, which include ethnic minorities, struggled with their studies. This finding bring into line with earlier research and national surveys showing lower literacy levels among OBCs compared to SC and ST students. The chi-square test confirmed a significant relationship between caste and study performance. These outcomes suggest that, following the progress made in uplifting SC and ST populations, the Indian government should now focus on improving the educational outcomes for OBC populations to fetch them into the mainstream.

**Table no 3 Percentage distributions of the respondents by coping with studies and parents education.**

| Coping with Studies | | | | |
|---|---|---|---|---|
| **Respondents Mother Education status** | **Yes** | **No** | **Some time** | **Total** |
| Illiterates | 20 | 3 | 116 | 139 |
| | 14.38% | 2.15% | 83.45% | 100% |
| Primary | 130 | 9 | 13 | 152 |
| | 85.52% | 5.92% | 8.55% | 100% |
| Secondary | 97 | 12 | 7 | 116 |
| | 83.62% | 10.34% | 6.03% | 100% |
| PUC | 40 | 6 | 4 | 50 |
| | 80% | 12% | 8% | 100% |
| Graduate | 26 | 7 | 3 | 36 |
| | 72.22% | 19.44% | .8.33% | 100% |
| Post graduate | 4 | 1 | 2 | 7 |
| | 57.14% | 14.28% | 28.57% | 100% |
| **Total** | 317 | 38 | 145 | 500 |
| | 63.40% | 7.60% | 29% | 100% |

Chi-square 000

Table 3 explores the association between parents' educational levels and adolescent girls ability to cope with school studies. Overall, 63% of the girls reported no difficulties, while 29% sometime faced challenges. The chi-square test revealed that 83.45% of girls with illiterate parents struggled with their educational level. As parents education levels increased, the girls difficulties decreased. This suggests a positive impact of parental education on adolescents coping abilities. Educated parents better support their daughters in overcoming challenges and developing problem solving skills. Nonetheless, the chi-square value at the 0.000 significant levels indicates that these two analytical variables as a whole have a clear-cut positive association. Based on the aforementioned empirical findings, it is clear that well-educated parents put themselves in a comfortable position, are skilled at persuading and shaping their adolescent daughter's behavioural and attitudinal traits, and work to enhance their capacity-building abilities so that they can better meet life's challenges and assist their children in solving their own problems.

**Conclusion:**

Families wield significant influence over adolescent development, playing a crucial role in addressing educational hurdles. Concurrently, various agencies in developing nations have implemented multifaceted programs aimed at enhancing challenges encountered by adolescent girls, spanning education, nutrition, health, child labor, and sexual harassment. This study intended to

comprehend the educational challenges encountered by teenage girls. The analysis revealed that a substantial majority, 63.4%, reported no difficulties in managing with their regular studies. These findings underscore the importance of family support and comprehensive programs in mitigating educational obstacles for adolescent girls. By addressing these challenges effectively, stakeholders can facilitate the holistic development and empowerment of adolescent girls, ensuring they have equal opportunities to thrive academically and beyond.

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# How Multidisciplinary LIS Research Advances NEP 2020 Goals for the Future of Learning

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**Abstract:**
The Indian education system is being modernized to become more multidisciplinary, flexible, holistic, and responsive to the demands of the twenty-first century. This is being achieved through the implementation of the National Education Policy (NEP) 2020. The revolutionary potential of NEP 2020 in the field of library and information science (LIS) is examined in this research. The focus placed by NEP 2020 on multidisciplinary approaches promotes the merging of expertise from disciplines like management, data analytics, computer science, and digital humanities. The study emphasizes the advantages of interdisciplinary teamwork, the training of professionals equipped for the future, and the significance of research and development in the advancement of LIS. LIS may be the cornerstone of a future-ready education system by aligning with NEP 2020, which will promote innovation, improve information management, and aid in the development of a knowledge-based society.

**Keywords: -** Library and Information Science (LIS), Research, NEP 2020, Multidisciplinary Approach

**Introduction:**

A transformative vision for education has been brought about by India's National Education Policy (NEP) 2020, which emphasizes a comprehensive, student-centric approach. To fulfill this aim, a realignment of many academic fields is required. Through interdisciplinary research, Library and Information Science (LIS) is ideally positioned to play a crucial part in this shift.

**Library and Information Sicence in Modern Education:**

Library science has become a dynamic area that merges technology and multidisciplinary knowledge, growing beyond traditional bounds to play a crucial role in modern education. Libraries of today are dynamic hubs for digital learning, information literacy, and research assistance rather than merely being places to store books. These days, librarians serve as instructors and facilitators, helping students make their way through the maze of digital information and fostering the growth of their research and critical thinking abilities. Library Science improves the structure and accessibility of information by utilizing cutting-edge technology like digital curation, data analytics, and information retrieval systems. This promotes a better informed and educated society. This progression facilitates the establishment of a knowledge-driven economy, where scholars and students are prepared to tackle the challenges of the twenty-first century.

**NEP 2020: A Beginning for Multidisciplinary Research:**

Multidisciplinary research is emphasized as a keystone for promoting innovation and holistic learning in India's National Education Policy (NEP) 2020. NEP 2020 seeks to dismantle traditional academic silos by promoting the integration of many fields of study, fostering a more flexible and integrated approach to education. In order to foster a collaborative and creative culture, this policy encourages the establishment of educational institutions that combine the arts, sciences, and vocational courses. Students' critical thinking and problem-solving abilities are strengthened by such a multidisciplinary framework, which also equips them to take on challenging global issues. The goal of NEP 2020's multidisciplinary research vision is to create well-rounded people who can contribute to a society that is changing quickly and becoming more interconnected.

**Integration of Technology and Digital Literacy:**

The importance of digital literacy and technology integration in supporting multidisciplinary research in library and information science (LIS) is emphasized in the National Education Policy (NEP) 2020. Considering libraries as essential centres of learning and creativity, NEP 2020 encourages the use of cutting-edge digital technologies to improve accessibility and information management. Through this integration, LIS professionals can leverage cutting-edge technologies like artificial intelligence, machine

learning, and data analytics to optimize operations related to digital curation, preservation, and information retrieval. Through the integration of digital literacy into the LIS curriculum, the policy guarantees that aspiring librarians will possess the necessary abilities to efficiently browse and employ digital resources.

**Collaboration with Other Disciplines:**

LIS can gain a great deal from working with other disciplines. For example, collaborating with computer science departments can result in the creation of digital archives and sophisticated information retrieval systems. Partnerships with the humanities can enhance digital humanities initiatives by increasing public access to historical and cultural materials. Collaborations between the business and management domains can augment the strategic and organizational proficiencies of librarians.

**Getting Professionals Ready for the Future:**

The multidisciplinary vision of NEP 2020 can be incorporated into LIS education to create future-ready professionals capable of managing the intricacies of the contemporary information landscape. These experts can handle enormous volumes of digital data, guarantee data security and privacy, and promote free and open access to knowledge.

**Research and Development in LIS:**

Library and information science (LIS) research and development are essential to the field's advancement and to tackling today's information concerns. This dynamic field is concerned with investigating new approaches and technology to improve information management, accessibility, and distribution. Digital curation, data preservation, information behavior, and knowledge management are important research areas. New approaches to information retrieval and digital archives are being driven by developments in artificial intelligence, machine learning, and big data analytics. Modern information systems and practices are developed as a result of collaborative research between LIS and other fields like computer science, digital humanities, and management. In an increasingly digital world, libraries and information centers play a crucial role in education, research, and lifelong learning. LIS is evolving as a result of persistent research and development initiatives.

**Conclusion:**

The NEP 2020 offers a singular chance to establish Library and Information Science as a multidisciplinary superpower. A key component of developing an education system that is prepared for the future is LIS's ability to embrace the policy's goal. This change will guarantee that students have the abilities and knowledge required to prosper in the information era, in addition to strengthening the role of libraries in society. The NEP 2020 offers a unique opportunity to transform Library and Information Science into a multidisciplinary powerhouse. By embracing the policy's vision, LIS can play a pivotal role in creating a future-ready education system. Ultimately, this transformation will not only enhance the role of libraries in society, but also guarantee that students have the skills and knowledge needed to thrive in the information age.

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# Synthesis and Characterization of ZnO Nanoparticles

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**Abstract:**
The synthesis and characterization of zinc oxide (ZnO) nanoparticles have garnered significant attention due to their unique physical and chemical properties applicable in various fields such as electronics, optics, and medicine. This research paper presents a comprehensive study on the synthesizing of ZnO nanoparticles using a chemical method. The structural and optical properties of the synthesized ZnO nanoparticles were characterized using X-ray diffraction (XRD), UV-Vis spectroscopy, and Fourier Transform Infrared Spectroscopy (FT-IR). The XRD analysis confirmed the formation of pure wurtzite ZnO with high crystallinity. The crystallite size for a high intense peak was obtained within the range of 28 nm using the Debye Scherer formula. UV-Vis spectroscopy absorbance peak obtained at 372 nm. Fourier Transform Infrared Spectroscopy showed absorbance bands for particular groups. The findings provide a deeper understanding of the synthesis, structural, and optical properties of ZnO nanoparticles, paving the way for optimizing their applications in various technological domains.

**Keywords:** ZnO, XRD, UV-Vis, FT-IR, Nanoparticles

**Introduction:**

Zinc oxide (ZnO) nanoparticles have attracted considerable interest in recent years due to their exceptional physical and chemical properties [1], making them highly versatile for various applications. ZnO is a wide bandgap semiconductor with bandgap energy of approximately 3.37 eV at room temperature and a high exciton binding energy of 60 meV [2]. These properties endow ZnO nanoparticles with unique optical [3], electronic [4], and piezoelectric characteristics [5], which are advantageous for various technological applications, including optoelectronics[6], photovoltaics [7], sensors [8], photocatalysis [9], and biomedicine [10].
The synthesis of ZnO nanoparticles is a critical aspect of their study, as the method and conditions of synthesis can significantly influence their size, morphology, and overall properties [11-13]. Numerous techniques have been developed to synthesize ZnO nanoparticles, such as sol-gel processes [14], hydrothermal methods [15], chemical vapor deposition [16], biological methods [17], and chemical methods [18]. Among these, the chemical method is particularly notable for its simplicity, cost-effectiveness, and potential for large-scale synthesis.

Characterizing the synthesized ZnO nanoparticles is equally important to understand their structure-property relationships and optimize their performance for specific applications. Common characterization techniques include X-ray diffraction (XRD) for crystallographic analysis, UV-Vis spectroscopy, and Fourier Transform Infrared Spectroscopy (FTIR) for optical property assessment. These techniques provide an analytical perception of the structural parameters and optical behavior of the nanoparticles.

This research focuses on the synthesizing method of ZnO nanoparticles via the chemical method, and their subsequent characterization using XRD, UV-Vis spectroscopy, and Fourier Transform Infrared Spectroscopy (FTIR). The study aims to elucidate the impact of synthesis parameters on the nanoparticle's properties and to explore their potential applications in various fields. By comprehensively analyzing the synthesis-structure-property relationships, this work contributes to the development of optimized ZnO nanoparticles for enhanced performance in technological applications.

**Materials and Method:**

Zinc acetate (99.99%) (Analytical grade) and Ethanol (analytical grade) were purchased from SDFine LTD. To synthesize ZnO nanoparticles, 8 gm of zinc acetate was dissolved in 50 mL of ethanol under continuous stirring for 1 hour; and kept without stirring for 20 hours. In the next step, the solution was washed 2-3 times with ethanol, and the resulting residue was heated at 400$^{o}$C in a muffle furnace for 1 hour. The obtained powder was fined using agate mortar. The structural study of ZnO nanopowder was performed by X-ray diffractometer (Model: Mini flex-II, Rigaku, Japan) with Cu Kα radiation (λ = 1.5406 Å) operating at 40 kV and 30 mA. Fourier transform infrared (FT-IR) spectra of the samples (as pellets in KBr) were recorded using an FT-IR Spectrometer (Shimadzu, Japan) in the range of 4000-400 cm-1. The UV-visible absorption

spectrum was measured within the range of 300-800 nm by using a UV-visible spectrometer (UV-1800 Spectrophotometer, –Shimadzu, Japan).

**Result and Discussion:**

**1. Structural Studies:**

The X-ray diffraction pattern of prepared ZnO nanoparticle powder was taken. The XRD pattern indicates the formation of the hexagonal wurtzite phase of ZnO. All the XRD peaks were represented by the hexagonal wurtzite phase of ZnO as shown in Figure 1. The sharp diffraction peaks indicate the good crystallinity of the prepared nanoparticles with 28 nm size. No additional peaks were found in the XRD pattern confirming the phase purity of ZnO nanoparticles. The crystallite size of the ZnO nanoparticles has been estimated from the full width at half maximum (FWHM) and the Debye-Scherrer formula as given below

$$D = \frac{K\lambda}{\beta_{hkl} Cos\theta} \qquad (1)$$

Where $\beta_{hkl}$ is the integral half-width, K is a constant equal to 0.90, $\lambda$ is the wavelength of the incident X-ray ($\lambda$ = 0.1540 nm), D is the crystallite size, and $\theta$ is the Bragg angle. The crystallite size obtained for synthesized ZnO nanoparticles is given in Table 1. For hexagonal structure, the plane spacing d is related to the lattice constant a, c, and the Miller indices by the following relation

$$\frac{1}{d_{hkl}^2} = \frac{4}{3}\left(\frac{h^2+hk+k^2}{a^2}\right) + \frac{l^2}{c^2} \qquad (2)$$

With the first-order approximation, n = 1

$$sin^2\theta = \frac{\lambda^2}{4a^2}\left[\frac{4}{3}(h^2 + hk + k^2) + (\frac{a}{c})^2 l^2\right] \qquad (3)$$

The lattice constant "a" for (100) plane is calculated by

$$a = \frac{\lambda}{\sqrt{3}\, sin\theta} \qquad (4)$$

And lattice constant "c" for (002) plane is calculated by

$$c = \frac{\lambda}{sin\theta} \qquad (5)$$

The lattice constants (a = b = 3.2644 Å and c= 5.6541 Å, c/a = 1.7320). The obtained lattice parameters are in good agreement with [19].

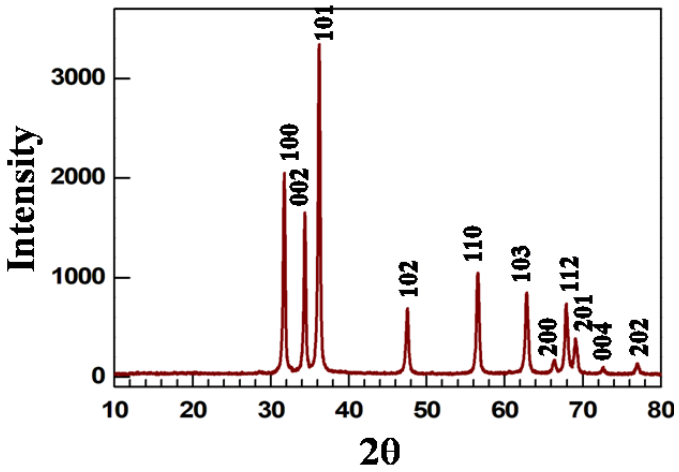


**Figure 1**: **XRD spectra of ZnO nanopowder**

| Crystallite Size D (nm) | a=b (Å) | c (Å) | c/a |
|---|---|---|---|
| 28.81 | 3.2644 | 5.6541 | 1.732 |

**Table 1: Shows Crystallite size and Lattice parameters of ZnO nanoparticles**

**2. Optical Studies:**

The UV-visible spectrum of the synthesized ZnO nanopowder is shown in Figure 2. The ZnO nanoparticles absorb the radiations in the UV range up to 372 nm as shown in Figure 2. The obtained absorbance peak position is in good agreement with the result [20-21] Chemical bonding in a material can be evaluated by using the FTIR technique. The absorption and transmission of the materials depend on crystalline structure, chemical composition, and also on the morphology of the synthesizing material. The FTIR spectrum of ZnO nanoparticles is shown in Figure 3. A series of absorption peaks were obtained from 1000 to 4000 $cm^{-1}$ corresponding to the carboxylate and hydroxyl impurities in materials. The O-H stretching mode of the hydroxyl group was obtained at 3427.51 $cm^{-1}$. The peak at 2929.87 $cm^{-1}$ is due to the C-H stretching vibration of alkane groups. The peaks observed at 1537.27 $cm^{-1}$ are due to the asymmetrical and symmetrical stretching of the zinc carboxylate.

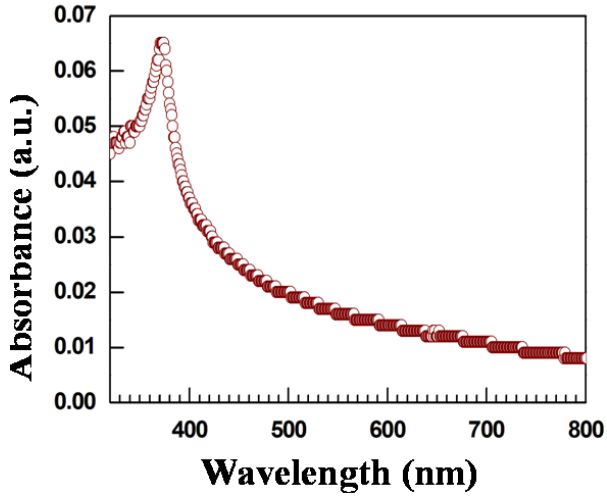


**Figure 2: UV-Visible absorbance spectrum of ZnO nanoparticles**

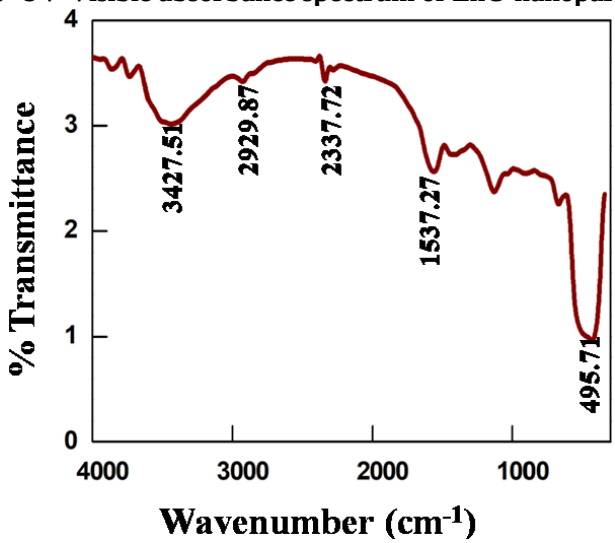


**Figure 3: FTIR spectrum of ZnO nanoparticles**

**Discussion:**

In this study, we successfully synthesized ZnO nanoparticles by a simple chemical method followed by investigating the structural parameters and optical parameters. X-ray Diffraction (XRD) analysis revealed the crystalline nature of the ZnO nanoparticles, with diffraction peaks corresponding to the hexagonal wurtzite structure of ZnO. The sharp and intense peaks indicate high crystallinity, which is crucial for various applications. The crystallite size was calculated using the Scherrer equation. Ultraviolet-visible (UV-Vis) spectroscopy was used to study the optical properties of the ZnO nanoparticles. The absorption spectrum exhibited a strong excitonic absorption peak around 372 nm, considered as characteristic of ZnO nanoparticles.

**Conclusion:**

In conclusion, the chemical method is an effective and simple synthesis route for producing high-quality ZnO nanoparticles. The comprehensive characterization of the nanoparticles confirmed their crystalline structure and optical properties. The synthesized ZnO nanoparticles exhibited excellent structural and optical properties, making them promising candidates for Photocatalysis, Solar cells, Sensors, Supercapacitors, and environmental remediation applications. Future work can focus on optimizing the synthesis parameters to enhance the properties of ZnO nanoparticles further. Additionally, exploring the functionalization of ZnO nanoparticles with various dopants or surface modifications can open new avenues for their application in diverse fields such as biomedical engineering, sensors, and energy storage devices. The promising results obtained in this study highlight the potential of ZnO nanoparticles as versatile nanomaterials with a wide range of practical applications.

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# Collection development Policy in the Digital age

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**Abstract:**

In the digital age, the world of library and information services has undergone significant change over the years, driven by rapid technological development and changing user expectations. This article examines the current state of policy for collection development in this dynamic context. The paper investigates fundamental aspects of present-day collection development methods, with a particular emphasis on the selection, procurement, and supervision of digital assets. The research highlights the necessity of implementing adaptive measures taken while selecting and procuring digital resources, which accommodate the changing demands of the digital age and ensure equal access to information that safeguards digital legacy. Recommendations for best practices and future research directions are provided to support librarians in the complex issues of digital collection development.

**Keywords**: collection development, policy, digital age, electronic resources.

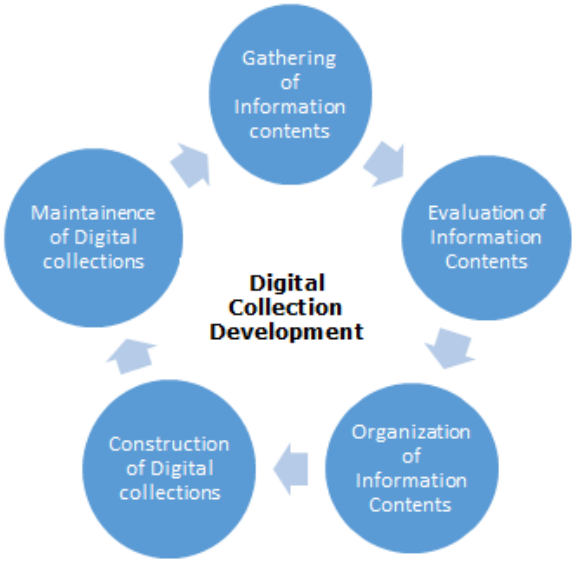
## Introduction

One of the goals of the library and library staff is to create a useful collection for its customers, preserve it, and provide access if necessary, according to the needs of the users. A library performs three main tasks: getting the right document, storing it, and providing access. The first task is to get the right document in the library. We know that from the ancient period, people began to store their information in different forms, starting with clay tablets, moving to paper, and now most recently in electronic digital form. The market is full of varied information available with latest publications and the library should acquire only the most suitable ones for its clientele, and this can only be achieved if the respective institution has a clear picture of the needs of the customers, and based on this, the library must have a collection development policy.

## Collection Development: A Process

Collection development is the most intellectual work of a library because only the collection is the key to fulfil library needs. Users believe that the library is the solution to their curiosity and is the library collection that can fulfill their desire for information. The customer's tastes vary from person to person, from time to time, and the collection must be developed accordingly to serve them in the best way. The whole development process is a process that enables a library to develop a collection of materials according to the information and service needs of users (khan, 2010). It is defined as "the process of identifying the strengths and weaknesses of a library collection according to user needs and community resources. It is a universal process in the library world where a library professional assembles a variety of materials to meet the needs of users. This dynamic and continuous cycle includes six elements: user research, practices, selection, acquisition, weeding, and evaluation (Evans, 2004). Therefore, in Dr. S.R. Formulating the Five Laws of Library Science, Ranganathan stated that the library is a growing organism like the fifth law; it explains that the library collection is constantly growing, so we understand that collection development is a continuous process.

**Digital Collection Development Process**




**Collection Development Policy**

A policy statement is a kind of framework and set of parameters inside which employees and users need to work. According to the American Library Association, collection development policies are documents that define the scope of a library's existing collections, plan for the continued development of resources, and identify the collection. Strengthen and outline the connection between election philosophy and institutional goals, general election criteria, and intellectual freedom (ALA, 1987). They serve many functions beyond just being a material selection tool. In addition to describing current collections, they set priorities, assist in budgeting, serve as an internal library communication channel between the library and external parties, support joint collection development, protect intellectual freedom and prevent censorship, and assist in general management of the collection, including donation processing, material selection, and series cancellation (Johnson, 1994). They also minimize personal bias in the selection of materials, identify gaps in collection development responsibilities, and provide a source of information for the new collection development librarian (Frank, 1993). Therefore, it can be said that the collection development policy guides libraries in issues and processes related to the selection of information resources according to the needs of their users. It explains all content-related issues, responsibility for the selection and assembly of library materials (Kiondo, 2004), etc. The lack of a collection development policy statement makes it impossible to identify the long-term and short-term needs of the clientele and to prioritize the allocation of resources to meet those needs (Odini, 1994). The collection development policy should clearly define:

i) In what form the collection should be acquired, or procured either in print, electronically or both?
ii) Which level of material should be preferred, scientific, specialist or popular?
iii) Which areas should be highlighted?
iv) Who chooses the material and
v) Who decides the allocation of funds to each department?

**Information Resources and Services**

As technology advancement took place, different forms of resources began to develop. These resources are created by various people from diverse professions, thanks to research support, which plays an important role in the field of informatics. When we discuss about informatics, libraries are the first to adopt these emerging resources. Part of the concept of the information society, or hub, which provides computers, various information resources, and human support, which has changed its services and reorganized its physical space to fulfill its new responsibilities. It has been observed that libraries today are not limited to only printed books and documents which was seen in the olden days. Over the years, due to technological advancement electronic resources have increased. Libraries have been acquiring electronic resources in various formats for twenty years, and library consortia's have played important roles in the process over the time.

**E-resources:**

An electronic resource is one that is available in digital or electronic form. Currently, the quantity of library collections has been replaced by quality, because it depends on the needs of users, quality has a direct association with the type of library collection. An electronic database is a well-structured collection of extensive material in one or more disciplines. It is searchable and its content is downloadable. Online books, magazine articles, newspapers, book reviews, conference materials, etc. Electronic databases are usually updated daily,

weekly, monthly, semi-annually or annually. (Devi, 2024)

**Types of e-resources held in the library**

The library manages e-resources, which are e-books, e-magazines, e-databases, e-thesis-dissertation, e-magazines, e-newspapers, electronic reference books, e-audio/video and reference sources in online open sources. Other types of e-resources such as OPAC (Online Public Access Catalogue), internal databases, and institutional repositories.

**Importance of Electronic Resources:**

Electronic resources are indispensable in today's society. Users should be aware of their importance. People from different backgrounds recognize the value, accessibility, usability, and readability of electronic resources.

1. Unlike print-based paper, they are affected by the environment or must be handled with care.
2. The information will be stored in electronic form at regular intervals and will be continuously updated to ensure availability.
3. Significantly reduces processing, printing, binding, and shipping time, allowing quick and easy handling without sacrificing time.
4. There is less or no library space.
5. There is no need to print and bind because the user has access to all the information in digital form.
6. Electronic resources are usually less expensive than printed materials.
7. Several search engines are available to find and retrieve relevant content.
8. Access to resources is wider and more convenient because a large number of people can access them at the same time.
9. Many access points facilitate the use of restricted networks.
10. It allows remote access anytime and anywhere.

**Selection of e-resources**

Tools and criteria for selecting e-resources Collection management of e-resources involves many aspects from selection, acquisition, and organization to access, retrieval, preservation, maintenance, and disposal.

When choosing e-resources, some means are considered. It is about reviews in e-journals, looking at other library resources, presentation of the publisher at seminars/conferences, opinion of experts/staff, a survey of existing suppliers, route offered by suppliers, route offered by publishers, and consortium.

The selection criteria for electronic resources are user needs, reliability of the publisher, reputation of the publisher, technical background of the publisher, availability of full text, full text of the back cover, search ability, existing peer-reviewed articles, electronic structure of resources, and availability format.

**Procurement and Acquisition of Electronic Resources**

These resources are acquired through publishers, editors, consortia, and rarely through aggregators. The acquisition of these e-resources takes into account the content provided in the resource, subject coverage, update frequency, price, search strategies, reputation, and impact factor, ease of use, technical support, and license terms.

**Licensing aspects:**

The important aspects to be kept in mind while licensing e-resources are: Scholarly sharing, Providing links, Access to databases, Electronic reserves, Indemnification, Modification in license terms, Archival/backup up copy, Cancellation terms, and Reimbursement (Dumbrava, 2013). Their nature of licensing is automatic renewal, notice-issued renewal, and early termination. The common obstacles while dealing with the licensor include disparity in bargaining power, inflexibility on the part of the vendor, and license agreements to library needs.

**Collection management of e-resource:**

For effective management of e-resources library must be regularly updated with the latest publications by vendors, updated in respect of OPAC about e-resources, create metadata, periodical review of e-resources, need feedback taken from users, monitor the speed of information download, and most importantly is security of e-resources must be ensured.

**Preservation and archiving of digital materials:**

Preservation of e-resources plays a very important role for future reference. The methods that can be adopted for preservation would be replication, migration, analog backups, emulation, digital archaeology, and technological preservation.

**Issues and Challenges of using E-Resources**:

There are a few problems and obstacles that come with using the facilities needed to access e-resources; these include searching for relevant information, taking a while to view, not being accessible at all, having trouble using digital resources, having limited computer access, having time constraints, computer viruses, etc (Devi, 2024). Another important challenge is the lack of digital literacy. The availability of these resources in libraries may encourage users especially students to utilize electronic journals more frequently. Some libraries still do not have computerized classrooms or any facilities that are necessary for patron use of technology.

**Suggestions for the use of E-Resources:**

It is important to raise awareness about using e-books and e-journals to get up-to-date information. The Librarian has to conduct frequent awareness programs for user information, wherein various e-resources that are provided by the library are very much aware to the users. The necessary

preparations should be undertaken to gain access to other publications about their disciplines in full text. Increase the number of computers, accelerating the internet link's speed by requesting an easy-to-read journal format from the provider (Devi, 2024). The provision of Wi-Fi will be advantageous. Users can access all of the online databases in the library by using the OPAC and the institution's website. The college website should be allowed with access to all online database news, and it should be updated often. Employees with IT training must assist users in the digital library. To find an accessible program that teaches and orients participants in search techniques, more information has to be made available to the users. Improved understanding of the electronic materials made accessible by the academic library system, as well as instructions on how to use them.

**Conclusion:**

In today's information society, Collection Development plays a crucial role in ensuring that information organizations have the necessary resources and reached to the users in efficient way. The development of technologies has enabled the extrapolation of information and the transfer of collection development from a traditional environment to a digital environment. The proposed collection development cycle includes all the valid steps to create and maintain digital collections in a digital library (Vignau Sánchez and Quesada, 2006). The philosophy behind this work expanded over time, from the mere collection and preservation of information to its dissemination, as library patrons became as valuable library assets as collections, or e ven more so. It has been observed that libraries often lack a collection development policy, which does not seem to be a sign of good business, as Johnson argues that libraries without a collection development policy are like businesses without a business plan (Johnson, 1994). A library is a service-oriented organization responsible for all citizens, so its collection policy must be open and clear. Whether the collection is in print, electronic, or hybrid format, the collection development policy must be clearly stated as such help to justify the entire nature of the document both in terms of its conceptual content and its form. The librarians acting according to the drafted policy will always remain on the safe side no one will be able to question against the collection development, Hence librarians should go for it (Shukla, 2014). The use of electronic resources has given rise to many new technical tools and tactics. The importance of using electronic resources in research is increasing (Devi, 2024). Digital libraries are currently in a phase of transformation, despite the goal of librarians to create fully integrated digital gateways, which will take several years to achieve. To maintain integrity and provide value-added services to customers, libraries that already own a certain journal in print are often required to subscribe to the online version of the journal for the same period. The explosion of digital data resources forces organizations to adopt new forms of handling user data, using tools that allow them to select and store only the data that meets their user needs.

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# Problems and challenges faced by sugarcane farmers in Vidarbha

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**Abstract:**
Sugarcane is an important crop in India. It plays an important role in the overall socio-economic development of the farming community. Sugar business is one of the major industries in India. This study was conducted to know the problems of sugarcane farmers in Vidarbha, Maharashtra state. This study was based on primary source of data. Simple statistical tools were used in this study. This study has revealed that sugarcane farmers in Vidarbha are facing some problems. 30 respondents were selected for this study.

## Introduction

The sugar industry is an important agro-based industry that affects the rural lives of about 50 million sugarcane farmers and about 5 lakh workers directly employed in sugar mills. Employment is also generated in various ancillary activities related to transport, trade services of machinery and supply of agricultural inputs. India is the second largest producer of sugar in the world after Brazil and is also the largest consumer. Sugarcane production should be increased for the sugar industry. Because the sugar industry needs a large amount of sugarcane as raw material. Sugarcane can be produced from seeds, stalks and roots. The prepared sugarcane is cut from the roots. Last about 30 cm. These parts are cut off along with the bark and reserved for further cultivation. Sugarcane can also be grown from sugarcane seeds. Since sugarcane ripens at different times in the fall, it is important to plant sugarcane at different times. Considering the agricultural land and tropical climate of Maharashtra, if the land can be brought under irrigation, the cultivated area of Maharashtra can produce good sugarcane production. Sugarcane is also cultivated in Vidarbha in Maharashtra. Sugarcane is cultivated in Amravati, Yavatmal, Wardha, Nagpur and Bhandara districts of Vidarbha. Sugarcane cultivation in Vidarbha is mainly dependent on rain water. Sugarcane cultivation starts around the month of June. Regarding sugar factories in Vidarbha, currently 6 sugarcane factories are working.

**Objective of the study:** To study the problem sand challenges faced by sugarcane farmers of Vidarbha region.

**Scope of Research:**

This study helps to understand the problems and challenges of sugarcane far ers of vidarbh region.

**Limitations of the study:** Only sugarcane farmers of Vidarbha have been included in this study. This study is also time bound. Only 30 respondents from different districts of Vidarbha are included.

**Need of Research study:**

This study helps to understand the problems and challenges of sugarcane farmers in Vidarbha. By understanding the problems and challenges of the farmers, the government should devise a suitable policy for the sugarcane growers. This study can help in understanding the sugar industry in Vidarbha.

**Research methodology:**

The study was conducted in the year 2024 in Vidarbha region of Maharashtra state. This study is an analytical research based on questionnaire method. Primary data was collected from 30 sugarcane farmers for the study. The respondents were selected by adopting convenience sampling method. Data collected from primary sources were analyzed using various statistical tools, such as percentage and simple mean ranking.

**Data analysis and presentation**

**1. Challenges in the sugarcane seed procurement process.**

| Valid Values | Value | Count | Percent |
|---|---|---|---|
| **1** | Transportation issue | 3 | 10.00% |
| **2** | High prices | 8 | 26.70% |
| **3** | Quality concerns | 8 | 26.70% |
| **4** | Limited availability | 11 | 36.70% |
| **5** | Other | 0 | 0.00% |

**Table 1**

Table 1 shows that the main challenges in the seed procurement process are the limited availability of seeds. Out of 30 respondents 11 farmers have problems with availability of seeds, 8 farmers have concerns about quality of seeds and 8 farmers have problems with high cost of seeds. Therefore, 90% of the farmers are facing difficulties in procuring seeds due to high cost of seeds, quality of seeds and limited availability of seeds.

**2. Irrigation system for sugarcane crop**

| Valid Values | Value | Count | Percent |
|---|---|---|---|
| **1** | Rain fed | 15 | 50.00% |
| **2** | Sprinkler irrigation | 15 | 50.00% |
| **3** | Drip irrigation | 0 | 0.00% |
| **4** | Flood irrigation | 0 | 0.00% |
| **5** | Other | 0 | 0.00% |

**Table 1**

Table 2 shows the irrigation methods used by sugarcane farmers. Out of 30 respondents, 15 farmers are dependent on rainwater and the rest are dependent on frost irrigation. It is found that 50% farmers are using rain water for irrigation and 50% farmers are using sprinkler irrigation.

**3. Climatic conditions affect the production of sugarcane in the region**

| Valid Values | Value | Count | Percent |
|---|---|---|---|
| 1 | Positively | 9 | 30.00% |
| 2 | Negatively | 21 | 70.00% |
| 3 | No significant impact | 0 | 0.00% |

**Table 2**

Table 3 shows that out of 30 respondents, 21 farmers are facing weather problems, as weather is negatively affecting their sugarcane production. Only 9 farmers are having a positive impact on their agriculture due to weather conditions. Therefore, 70 percent of the farmers are facing the problem of climate change.

**4. Government Support and Subsidies**

| Valid Values | Value | Count | Percent |
|---|---|---|---|
| 1 | Sufficient | 0 | 0.00% |
| 2 | Insufficient | 13 | 43.30% |
| 3 | No Support | 17 | 56.70% |

**Table 3**

Table 4 shows the government assistance and subsidies. Out of 30 responses, 17 farmers received no support from the government and 13 farmers received insufficient government assistance and subsidies. It is seen that the farmers have not received enough government help and subsidy.

**5. Storage Facilities**

| Valid Values | Value | Count | Percent |
|---|---|---|---|
| **1** | Adequate | 0 | 0.00% |
| **2** | Insufficient | 10 | 33.30% |
| **3** | Non-existent | 20 | 66.70% |

**Table 4**

Table 5 shows the sugarcane storage facilities. Out of 30 respondents, 20 farmers are facing problems with storage facilities, while 10 farmers have insufficient storage space. Therefore, 67 percent of the farmers have storage problems.

**6. Sugar mills faced delayed payments for sugarcane deliveries**

| Valid Values | Value | Count | Percent |
|---|---|---|---|
| 1 | Yes | 16 | 53.30% |
| 2 | No | 14 | 46.70% |

**Table 5**

Table 6 shows that sugarcane farmers are facing payment problems. Out of 30 respondents 16 farmers are facing payment problems from vendors and 14 respondents are not facing that problem. It is observed that more than 50% of the respondents have payment problems.

**7. Use of Technology in Farm Management**

| Valid Values | Value | Count | Percent |
|---|---|---|---|
| **1** | High | 0 | 0.00% |
| **2** | Moderate | 16 | 53.30% |
| **3** | Low | 14 | 46.70% |

**Table 6**

Table 7 shows the extent to which farmers have used technology in farm management. Out of 30 respondents 16 farmers are using medium level of technology for farming and 14 farmers are not using technology in their farming. 53% used technology moderately and remaining 47% used very little technology in their farming.

**Conclusion:**

It has been concluded that availability of water, lack of technology, storage facilities, weather problem, and availability of seeds, government support and subsidy are the critical problems and challenges facing sugarcane farmers in Vidarbha. Delay in payment of goods is a major problem faced by farmers.

**Suggestion:**

Farmers have very little knowledge about what new and modern techniques can be used in agriculture. Therefore, training (agricultural exhibitions, lectures etc.) should be organized for the farmers on adopting modern techniques of sugarcane production. The study revealed that water is the most important production problem faced by sugarcane farmers. So the government should work on irrigation schemes like Jalyukta Shivar Yojana. Better disease management can be done by providing farmers with magazines, books or leaflets related to agriculture. The government or the sugar industry should provide storage facilities for the farmers and also pay the sugarcane farmers.

**Future researcher scope:**

Future, researchers can use this study to learn more about the problems of sugarcane farmers in Vidarbha. This study can also be used to study sugar industry in Vidarbha. With the help of this study, further researchers can find modern solutions to farmers' problems.

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# A Case Study on Understanding Worldwide Temperature Alteration and Its Socio-Legitimate Ramifications on Environment with Special reference to India

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**Abstract:**
Climate change, characterized by global temperature alterations, has profound socio-economic and legal ramifications worldwide. This case study focuses on understanding these changes with a special emphasis on their impact in India. It examines the causes and consequences of rising temperatures, the social and legal responses to these changes, and the policies implemented to mitigate adverse effects. Through comprehensive analysis, the study aims to highlight the critical need for adaptive and mitigative strategies to address climate change and its far-reaching implications.

**Keywords:** Climate Change, Global Temperature Alteration, Socio-Legal Ramifications, Environmental Impact, India, Mitigation Strategies, Adaptation Policies, Sustainable Development

**Introduction:**

Climate change is one of the most pressing issues facing the world today. The alteration in global temperatures has led to significant environmental, social, and economic challenges. These changes are driven primarily by human activities, such as the burning of fossil fuels, deforestation, and industrial processes, which increase greenhouse gas emissions. In India, the effects of climate change are particularly pronounced, affecting agriculture, water resources, public health, and the overall economy. This study explores the multifaceted impacts of temperature alteration globally and specifically in India, examining the socio-legal implications and the measures being taken to address these challenges. Climate change, driven by global temperature alterations, is one of the most significant and complex challenges of our time. The Earth's climate system is experiencing unprecedented changes due to human activities, such as the burning of fossil fuels, deforestation, and industrial processes. These activities increase the concentration of greenhouse gases in the atmosphere, leading to global warming and a cascade of environmental, social, and economic consequences. This case study delves into the multifaceted impacts of these temperature alterations, with a special emphasis on their socio-legal ramifications, particularly in the context of India.

Global temperature alteration refers to the long-term rise in the average temperature of the Earth's climate system. This phenomenon has far-reaching effects on natural and human systems, disrupting weather patterns, melting ice caps, raising sea levels, and intensifying extreme weather events. The Intergovernmental Panel on Climate Change (IPCC) has provided compelling evidence that these changes are largely attributable to human activities, necessitating urgent and coordinated action to mitigate and adapt to their impacts.

In India, the impacts of climate change are profoundly felt across various sectors. The country is highly vulnerable to climate-related risks due to its diverse geography, high population density, and dependence on climate-sensitive sectors like agriculture, water resources, and fisheries. Rising temperatures and altered precipitation patterns threaten food security, water availability, and public health, posing significant challenges to sustainable development. Moreover, the socio-economic fabric of Indian society, characterized by significant inequalities, exacerbates the vulnerability of marginalized communities to climate impacts.

The socio-legal ramifications of climate change encompass a broad spectrum of issues, including environmental justice, human rights, migration, and governance. Climate change exacerbates existing social inequalities, disproportionately affecting low-income and marginalized communities. These groups often lack the resources and capacity to adapt to changing conditions, making them more susceptible to climate-related hazards. Addressing these disparities requires robust legal frameworks and policies that promote equity and resilience.

India's response to climate change has been shaped by both international commitments and domestic priorities. As a signatory to the Paris Agreement, India has pledged to reduce its greenhouse gas

emissions intensity and increase its renewable energy capacity. The National Action Plan on Climate Change (NAPCC) outlines eight national missions, focusing on areas such as solar energy, energy efficiency, sustainable agriculture, and water conservation. Additionally, various state-level initiatives and policies aim to address region-specific climate challenges and promote sustainable development.

Despite these efforts, significant challenges remain in implementing and enforcing climate policies in India. Institutional capacity, financial constraints, and political will are critical factors influencing the effectiveness of climate action. Moreover, the integration of climate considerations into broader development planning and decision-making processes is essential for achieving long-term sustainability.

This case study aims to provide a comprehensive understanding of global temperature alterations and their socio-legal implications, with a particular focus on India. By examining the causes, consequences, and responses to climate change, this study seeks to highlight the critical need for adaptive and mitigative strategies. It also aims to identify gaps and challenges in current policies and propose recommendations for enhancing climate resilience and sustainability. Addressing climate change requires a holistic and multi-disciplinary approach that considers scientific, social, economic, and legal dimensions. By understanding the complex interplay between global temperature alterations and their socio-legal ramifications, this case study aims to contribute to the ongoing efforts to combat climate change and promote sustainable development, both in India and globally.

**Definition**

**Global Temperature Alteration:** Refers to the long-term changes in the average temperature of the Earth's climate system, typically attributed to human activities that increase greenhouse gases in the atmosphere.

**Socio-Legal Ramifications:** The social and legal consequences that arise from a particular issue, in this case, climate change, including impacts on communities, economies, legal systems, and policies.

**Aims**

1. To analyze the causes and effects of global temperature alteration.
2. To explore the socio-legal ramifications of climate change on a global scale.
3. To examine the specific impacts of climate change in India.
4. To evaluate the effectiveness of current policies and strategies aimed at mitigating climate change.
5. To propose recommendations for improving climate resilience and sustainability.

**Objectives**

1. To investigate the scientific basis of climate change and global temperature trends.
2. To assess the environmental, social, and economic impacts of climate change.
3. To study the legal frameworks and policies related to climate change mitigation and adaptation in India and globally.
4. To identify gaps and challenges in current climate strategies.
5. To suggest actionable measures for enhancing climate policy and governance.

**Need**

Understanding climate change and its socio-legal ramifications is crucial for developing effective strategies to mitigate its adverse effects. In India, where millions depend on climate-sensitive sectors like agriculture, addressing these issues is essential for ensuring sustainable development and protecting vulnerable populations. This study aims to fill knowledge gaps and provide insights that can inform policy-making and enhance climate resilience.

**Scope**

The scope of this case study includes:

1. Examination of global temperature trends and their driving factors.
2. Analysis of the socio-economic and environmental impacts of climate change.
3. Review of international and national legal frameworks addressing climate change.
4. Case studies of specific climate impacts in India.
5. Evaluation of current mitigation and adaptation strategies.
6. Recommendations for future policy and action.

**History**

The study of climate change and its impacts has evolved significantly over the past few decades. Early research focused on the scientific understanding of climate systems and the role of greenhouse gases. As evidence of human-induced climate change mounted, attention shifted to assessing its impacts and developing mitigation and adaptation strategies. International efforts, such as the United Nations Framework Convention on Climate Change (UNFCCC) and the Paris Agreement, have been pivotal in shaping global climate policy. In India, the National Action Plan on Climate Change (NAPCC) and various state-level initiatives reflect the country's commitment to addressing climate challenges. This historical context provides a foundation for understanding the current state of climate policy and the ongoing efforts to combat climate change. **History**

The understanding and study of climate change and its impacts have evolved significantly over the past few centuries. This historical journey is marked by key scientific discoveries, socio-political

movements, and international agreements that have shaped the current climate discourse and action. The case study on understanding worldwide temperature alteration and its socio-legitimate ramifications, especially with reference to India, draws on this rich historical context.

**Early Scientific Discoveries**

The journey began in the 19th century with the foundational work of scientists such as John Tyndall and Svante Arrhenius. Tyndall's experiments in the 1850s demonstrated that certain gases, including carbon dioxide (CO2) and water vapor, trap heat in the Earth's atmosphere, a phenomenon now known as the greenhouse effect. Arrhenius, in the late 19th century, quantified the impact of CO2 on Earth's temperature, predicting that increased CO2 levels could lead to global warming.

**The 20th Century: Advancements and Awareness**

The 20th century saw significant advancements in climate science and growing awareness of human-induced climate change. Charles David Keeling's precise measurements of atmospheric CO2 at Mauna Loa Observatory in the 1950s provided clear evidence of rising CO2 levels. The Keeling Curve became a crucial indicator of human impact on the global climate.

During the 1960s and 1970s, concerns about environmental degradation and pollution led to the emergence of the modern environmental movement. Rachel Carson's seminal book, "Silent Spring" (1962), highlighted the adverse effects of pesticides and spurred public interest in environmental issues. This period also saw the establishment of environmental regulatory bodies, such as the United States Environmental Protection Agency (EPA) in 1970.

**The IPCC and Global Climate Policy**

The establishment of the Intergovernmental Panel on Climate Change (IPCC) in 1988 marked a pivotal moment in climate science and policy. The IPCC's assessment reports synthesized scientific knowledge on climate change, providing a comprehensive understanding of its causes, impacts, and potential solutions. The First Assessment Report (1990) highlighted the increasing certainty of human influence on climate change and called for international cooperation to mitigate its effects.

The United Nations Framework Convention on Climate Change (UNFCCC), adopted at the Earth Summit in Rio de Janeiro in 1992, provided a framework for international climate negotiations. The Kyoto Protocol (1997) was the first significant international agreement to set binding emission reduction targets for developed countries. However, it faced challenges in implementation and participation.

**The Paris Agreement and India's Climate Policy**

The Paris Agreement, adopted in 2015, represented a landmark global commitment to limit global warming to well below 2 degrees Celsius above pre-industrial levels. Unlike the Kyoto Protocol, the Paris Agreement included commitments from both developed and developing countries, emphasizing a collective approach to addressing climate change. India, as a signatory, pledged to reduce its emissions intensity and increase its renewable energy capacity, aligning with its developmental goals.

In India, climate policy has been shaped by both international commitments and domestic priorities. The National Action Plan on Climate Change (NAPCC), launched in 2008, outlines eight national missions focusing on key areas such as solar energy, energy efficiency, sustainable agriculture, and water conservation. State-level action plans complement the NAPCC, addressing region-specific climate challenges.

**Socio-Legal Dimensions and Environmental Justice**

The socio-legal ramifications of climate change have gained increasing attention over the years. Climate change disproportionately affects vulnerable populations, exacerbating existing social inequalities. Environmental justice movements have emerged globally, advocating for the rights of marginalized communities to live in a healthy environment. Legal frameworks and policies are evolving to address issues such as climate-induced displacement, human rights, and equitable access to resources.

In India, environmental laws such as the Environment (Protection) Act, 1986, and the National Green Tribunal (NGT) play crucial roles in regulating activities that impact the environment. The judicial system has been instrumental in interpreting and enforcing these laws, contributing to environmental governance.

**Current Trends and Future Directions**

The historical context of climate change is marked by both progress and challenges. Scientific understanding has advanced significantly, and international cooperation has led to landmark agreements. However, the implementation of climate policies remains a critical challenge, influenced by factors such as political will, economic constraints, and institutional capacity.

As climate impacts intensify, there is a growing recognition of the need for integrated and adaptive approaches to climate policy. This includes mainstreaming climate considerations into broader development planning, enhancing community resilience, and fostering sustainable practices. In India, ongoing efforts to transition to a low-carbon economy, improve climate resilience, and promote

sustainable development are crucial for addressing the multifaceted impacts of climate change.

**Conclusion:**

The history of climate change research and policy is a testament to the evolving understanding of one of the most pressing global challenges. From early scientific discoveries to contemporary international agreements, the journey reflects the complex interplay between science, policy, and society. By examining this historical context, the case study on worldwide temperature alteration and its socio-legitimate ramifications provides valuable insights into the ongoing efforts to combat climate change and promote sustainability, with a special focus on India. The journey to understand and address worldwide temperature alteration and its socio-legitimate ramifications has been long and complex. From early scientific discoveries to the establishment of international climate agreements, significant progress has been made in recognizing and mitigating the impacts of climate change. However, challenges remain, particularly in implementing effective policies and ensuring that vulnerable communities are protected.

India, with its diverse geography and socio-economic landscape, faces unique challenges and opportunities in addressing climate change. The country's commitment to international agreements like the Paris Agreement, coupled with domestic initiatives such as the National Action Plan on Climate Change (NAPCC), reflects a robust framework for climate action. However, the effective implementation of these policies is critical to achieving sustainable development goals and building resilience against climate impacts.

The socio-legal ramifications of climate change, including environmental justice, human rights, and equitable resource distribution, are increasingly recognized as central to climate policy. Ensuring that marginalized and vulnerable populations are not disproportionately affected by climate impacts is essential for fostering social equity and sustainability.

Moving forward, a holistic and integrated approach is needed to address the multifaceted challenges posed by climate change. This includes strengthening institutional capacities, enhancing community resilience, promoting sustainable practices, and ensuring that climate considerations are mainstreamed into broader development planning. Collaboration between governments, communities, and international bodies will be crucial in driving effective climate action.

In conclusion, understanding and addressing global temperature alterations and their socio-legal implications requires a concerted effort across multiple sectors and levels of governance. By learning from historical developments and current trends, and by fostering a cooperative and inclusive approach, we can better navigate the challenges of climate change and work towards a more sustainable and equitable future for all, with a special focus on the unique context and needs of India.

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# Digitization of Rare Books: Procedure and Precaution -An Overview

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**Abstract:**
The digitization of rare books is a crucial method for preserving cultural heritage and making historical texts more accessible to the public and researchers. This paper provides a comprehensive overview of the procedures and precautions involved in digitizing rare books. It examines the steps involved, from initial assessment to final digitization, and discusses the precautions necessary to protect these valuable materials.

**Keywords:** Rare Books, Digitization, Preservation, Rare Documents.

**Introduction:**

The digitization of rare books is a multi-faceted process that involves careful planning and execution to ensure the preservation and accessibility of historical texts. As libraries and archives increasingly turn to digital methods to conserve their collections, it is vital to understand the specific procedures and precautions necessary to safeguard these irreplaceable materials.

**Procedures for Digitizing Rare Books**

**1. Preparation and Planning:** The initial phase involves preparing the physical condition of the books and planning the digitization process. This includes:

1) **Assessment of Book Conditions**: Evaluating the physical state of the books to determine if they can withstand the digitization process.
2) **Selection Criteria**: Deciding which books are suitable for digitization based on their historical significance, condition, and demand.
3) **Digitization Plan**: Develop a detailed plan that outlines the workflow, equipment, and personnel required.

**2. Preparation:** Preparation is crucial to minimize the risk of damage during digitization:

1) **Cleaning and Stabilization**: Cleaning the books and performing minor repairs if necessary.
2) **Documentation**: Recording the current condition of the books through photographs and written reports.
3) **Equipment Selection:** Choosing the right equipment is essential for high-quality digitization:
4) **Scanners and Cameras**: Selecting appropriate scanners or cameras that can handle delicate materials without causing damage.
5) **Lighting**: Using non-invasive lighting to avoid heat and light damage to the books.

**4. Digitization Process:** The actual digitization involves several steps:

1) **Handling**: Employing proper handling techniques to prevent physical stress on the books.
2) **Scanning**: Using flatbed scanners, overhead scanners, or digital cameras to capture high-resolution images.
3) **Quality Control**: Ensuring that the digitized images meet the required standards in terms of resolution, color accuracy, and clarity.

**5. Post-Processing:** Post-processing involves enhancing and organizing the digital images:

1) **Image Processing**: Correcting any distortions, adjusting color balance, and enhancing readability.
2) **Metadata Creation**: Adding descriptive metadata to facilitate searchability and access.
3) Quality Assurance

**6. Storage and Access:** Storing and providing access to the digitized materials is the final step:

1) **Digital Preservation**: Using reliable storage solutions to ensure the longevity of digital files.
2) **Access Platforms**: Making digitized books available through digital libraries and repositories.

***6.1 Digital Preservation***

Ensuring the long-term preservation of digital files:

1. **Reliable Storage**: Using secure, redundant storage solutions, such as cloud storage and external hard drives. Network Attached Storage(NAS)
2. **Backup Systems**: Implementing regular backup routines to prevent data loss.
3. File Formats and compression.

***6.2 Access Platforms***

Making digitized books accessible:

1. **Digital Libraries**: Uploading digital files to online repositories or digital libraries.

2. **User Interface**: Ensuring a user-friendly interface for easy access and navigation.

**Digital Management Software:** For the selection of Digital management software (DMS) must have following some of the features.

**1)** License copy of software.
**2)** Architect of software.
**3)** Fonts and modules.
**4)** Search capabilities.
**5)** Metadata.
**6)** Security access and control.
**7)** Content Viving.
**8)** Batch data upload tools.
**9)** Multilingual support.
**10)** Reports.

**Precautions during Digitization:**

**1. Handling and Transport**

Proper handling and transport techniques are essential to avoid damage:

**1)** **Gloves and Tools**: Use clean gloves and non-abrasive tools to handle the books.
**2)** **Support Structures**: Utilizing book cradles and supports to minimize stress on the spine and pages.
**3)** Handle Fridgile Materials.

**Copyright and legal consideration.**

**1)** Books should be copyright-free.
**2)** Fair use of digitized books.
**3)** Copyrighted materials can also be digitized under adjudicated regulations and agreements.

**2. Environmental Controls**

Maintaining a controlled environment helps protect the books:

**1)** **Temperature and Humidity**: Keeping the temperature and humidity at optimal levels to prevent deterioration.
**2)** **Lighting**: Using low-intensity, UV-filtered lighting to prevent light damage.

**3. Security Measures:**

Implementing security measures to protect the books from theft or loss:

**1)** **Restricted Access**: Limiting access to authorized personnel only.
**2)** **Monitoring**: Using security cameras and monitoring systems to ensure the safety of the books.

**Suggestions**:

**1)** Collaboration for projects like the Piolat Project.
**2)** Enhancing user access and quality control.

**Conclusion:**

Digitizing rare books is a complex but essential process for preserving cultural heritage and improving accessibility. By following careful procedures and taking necessary precautions, libraries and archives can successfully digitize their rare book collections while ensuring their preservation for future generations.

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# Transformation of Banking Governance in Digital Age

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**Introduction**:

Indian Banking sector is governed by the Reserve Bank of India (RBI) regulates all the major issues related to currency, foreign exchange reserves of Public Sector as well as Private Sector. Setting the bank's business objectives, its appetite for risk, its internal controls, as well as allocating roles and responsibilities and setting up adequate reporting lines are all aspects which fall under the scope of internal governance. Corporate Governance" is the mechanism by which managers are selected, motivated, and become accountable to shareholders and managers as well. Central Bank of India regulates all the major issues related to currency, foreign exchange reserves of Public Sector as well as Private Sector. Banking Governance for banks is crucial for the development of banking activities. RBI has brought out specific guidelines for corporate governance for banks.

**Significnace of the Study**:

The Corporate Governance assumes an essential job in Banking Sector of the nation so uncommon spotlight on the Corporate Governance in this area becomes vital on the grounds that banks are assuming a significant job in the budgetary arrangement of the nation, awareness, lessening the conceivable monetary weight of recapitalizing the PSBs, consideration towards Corporate Governance in the financial area is required and the strength of open proprietorship in the financial part so corporate practices can be introduced in banking sector for effective control and efficient performance.

**Review of Literature:**

To setup standards for governance in Indian commercial banks, the RBI formed the ';Standing Committee on International Financial Standards and Codes'; (chaired by Y.V. Reddy) in 2000, which later entrusted the task to the " Advisory Group on Corporate Governance" in 2001 (chaired by R.H. Patil) recommended such as directors' responsibilities, shareholders'/stakeholders' accountability, criteria for selecting independent directors, the board structure and composition, the constitution of committees for audit, nominating and remuneration, stakeholder relationship etc., and relevant disclosures.in continuation to that RBI established the ';Consultative Group of Directors of Banks and Financial Institutions'; (chaired by A.S. Gangly) for reviewing the role of boards as supervisors, which, in 2002, submitted a report making specific suggestions for scheduled commercial banks and non-banking finance companies. Recently, a review of boards of Indian banks was undertaken by the'; Committee to Review Governance of Boards of Banks in India, (chaired by P. J. Nayak) recommended banks should follow the SEBI regulations on corporate governance. Firoz M. (2010) has deduced in his investigation that the associations are constantly expected to improve the extent of monetary revealing from the present detailing framework as acknowledgment and estimation of natural budgetary advantages, costs, resources and liabilities. Millon, David (2011) has clarified in his examination that since a long time ago run thriving of company relies upon the prosperity of its different partners and investors and maintenance likewise for current accessibility of common assets in which the organization can endure and prosper. Gupta, P. (2012) has examined that the better corporate administration prompts better execution of the organizations. He additionally found in his examination that corporate administration soundly affects the offer's costs and money related execution of the organizations.

**Objectives of the Study:**

The present study has the following objectives.

1. To know the evolution of corporate governance in the banking sector
2. To explore the significance of corporate governance in banking sector
3. To discuss the RBI initiatives towards ensuring good corporate governance
4. The study is based on the secondary data reports of RBI, other banks.

**Findings and Discussions:**

**Evolution of Corporate Governance in the Banking Sector**

Banking Industry has been one of the oldest Industries globally began in 2000 B.C. in the ancient world. It began with merchants lending money to farmers. Since then, the banking industry came into existence evolving from the dimple barter system

and gift economics of ancient times to modern complex, globalized, technology, and internet-based e-banking models. Banking in the modern world is traced way back to medieval and early Renaissance Italy, to rich cities in the north such as Florence, Venice, and Genoa. Development began to flourish from Europe and a number of innovations occurred in Amsterdam during the Dutch Republic in the 16th century and then London in the 17th century. Banking in the 20th century faced various ups and downs in the Banking Sector. There were a few guidelines related to working of the Corporate Governance of Banks before the banking reforms. The Public Sector Banks were dominating the industry as the number of Private Sector Banks was less against them. Banking Governance flourished by the reforms of 1991, the banking sector experienced a drastic change in India. The Private Sector Banks entered into the industry as a result the shareholdings of the Public Sector Banks experienced a downfall. Banks today are autonomous in nature and have maximum freedom. Corporate Governance also flourished due to the involvement of the Institutional and retail shareholders. OECD (Organisation for Economic Co-operation and Development), an international organization formulated the corporate governance principles in 1999 (revised again in 2004). In 1999, The Basel Committee too formulated the principles of governance for the banks which are followed by every bank are called Basel III Norms. The Reserve Bank of India (RBI) took over to have a deeper improvement of the principles of corporate governance in the banking sector (or Banking Governance) of India to reach international standards. On August 21, 2002, the Ministry of Finance and Company Affairs formed an institution to look after the issues of Corporate Governance in India.

**Significance of Corporate Governance in Banking Sector**

Banking sector plays an important role of managing funds and its circulation. Good corporate governance is important factor in retaining existing investors and attracting new investors. Investors believe that a bank with good governance will provide them a safe place for investment and also give better returns. An adequate and strong disclosure therefore helps to attract capital and maintain confidence of investors which calls for qualitative governance standards which include standards such as internal controls, composition and role of the Board, disclosure standards and risk management. High-quality communications reduce investors' uncertainty about the accuracy and adequacy of information being disseminated and thereby help the firms to raise adequate capital at a competitive cost. Corporate governance can be useful in providing the appropriate structure in any system by placing right objectives and goals in front of the organization and helping the organization to attain these goals.

Banking governance in India has undergone significant transformation in the digital age, driven by technological advancements and regulatory reforms.

**Digital Payments Revolution:** India has witnessed a massive shift towards digital payments, spearheaded by initiatives like Unified Payments Interface (UPI) and Aadhaar-enabled Payment System (A-ePS). This has reduced reliance on cash, increased financial inclusion, and improved transparency in transactions.

**Regulatory Framework:** The Reserve Bank of India (RBI) plays a crucial role in governing the banking sector. It has introduced regulations to ensure the security of digital transactions, protect consumer interests, and promote competition among banks and fintech companies.

**Cybersecurity Measures:** With the increase in digital transactions, cybersecurity has become a top priority. The RBI has mandated stringent guidelines for banks and payment providers to safeguard customer data and prevent cyber threats.

**Financial Inclusion:** Digital banking has played a pivotal role in enhancing financial inclusion in India. Through initiatives like Jan Dhan Yojana, the government has aimed to provide banking services to the unbanked population, leveraging digital platforms for accessibility.

**Digital Lending:** Fintech companies have disrupted traditional lending practices by leveraging data analytics and AI algorithms to offer quick and efficient lending solutions. This has expanded credit access to individuals and small businesses.

**Governance Challenges**: While digital banking offers numerous benefits, it also poses governance challenges such as data privacy concerns, regulatory compliance, and the need for robust risk management frameworks to address cyber threats and operational risks.

**Role of Technology:** Banks are increasingly adopting technologies like blockchain for secure and transparent transactions, AI for customer service automation, and big data analytics for personalized services and risk management.

**Consumer Protection:** The RBI has introduced mechanisms like the Banking Ombudsman Scheme to address consumer grievances related to digital banking services, ensuring fair practices and efficient redressal.

**RBI's Initiatives towards Ensuring Good Corporate Governance**

The RBI has been taken number of initiatives to enhance the usefulness of good corporate governance and some of these are:

1. RBI is issued licenses to more and more banks exercising its power to issue license under the Banking Regulation Act of 1949.
2. Greater independence is now given to boards of Public Sector Banks and emphasis has been laid on deregulation and operational freedom.
3. The nominee directors increasingly replaced by independent directors with a view to increase professional representation on boards of Public Sector Banks and increase the level of competence.
4. To achieve operational transparency, with the abolition of minimum lending rates for co-operative banks, it is incumbent on banks to make the interest rates charged by them transparent and known to all customers.
5. The commercial banks in India are required to disclose accounting ratios relating to operating profit, return on assets, business per employee, NPAs, etc. as also maturity profile of loans, advances, investments, borrowings and deposits.
6. Dedicated Information Desks manned by trained personnel in Central Office and in each Regional Office, under the direct oversight of the Regional Director are proposed to be set up to which the common person may approach either through mail or telephone or fax or in person to get information or to clarify doubts;
7. Mandate has been imposed on the banks to disclose the actual NPAs so that the problem of NPAs can be addressed.
8. The "Corporate Governance Reforms 2.0" - most recent initiatives taken up by the RBI.

**Conclusion:**

Indian Banking sector is governed by the Reserve Bank of India (RBI) regulates all the major issues related to currency, foreign exchange reserves of Public Sector as well as Private Sector. Banking Governance is crucial for the development of banking activities. Setting the bank's business objectives, its appetite for risk, its internal controls, as well as allocating roles and responsibilities and setting up adequate reporting lines are all aspects which fall under the scope of internal governance. Overall, banking governance in India is evolving in response to the digital age, focusing on enhancing efficiency, security, and inclusivity while addressing emerging challenges through regulatory reforms and technological innovations.

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# Domestic Violence against Women And Children is a Social Evil: A Study with Special Reference to Domestic Violence Act, 2005

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**Abstract:**

One of society's most destructive and terrible social evils that destroy families is domestic violence. More than a million women in India are the targets of this kind of cruelty, that has a significant effect on the children who see it. Therefore, it is crucial to have a conversation about domestic violence and its repercussions on women and children. The study will highlight how parental disagreement destroys children's lives and how difficult it is to rehabilitate them. The primary goal of the study is to understand the problems raised in the life of women and children because of domestic violence. The secondary goal of the study is to discuss the solutions or remedy to the women against domestic violence. And the third Goal of the study is to identify the effect on children and how to handle them who are the witness of domestic violence. In this paper there is brief discussion about the effects of domestic violence on women and children and the remedy or relief accessible to women under The Domestic Violence Act, 2005.

**Keywords:** Domestic violence a social evil, effect of domestic violence on children, Relief to women against domestic violence.

**Introduction:**

Domestic violence is problem which is surrounded by whole world. Domestic violence is raised in between life partners who is in an intimate relationship due to imbalanced power, duties and obligations to each other. It directly attacks on the emotions of person means domestic violence are a different forms like emotional, sexual, physical, psychological, economical abuse and threats to abuse. Domestic violence is the social evil which is more dangerous giant and painful to family who destroy the family. In India Over and above the millions of women are the victims of such evil and its broadly impacted on the children who are the witnessed of this. Domestic violence affects the mental health, physical health wellbeing, and quality of life of children, women and her paternal family. In this research paper the researcher attempted to write down the children and teens who are the witnessed and brought up with domestic violence in the families and households are use violence at school and colleges and community as response to perceived to threats, attempt suicide, use drugs, commits crimes of sexual assaults, to use violence to enhance their reputations and esteem, and to become abuser in later life.

**Domestic Violence:**

In general, domestic violence is violence or other abuse that occurs in domestic setting such as marriage or cohabitation or by an intimate partner.[1] Domestic violence is the violence which creates fear and difficulties in a woman and children in a domestic environment such as a home. Domestic violence includes abuse experienced by women at the hands of male family members or relatives basically with the biological relations.[2]

**Related Laws to Domestic Violence:**

To safeguard women and children the key piece of legislation is the Domestic Violence Act of 2005. Other than this the provisions relating to cruelty about the domestic violence against women is available in section 498 A of Indian Penal Code, 1860 with punishment to abuser as follows.

**Section- 498A:** Husband or relative of husband of a woman subjecting her to cruelty: Whoever, being the husband or the relative of the husband of her, subjects such a lady to abuse will be guilty to a penalty in addition to a sentence of detention for a maximum of three years.[3]

The term "cruelty" has been widely understood to cover any act of bodily injury or psychological harm to a woman's or health furthermore harassment committed with the intention of forcing the victim or her relationships to comply with any illegal demand for asset or worthwhile security. Harassment for dowry is covered by the section's latter limb. Another component of "cruelty" is putting her in a scenario

[1] https://en.wikipedia.org/wiki/Domestic_violence

[2] https://www.ezylegal.in/blogs/what-is-domestic-violence-in-india

[3] I. P. C., 1860

that makes her want to end life.[4] The ingredients of this provision come under the ambit of domestic violence against women. Means before passing law of Domestic Violence, domestic violence was controlled by 498 A of Indian Penal Code, 1860.[5]

**The Protection of Women from Domestic Violence Act, 2005:**

**Definition of domestic violence:**

In the said act the comprehensive definition is given about domestic violence that, any act, omission or commission or conduct of the respondent shall constitute domestic violence in case it

(a) Causes physical assault, sexual assault, or verbal and emotional abuse, or puts in danger the aggrieved person's health, safety, life, limb, or well-being, whether mental or physical, or has the tendency to do so.

(b) Abuses the victim emotionally and financially; or abuses, hurts, assaults, or puts the victim in risk to force woman or anyone connected to her to comply to an illegal demand such as a money or other asset or valued security.

(c) Having the result of putting the individual who is upset, or anybody connected to her in danger through any actions stated in clause (a) or clause (b).

(d) Physically hurts or harms the resentful party in any way, either physically or mentally

Explanation I.—in the context of this part,

(i) "physical abuse" denotes any action or behaviour, including assault, criminal intimidating, and use of force, that is of some sort that could endanger someone's life, put them at risk, or hurt their physical well-being.

(ii) "Sexual abuse" includes any conduct of a sexual nature that abuses, humiliates, degrades or otherwise violates the dignity of woman.

(iii) "Verbal and emotional abuse" comprises_

(a) Insults, verbal abuse, disgrace, mockery, and taunts, particularly regarding the lack of son or a male child; and

(b) Persistent attempts to hurt physically anyone that the individual that is offended finds appealing.

(iv) "Economic abuse" comprises—

(a) loss of all or any monetary assets that the victim needs for their needs, regardless of if they are paid for by a judicial order, tradition, or another source; this includes, but does not restrict to, living expenses for the aggrieved party and her children, stridhan, assets that the victim owns jointly or independently, money of maintenance and rental fees associated with the shared household.

(b) removal of personal belongings, any forfeiture of assets whether real or personal, valuables, investments, and the like, as well as any additional assets that the harmed party owns together or independently, or that she has the right to utilize because of her at home connection to the other individual, her family members, or her stridhan, or that she may fairly need; as well as

(c) Limitation or limitation on the injured party's ongoing utilization or enjoyment of any assets or amenities, include sharing home entry, because of the marital partnership.

Interpretation II: The total information and events of the case will be considered into account to assess whether any action, neglect, commission, or behaviour of the responder qualifies as domestic assault in this part of the law.[6]

As we discuss about definition of The Domestic Violence Act, 2005 the type of domestic violence as follows:

Physical abuse: Physical assault is the most obvious form of domestic violence against women in India. As stated by the Domestic Violence Act, domestic violence is any act that harms the victim's body or puts their life, limb, health, or development in jeopardy. Assault, use of illegal force, and criminal intimidation are examples of physical abuse. Women need to seek legal advice from an attorney and take urgent action on these issues

Sexual violence: One form of coercion related to sexuality or reproduction is the use of force against women. Marital rape must be seen as sexual abuse in general. Marital rape is lawful, nonetheless, if the victim is under the age of fifteen. "Any sexual abuse that abuses, humiliates, degrades, or otherwise violates the dignity of a woman" is how the Domestic Violence Act defines sexual abuse.

Verbal and emotional abuse: Verbal abuse refers to remarks or threats made against women by domestic partners in India. From a human rights standpoint, emotional abuse, a very common form of domestic violence in India, is a direct result of verbal abuse. When a woman experiences emotional and verbal abuse, her sense of worth is undermined.

**Economic abuse:**

That was a significant milestone when the government added economic abuse to the list of abuses covered under the Domestic Violence Act. The conventional definition of economic abuse is the denial of financial resources or assets to the victim and her children, or the fear of such denial.[7]

**Relief to women against Domestic violence:**

This legislation is for the protection to women against the domestic violence means if any

[4]https://www.scconline.com/blog/post/2018/12/03/law-for-laymen-section-498-a-ipc-and-allied-sections-cruelty-to-women/

[5] Ins. by Act 46 of 1983, s. 2 by Amendment in I. P. C., 1860.

[6] Section 3 of The Protection of Women from Domestic Violence Act, 2005

[7] https://www.ezylegal.in/blogs/what-is-domestic-violence-in-india

incidence occurred against any women some protections are available to her in the form of reliefs as follows:

**Protection Order**:

After providing all parties with a chance to be heard, the magistrate may, if they are initially convinced that domestic abuse has occurred or is likely to occur, issue a protective decree supporting the victim and forbid the other party from doing any act against the aggrieved party which is harmful to her.[8]

**Residence Order:** A residence order prohibiting the abuser from removing the victim and ordering them to leave the same household shall be issued by the magistrate. The judge is instructed under the residence order to prevent the abuser from allowing any family members to enter the house where the victim is permitted to dwell.[9]

**Compensation order:** Furthermore, to other remedies available under this Act, the judge may, upon the aggrieved party's application, issue an order compelling the other party to provide damages and compensation for any harm includes the emotional suffering and mental agony brought by the respondent's acts of domestic violence.[10]

**Maintenance order**: If the injured party does not have enough money to themselves the magistrate will issue an interim and final maintenance order to maintain them.[11]

**Custody Order:** If the court determines that there is no danger to the child or the victim, the woman will be granted custody of the child based on their application. The abuser will then be given the opportunity to visit the children.[12]

In reference to protection to women against domestic violence there are various provisions, but we have discussed some of these. But one more provision is section- 36 of The Protection of Women from Domestic Violence Act, 2005 will operate a supplement to, and not in lieu of, the requirements of any other legislation that is now in effect. For example, maintenance order passed under section 125 of Cr. P. C. and later passed under The Domestic Violence Act, 2005 are valid orders and latter is addition to first order.[13]

**Effect on Children:**

The victim woman and her children suffer greatly from domestic abuse. The victims experience issues with their physical and mental health. Youngsters who witness domestic abuse run a very high danger of enduring problems such as anxiety, depression, and behavioural disorders. As they age, they may exhibit an increased propensity for aggressive behaviour. Some bad effects on children pointed out as follows:

**Children physically abused:**

This phenomenon may manifest in youngsters who attempt to assist or shield others, or who attempt to mediate disputes between their parents and discern whether they are being directly impacted or abused. Domestic abuse can have direct and immediate physical impacts, such as bruises, fractures, lost teeth, and hair loss.

**Children Psychologically Disturbed:**

Because the psychological repercussions of this effect are complicated and in certain situations silent, it poses a serious risk to children. Unquestionably, domestic abuse of any kind will influence a child's mental health, and impacted youngsters may behave in one of two ways: either they communicate their feelings, or they do not. It is undeniable that a very small percentage of kids communicate their emotions since they find it embarrassing and prefer to keep their problems hidden. Children can express themselves in a variety of ways, including sobbing, yelling, using harsh or disrespectful language, and damaging objects. These behaviours are ways for them to vent their uncomfortable emotions. Children who choose to conceal the suffering they endured because of domestic abuse run the risk of developing depression and suffering psychological damage. People suffering from depression may harm themselves or others, obstructing their positive experiences, which will keep them in agony; the worst-case scenario is that they may commit suicide to end their suffering.[14]

**Avoid Relationship with Family Members and Others:**

There is no denying that relationships are an inevitable part of every life. Children who are victims of domestic abuse may avoid having positive relationships with other people because of their family relationships making them nervous about their interactions with another people. For every relationship with children, the family comes first. For all children, the person who can provide them with comfort and protection is referred to as their parent. Children, however, begin to doubt the connection when domestic violence happens. It's possible that children and adults have distinct perspectives. Their brains have not fully evolved to comprehend the complexity of the relationship, so they make decisions based only on what they see and, consequently, perceive. It is undeniable that in

[8] Ibid, Section 18
[9] Ibid, Section 19
[10] Ibid, Section 20
[11] https://wcd.delhi.gov.in/wcd/protection-women-domestic-violence-act-2005
[12] Ibid, Section 21
[13] Bhagyashri v/s Purushottam, Bombay High court, 2023, 22nd Nov.
[14] https://www.justice.gov/ovw/domestic-violence

cases of domestic violence or disagreement, parents frequently ask their kids to choose between their mother and father. This puts confusion and pressure on the kids, even though the issue is unrelated to them. Nevertheless, it affects the kids directly, and if this occurs frequently enough, it will negatively impact the relationships within the family, leading the kids to choose to ignore the domestic violence they witness and to lose interest in the relationships with their parents.

Today, domestic violence occurs frequently, yet it has never been condoned. There is no doubting that children who are victims of domestic abuse are poorly perceived by society, which may cause the children to feel ashamed. However, the worst issue is that children are being tormented and made socially unacceptable for problems they did not cause. Children who experience domestic violence tend to have poor family relationships and feel afraid in all relationships, which makes it difficult for them to make friends and ultimately causes them to decide to live alone.

**Drop out From School:**

The dropout rate of children from school due to domestic violence against women is very high in nature. There are two types of emotions: positive and negative, and they can both reinforce and undermine academic goals. School-age children who experience domestic violence find it incredibly challenging to manage their emotions because education is challenging and might put pressure on them. As was previously said, children already face stress and exhaustion at school. If domestic violence stress persists, it could cause children to lose interest in their education and create negative behaviour. The only sensation that the youngsters in this terrible scenario seem to be feeling is boredom, and their education ends in retreat. Many people worldwide are impacted by domestic violence. However, because of this ongoing problem, youngsters should receive the greatest attention. The reason behind this is violent families are not able to lift their kids, which causes them to lack warmth, concern, love, unity, and mutual trust.

**Conclusion:**

As we discussed the effects on youngsters as a result the domestic violence against women in furtherance of this it is observed that, children become more violent, attempt suicide, become drugs addicted, commits crimes especially sexual assault, and in their further life become abuser as they abused in past. In their life raised many problems like anxiety, depression, sleep problems including nightmares or bedwetting, spending more time alone.[15] The Domestic Violence Act, 2005 Provides protection to women against the domestic violence by giving various remedies but what about the children who are the sufferers of this evil that is the question before us and what should be the solution for this. First, the best way to safeguard the children from this evil to reduce domestic violence by educating people and creating awareness in them by informing the bad effect of this. Second one is counselling to the parents as well as children about the better wellbeing of the children and themselves.

[15] https://www.aacap.org/AACAP/Families_and_Youth/Facts_for_Families/FFF-Guide/Helping-Children-Exposed-to-Domestic-Violence-109.aspx

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# A Study on the Impact of Artificial Intelligence on Pharmaceutical Firms

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**Abstract:**
Pharmaceutical companies specialize in developing, producing, and distributing pharmaceutical products such as over-the-counter medications, vaccines, and prescription medications. They make a substantial contribution to the development of healthcare by creating unique remedies for various medical illnesses. The emergence of a revolutionary era in the pharmaceutical industry results from the rapid advancement of AI technology. The focus of this study is to evaluate the impact of artificial intelligence on pharmaceutical firms. The technique used in this is the Wilcoxon one-sample signed rank test. The outcome of this study indicated that Accelerated drug discovery, Drug design, Drug repurposing, Clinical trial optimization, Personalized medicine development, Patient outcome improvement, Knowledge discovery, Sales forecasting, Cost reduction, and Supply chain optimization have a high impact on pharmaceutical firms implementing artificial intelligence.

**Keywords:** Artificial Intelligence, Pharmaceuticals firms, Wilcoxon one-sample signed rank test.

## Introduction:

Artificial intelligence (AI) refers to the replication or simulation of human intellect by computers, giving them the capacity to think and act like people. Due to its capacity and promise to manage complicated and vast volumes of data efficiently, artificial intelligence has emerged as a significant and influential aspect of the 21st century and has shown to be beneficial for the technology sector. The fundamental objectives of artificial intelligence include reasoning, data sorting, learning, natural language processing, and the capacity to manipulate objects using techniques from many different relevant fields, including statistics, traditional symbolic AI, computation, economics, psychology, and many others. Computer science, information technology, mathematics, statistics, philosophy, linguistics, and many other significant disciplines are used in AI research and development. Although AI has aided in the advancement of several businesses, it also raises several ethical concerns for the scientific community. Some people think that if artificial intelligence (AI) development continues, it might endanger our very survival, while others think that it would lead to widespread unemployment in all industries. Artificial intelligence has proved useful for the healthcare sector, particularly in speeding up the drug discovery process, even if these hazards are cause for concern (Sudan et al. 2020).

There is shift in the medical industry. The cost of healthcare as a whole is increasing, and there is a growing lack of healthcare workers, which are two components of this transition. The healthcare industry is looking at embracing cutting-edge technologically driven practises and solutions to cut costs and solve these developing challenges. A few of the major issues affecting healthcare systems throughout the world are a lack of access, high costs, waste, and a growing elderly population. A few of the implications that epidemics like the coronavirus (COVID-19) are capable of having on healthcare systems include inadequate or erroneous diagnostic tests, overworked physicians, and a lack of information interchange (Greenberg et al., 2020; Pavli et al., 2021). Each year, a large number of pharmaceuticals are approved for use and put on the market to treat various conditions. Thousands of possible pharmaceutical options are screened and tested to locate a single prospective medication for the therapy of a certain ailment, which costs over a billion dollars in financing and takes approximately ten years to reach the market. The journey starts in a university or research institution that is funded by several organizations and pharmaceutical firms, where basic research on understanding the cell and molecular components of disease begins. This comprehension of the routes and mechanisms of disease makes it feasible to identify potential targets for innovative therapies (Sudan et al. 2020).

More and more applications of artificial intelligence (AI) are being used in business and daily life, including healthcare. Healthcare workers may benefit from AI in several areas, such as care of patients and administrative work. The bulk of AI and healthcare developments are helpful to the

healthcare sector, even though the approaches they support may differ greatly. It will be some time until AI in healthcare completely replaces people for a variety of medical professions, despite claims made in certain publications on the subject that AI is capable of doing just as well as or better than humans at different tasks, including recognising illness. Despite these amazing developments, AI's application in healthcare is still in its early stages. The capabilities of the technology are being regularly improved via research, which will result in more breakthroughs over the next years in a variety of various industries. Healthcare facilities have the potential to greatly improve patient quality of life, and AI and machine learning have much to offer the crucial healthcare sector, which is now going through one of the quickest digital transitions. (Shaheen 2021).

This study aims to investigate the effects of artificial intelligence (AI) on pharmaceutical companies. It aims to examine how AI technologies are changing the processes of drug discovery, development, and manufacture in the pharmaceutical sector. The goal of the study is to determine how AI is boosting productivity, cutting costs, and stimulating innovation in pharmaceutical firms, ultimately leading to improvements in healthcare.

**Review of Literature:**

1. **Bhattamisra, S.K., (2023).** This study examined the growing influence of artificial intelligence (AI) on medical and pharmaceutical research. The evaluation concentrated on the potential and difficulties in these areas. According to the study, AI has potential uses in the diagnosis of diseases, digital therapy, individualized treatment, medication development, and epidemic/pandemic forecasting. “Deep learning, neural networks, Bayesian nonparametric clinical trial design models”, and processing of natural languages for detecting patients and clinical trial monitoring were important AI technologies. Notably, deep learning and neural networks have been used successfully to forecast the emergence of several illnesses, including seasonal “influenza, Zika, Ebola, tuberculosis, and COVID-19”.
2. **Prasad, Patil., et al. (2023).** The study's goal was to present a comprehensive picture of artificial intelligence's significant influence and potential uses in the pharmaceutical industry. It highlighted the many advantages artificial intelligence (AI) provides, including medication discovery, personalised medicine, expediting drug development, and improving drug safety protocols. The study found that although artificial intelligence offers the pharmaceutical business tremendous potential, there are significant obstacles to its broad implementation. The lack of clear legislative frameworks, enduring worries about data security and privacy, restrictions on the quality and accessibility of data, and moral conundrums are some of these difficulties. Nevertheless, despite these challenges, further research and development in AI technology has the potential to significantly improve the accuracy and effectiveness of drug development procedures.
3. **Krishnagiri, Krishnababu., et al. (2023).** The purpose of this study was to demonstrate how artificial intelligence (AI) is revolutionising the pharmaceutical sector and how it has the power to completely change the way that drugs are developed and how healthcare is delivered. The study confirmed that artificial intelligence (AI) is revolutionising the pharmaceutical industry by streamlining labor-intensive processes through its ability to manage enormous datasets and execute efficient methods. Important discoveries included the function of AI in lowering costs, accelerating drug research, and enhancing medicine efficacy. The study emphasised how AI has the potential to save lives by expediting the development of a strong pipeline of innovative pharmaceuticals, in addition to bringing more affordable and effective drugs to market.
4. **Devendra, S. et al. (2022).** The pharmaceutical industry's use of AI was the primary focus of this paper. To put it all together, there were several difficulties in completing the job. At that time, the employment of genetic algorithms (ANNs) and artificial intelligence (AI) in the pharmaceutical industry was already widely accepted. Robotics may be used in combination with artificial intelligence (AI), which has demonstrated potential in the pharmaceutical industry. The healthcare sector may have undergone a revolution had physical robots been used. It offered a focus for social interaction, keeping the minds of older patients active and engaged. Artificial intelligence (AI) may have helped the pharmaceutical sector save time and money.
5. **Praveen, Tahilani., et al. (2022).** The goal of the study was to draw attention to the growing influence of data science, machine learning, and artificial intelligence (AI) on the pharmaceutical industry, with a focus on how these technologies may improve the drug discovery process. The study demonstrated how AI, ML, and data science have the ability to change the pharmaceutical industry completely. These technologies are positioned to alleviate the expensive costs and lengthy timescales often associated with medication research and approval by simplifying and optimizing the drug

discovery process. The research highlights that using artificial intelligence (AI) in pharmaceutical procedures offers advantages not only for the pharmaceutical sector but also for scientists working in chemical biology, computational chemistry, medicinal chemistry, and bioinformatics. As the pharmaceutical industry looks to the future, the results together highlight the critical role that AI, ML, and Data Science will play in fostering efficiency and innovation in drug development processes and drawing interest from a wide range of scientific disciplines working in adjacent fields.

6. **Hameed, B.M. et al. (2021).** This study's objective was to investigate how current developments in artificial intelligence (AI) have affected urology. The study's goal was to examine how AI algorithms and techniques are used in urology for diagnostic, therapeutic, and prognostic purposes. The study also examined the advantages of using AI in the treatment of urological problems versus more traditional methods. According to the study, AI has significantly impacted how urological issues are treated across a variety of disorders, including major ailments like benign prostatic hyperplasia and urothelial and prostate cancer. AI algorithms have dramatically improved disease diagnosis, treatment methods, and result prediction in urology. The advantages of AI over traditional urological practises were identified and emphasised, highlighting AI's revolutionary potential to improve patient care and disease management.
7. **Shaheen, M. (2021).** In this study, recent applications of artificial intelligence (AI) in healthcare were emphasized, including medication discovery, clinical studies, and patient care. The study found that AI is changing the healthcare industry by predicting, understanding, learning, and acting. It benefits pharmaceutical firms since it streamlines target identification and expedites medication development. AI also simplifies the management of massive amounts of data in clinical studies. AI systems have a significant impact on modern healthcare since they help patients and analyze their health information to improve their quality of life.
8. **Shanbhogue H, M., et al. (2021).** The researchers carried out an in-depth analysis of artificial intelligence in the pharmaceutical industry. Artificial intelligence has been hailed as one of the most promising methods to tackle the challenges of drug development, which included high R&D expenditures and unpredictability in time consumption. Due to the abundance of data, there was a potential that some important information would have been overlooked. Techniques like "deep learning, machine learning, and other systems for expertise were being employed to address these problems. The delays in drug development and failures at the experimental and marketing levels might be decreased with the effective application of AI in the pharmaceutical industry. This assessment included details on the evolution of AI, its subfields, its general implementation, and its use in the pharmaceutical industry. It also included insights into its difficulties and restrictions.
9. **Bowen, Lou., Lynn, Wu. (2021).** This study focused on the development of an AI innovation capacity within pharmaceutical companies, with the goal of investigating how artificial intelligence (AI) may simplify drug discovery procedures. The analysis showed that AI innovation capabilities has a major impact on a company's ability to find new drug-target combinations, particularly for medications with modest degrees of chemical novelty and in situations where the drug's mechanism of action on a disease is understood. The study did point out that AI has limits when it comes to completely new treatments, situations in which there is no therapy at all, and gradual "follow-on" medications. The study found out that personnel who have domain knowledge and AI skills—rather than just AI skills—will be more successful in using AI for drug discovery. Developing and improving AI systems for drug discovery iteratively has been shown to need synthesizing inputs from both AI and domain specialists. The study's overall findings shed light on the benefits and drawbacks of using AI in drug discovery and emphasized how crucial it is for pharmaceutical companies to manage their AI resources well to produce successful drugs.
10. **Adam, Zielinski. (2021).** This research aimed to examine how developments in pharmaceutical artificial intelligence (AI) could affect the creation of novel medications in the near future. The study produced several important findings that corroborate the claim that advances in pharmaceutical AI might fundamentally alter the course of drug development. It brought attention to the productivity problems facing the pharmaceutical industry today. It demonstrated how AI-driven research techniques may directly solve these problems by cutting costs and time associated with drug discovery initiatives. The study included examples of significant outcomes from AI interventions, including a tenfold decrease in the time it takes to find new medication molecules and the creation of large databases and prediction models for drug safety. The study also highlighted the momentum that

record financing rounds and partnerships between business, government, academia, and IT giants have created, which should lead to the development of safer and more potent treatments.

11. **Rohan, Gupta. et al. (2021).** The editorial sought to draw attention to the difficulties in medication design, which are made worse by complicated data and include low effectiveness and high prices. It highlighted how crucial machine learning (ML) and artificial intelligence (AI) are to changing the drug development process. The importance of AI and ML technologies on medication development was highlighted in the article. It emphasised how artificial intelligence (AI) might help overcome obstacles including exorbitant prices and inefficiencies in medication research and design. Deep learning methods were specifically highlighted for their use in toxicity prediction and virtual screening, among other phases of drug development. The article demonstrated how AI may be used to solve problems related to screening, toxicity prediction, and pharmaceutical production at various stages of the drug development process. In the end, it suggested AI as a possible path towards more efficient and successful medication research and design procedures in the pharmaceutical industry.
12. **Sudan, S.S. et al. (2020).** This study's goal was to investigate how artificial intelligence (AI) is used in medication development. The goal of the study was to determine how quickly developing AI technologies would alter the process of developing new drugs. It also looked into how the deployment of AI technologies and approaches was influencing cooperation between the IT and pharmaceutical industries. The main emphasis was on how AI might speed up and reduce costs associated with medication research and development. According to the report, the pharmaceutical sector might significantly enhance the process of developing new drugs by integrating AI tools and procedures. The industry may significantly cut expenses associated with research and development and shorten the time it takes to produce new drugs by utilizing AI. This IT and pharmaceuticals partnership, made possible by AI, presented exciting opportunities for improving medication research and design. Artificial intelligence, machine learning, medicines, and IT were among the key themes.

**Objectives of the Study:**

1. To evaluate the impact of artificial intelligence on pharmaceutical firms.
2. To give appropriate suggestions to pharmaceutical firms for the implementation of artificial intelligence.

**Hypothesis:**

**$H_0$**: The impact of artificial Intelligence on pharmaceutical firms is insignificant. (Median = 3)

**$H_1$:** The impact of artificial Intelligence on pharmaceutical firms is significant. (Median ≠ 3)

**Research Methodology:**

**Data collection:** Both Primary and secondary data

**Sample size:** 110 Managers of Pharmaceutical companies

**Sampling Technique:** Non-probability purposive sampling

**Statistical Technique:** Non-parametric One Sample Wilcoxon Sign Rank Test. (The Non-parametric One Sample Wilcoxon Sign Rank Test is a statistical method employed to assess if a sample's median significantly differs from a hypothesized population median.)

**Statistical tool:** SPSS 26

**Table No: 1 Demographic Profile**

| Variables | Category | Frequency | Percentage |
|---|---|---|---|
| **Gender** | Male | 73 | 66.36 |
| | Female | 37 | 33.64 |
| **Age** | 25 – 34 years | 15 | 13.64 |
| | 35 – 44 years | 47 | 42.72 |
| | 45 – 54 years | 26 | 23.64 |
| | 55 years and above | 22 | 20.00 |
| **Educational Background** | BSc | 32 | 29.09 |
| | MSc | 57 | 51.81 |
| | PhD/Doctorate | 21 | 19.10 |

Based on the data collected, the gender distribution of the respondents reveals that 73 people (66.36% of the total) identified as male, and 37 people (33.64%) identified as female. Regarding the age distribution of the participants, 47 of them, or 42.72% of the total, were between the ages of 35 and 44. After this group, there were 26 respondents (23.64%) who were 45–54 years old, 22 people (20.00%) who were 55 years old and older, and 15 respondents (13.64%) who were 25–34 years old. The majority of responders (51.81%) had an MSc degree, accounting for 57 out of the total participants' educational background. Then came 32 people (29.09%) who had a BSc degree and 21 respondents (19.10%) who had a PhD/Doctorate.

**Data Analysis and Interpretation:**

**Table No: 1: One Sample Wilcoxon signed ranked test**

| Items | Observed Median | P – value | Results |
|---|---|---|---|
| Accelerated drug discovery | 4 | 0.000 | Rejected (High impact) |
| Drug design | 5 | 0.000 | Rejected (High impact) |
| Drug repurposing | 4 | 0.000 | Rejected (High impact) |
| Clinical trial optimization | 4 | 0.000 | Rejected (High impact) |
| Personalized medicine development | 4 | 0.000 | Rejected (High impact) |
| Patient outcome improvement | 4 | 0.000 | Rejected (High impact) |
| Knowledge discovery | 5 | 0.000 | Rejected (High impact) |
| Sales forecasting | 4 | 0.000 | Rejected (High impact) |
| Cost reduction | 5 | 0.000 | Rejected (High impact) |
| Supply chain optimization | 4 | 0.000 | Rejected (high impact) |

Non - parametric one-sample Wilcoxon signed ranked test is applied to evaluate the impact of artificial intelligence on pharmaceutical firms. It is seen that p-value < 0.05, Accelerated drug discovery, Drug design, Drug repurposing, Clinical trial optimization, Personalized medicine development, Patient outcome improvement, Knowledge discovery, Sales forecasting, Cost reduction and Supply chain optimization have a high impact of artificial intelligence on pharmaceutical firms.

**Table No: 3 Summary of Hypothesis**

| Alternative Hypothesis | Results |
|---|---|
| Ha1: The median of Accelerated drug discovery not equals 3 | Supported |
| Ha2: The median Drug design not equals 3 | Supported |
| Ha3: The median of Drug repurposing not equals 3 | Supported |
| Ha4: The median of Clinical trial optimization not equals 3 | Supported |
| Ha5: The median of Personalized medicine development not equals 3 | Supported |
| Ha6: The median of patient outcome improvement evidence not equals 3 | Supported |
| Ha7: The median of Knowledge discovery not equals 3 | Supported |
| Ha8: The median of Sales forecasting not equals 3 | Supported |
| Ha9: The median of Cost reduction not equals 3 | Supported |
| Ha10: The median of Supply chain optimization not equals 3 | Supported |

**Findings**

The study's findings highlight how artificial intelligence (AI) has a significant influence on pharmaceutical companies. Accelerated drug discovery, drug design, drug repurposing, clinical trial optimization, Personalized medicine development, Patient outcome improvement, Knowledge discovery, sales forecasting, cost reduction, and supply chain optimization are just a few of the crucial areas in which AI is having an impact. Together, these developments are boosting productivity, cutting expenses, and stimulating innovation within the pharmaceutical industry, eventually advancing healthcare.

**Conclusion:**

Artificial intelligence (AI) has had a profoundly transformational effect on pharmaceutical industries. The impact of artificial intelligence (AI) is changing the pharmaceutical innovation environment in key areas such as targeted medication design, effective clinical trial optimization, and expedited drug discovery. Its numerous contributions to the advancement of healthcare are highlighted by its involvement in improving patient outcomes, developing personalized medicine, and repurposing drugs. AI simplifies procedures and advances innovative tactics by promoting information discovery and facilitating sales forecasting. It also has an impact on supply chain optimization and cost reduction, resulting in increased productivity and lower costs. When taken as a whole, these developments are stimulating unmatched creativity in the pharmaceutical sector while simultaneously improving operational efficiency. The combination of artificial intelligence (AI) and pharmaceuticals is bringing healthcare into the modern era, characterized by faster research, more individualized treatment plans, and ultimately better health outcomes for people all over the world. AI's potential to be a driving force behind advancement in the pharmaceutical industry will only make the future of healthcare on a global scale even more promising as it develops and becomes more integrated.

**Recommendation:**

1. **Investment in AI skills:** To realize the full promise of AI-driven solutions, pharmaceutical companies should prioritize investments in AI skills, including infrastructure and talent acquisition.
2. **Collaborative Initiatives:** Encourage collaborations that spur innovation and information sharing by promoting collaboration between pharmaceutical companies and AI technology suppliers.

3. **Regulatory Considerations:** To ensure the ethical and responsible use of AI in pharmaceutical research and development, policymakers and regulatory agencies should provide clear rules and frameworks.
4. **Continuous Monitoring:** Pharmaceutical companies should keep an eye on the success of AI solutions and adjust their plans as necessary to take full advantage of the rapidly changing field of AI technology.
5. **Skill Development:** Training and up skilling of the workforce is an investment that will maximize the use of AI platforms and solutions.
6. **Data Security and Privacy:** Protecting sensitive healthcare data in AI-driven operations requires a strong focus on data security and privacy.
7. **Patient-Centric Approach:** Pharmaceutical companies should take a patient-centric approach when implementing AI technology. This entails utilizing AI to tailor therapies, increase patient participation, and optimize patient outcomes. Artificial intelligence-driven healthcare solutions may be more effective if patient satisfaction and well-being are prioritized.
8. **Long-Term Strategic Planning:** Create thorough, long-term plans for integrating AI. Pharmaceutical companies should coordinate their AI activities with their overarching business objectives to make sure that their AI expenditures have a discernible and quantifiable impact on R&D and operational effectiveness.
9. **Determine Benefit Scenarios:** Decide which parts of the business (drug development, clinical trials, manufacturing, etc.) AI can most significantly improve efficiency and impact.
10. **Integrate with Current technologies**: To guarantee seamless adoption and compatibility, integrate AI technologies with current workflows and infrastructure.
11. **Training and Change Management:** Educate staff members about AI systems through training. To ensure a seamless transition, put change management ideas into practice.
12. **Track and Evaluate Achievement:** Define key performance indicators (KPIs) to gauge the effects of implementing AI. Check its performance against these criteria on a regular basis.

By implementing these recommendations, pharmaceutical businesses may further leverage AI's potential to promote innovation, improve patient outcomes, and maintain a competitive edge in the ever-evolving pharmaceutical industry.

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# Resource Acquisition In The Digital Age For Digital Libraries: A Review Study

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## Introduction

In the digital age, resource acquisition for digital libraries has transformed dramatically, leveraging advanced technologies and global connectivity to amass diverse and comprehensive collections. Unlike traditional libraries that rely on physical mediums, digital libraries utilize electronic formats, enabling instant access to vast amounts of information from anywhere in the world. The process involves sourcing e-Books, academic journals, multimedia files, and various digital artifacts through collaborations with publishers, open access initiatives, and digitization projects. Efficient acquisition strategies are crucial, ensuring that digital libraries remain robust, up-to-date, and capable of meeting the evolving needs of users. This paradigm shift not only enhances accessibility and preservation but also fosters a more inclusive and dynamic environment for knowledge dissemination and learning.

## Definition of Digital Library

A digital library is a collection of digital objects that can include text, visual material, audio material, video material, stored as electronic media formats (as opposed to print, microform, or other media), along with the means for organizing, storing, and retrieving the files and media contained in the library collection. This library can be accessed via digital means such as the internet, a local area network, or other forms of electronic media.(Chowdhury & Chowdhury, 2003). Digital libraries can offer numerous advantages over traditional libraries, such as remote access, greater availability of resources, and enhanced search capabilities. They may also include features like digitized books, academic journals, multimedia content, and databases.

## Importance of resource acquisition in the digital age

Resource acquisition in the digital age is critical for organizations and individuals striving to stay competitive, innovative, and relevant. Here are some key reasons why resource acquisition is so important, along with references to support these points:

**1. Technological Advancement:**

In the digital age, technology evolves rapidly. Acquiring the latest hardware, software, and technical expertise is essential for maintaining a competitive edge. Organizations that lag in technology adoption can quickly become obsolete.

**2. Data Utilization:**

The ability to acquire and leverage data is a cornerstone of modern business strategy. Data-driven decision-making enables companies to optimize operations, enhance customer experiences, and develop new products and services. According to a report by MIT Sloan Management Review (2019), companies that leverage data analytics are 5-6% more productive and profitable than their competitors.

**3. Talent Acquisition:**

Skilled personnel, particularly in IT, cyber security, and data science, are vital resources. The competition for talent in these areas is fierce, and organizations that can attract and retain top talent have a significant advantage. A survey by Deloitte (2021) found that 80% of CEOs see the need for new skills as their biggest business challenge in the next five years.

**4. Financial Resources:**

Securing adequate funding allows for investment in innovation, expansion, and resilience against market fluctuations. This includes venture capital, private equity, or other financial instruments. Harvard Business Review (2018) discusses how financial agility is crucial for digital transformation initiatives.

**5. Intellectual Property and Partnerships:**

Acquiring intellectual property (IP) and forming strategic partnerships can provide access to new technologies, markets, and innovations. This can accelerate growth and create barriers to entry for competitors. PwC (2019) noted that strategic partnerships and IP acquisitions have become integral to the growth strategies of top-performing companies.

**6. Supply Chain Optimization;**

In the digital age, supply chains must be more agile and responsive. Acquiring the necessary

resources to digitize and integrate supply chain operations can lead to significant efficiencies and cost savings. Gartner (2020) reported that companies investing in supply chain technology saw a 30% improvement in operational efficiency.

**7. Market Intelligence:**

Access to market intelligence resources, including competitor analysis and market trends, allows businesses to make informed strategic decisions and quickly adapt to changes. Forrester Research (2021) found that companies leveraging market intelligence resources were 20% more likely to enter new markets successfully.

**8. Customer Relationship Management:**

Acquiring advanced CRM systems helps businesses understand and engage with their customers more effectively; leading to improved customer satisfaction and loyalty.Salesforce (2020) reported that companies using advanced CRM systems experienced a 30% increase in customer satisfaction. Hence, resource acquisition in the digital age is multifaceted and essential for maintaining competitiveness. From technological advancements and data utilization to talent acquisition and financial resources, each aspect plays a critical role in enabling organizations to thrive in an increasingly digital world. Prioritizing and strategically managing these resources can lead to sustainable growth and long-term success.

**Literature Review**

Historically, traditional libraries have relied on a variety of methods for resource acquisition, shaped by the cultural and technological contexts of their times. In ancient libraries, such as the Library of Alexandria, acquisition was often through copying manuscripts by hand or receiving donations from scholars and travelers.(Harris, 1999) During the medieval period, monastic libraries preserved and copied texts, primarily focusing on religious and classical works. The advent of the printing press in the 15th century revolutionized acquisition, making books more widely available and affordable.(Battles, 2003). In the modern era, libraries have developed systematic methods for purchasing, cataloging, and preserving materials, supported by institutional budgets and consortia agreements (Casson, 2002).

The revolution in digital resource acquisition has dramatically transformed how information is accessed, stored, and disseminated. This shift, driven by advancements in technology, has made resources more accessible globally, reducing barriers related to physical location and cost. Digital libraries, open access journals, and cloud storage have enabled instant access to vast amounts of information (Borgman, 2000). Additionally, the integration of AI and machine learning has improved search accuracy and relevance, making information retrieval more efficient. This revolution supports continuous learning and innovation by providing researchers, students, and professionals with unprecedented access to knowledge.

Key theories and models in resource acquisition include the Resource-Based View (RBV), which posits that firms gain competitive advantage through unique resources that are valuable, rare, inimitable, and non-substitutable (Barney, 1991). The Dynamic Capabilities Framework emphasizes the ability of firms to adapt, integrate, and reconfigure internal and external competencies to address rapidly changing environments (Teece, Pisano, & Shuen, 1997). Social Capital Theory highlights the importance of social networks and relationships in accessing resources (Burt, 1992). Finally, the Resource Dependence Theory suggests that organizations must manage dependencies on external resources to minimize uncertainty and maximize autonomy (Pfeffer & Salancik, 1978).

**Types of Digital Resources**

**1. Textual Resources:**

These include any type of document that contains text. They can be simple or complex, and are often used for educational, informational, and professional purposes.

EBooks: Electronic books that can be read on computers, e-readers, tablets, or smartphones. They come in formats such as PDF, EPUB, and MOBI.

Articles and Journals: Academic and professional articles published in electronic journals. These are often accessible through academic databases like JSTOR, PubMed, and Google Scholar.

Blogs and Websites: Online platforms where individuals or organizations publish articles and posts on various topics.

**2. Multimedia Resources:**

These resources combine text, audio, video, and images to create rich and engaging content.

Videos: Found on platforms like YouTube, Vimeo, and educational sites such as Khan Academy. They are used for entertainment, education, and professional training.

Podcasts and Audio Files: Audio recordings that can be streamed or downloaded. Podcasts cover a wide range of topics, from news and education to entertainment.

Interactive Simulations and Animations: Used in education and training to demonstrate complex processes and concepts. Examples include PhET Interactive Simulations and various e-learning tools.

**3. Data and Databases:**

Digital repositories of structured and unstructured data, often used in research, business, and technology.

Databases: Collections of data organized for quick search and retrieval. Examples include SQL databases (MySQL, PostgreSQL) and No SQL databases (MongoDB, Cassandra).

Big Data: Large and complex datasets that require advanced tools and techniques for analysis. Examples include data from social media, sensors, and large-scale transaction records.
Open Data: Data that is freely available for anyone to use and republish. Government agencies and organizations often provide open data portals.

**4. Software and Applications:**

Programs and applications used for a wide range of tasks, from productivity to entertainment.
Desktop Software: Applications installed on a computer, such as Microsoft Office, Adobe Creative Suite, and various development tools.
Mobile Apps: Applications designed for smartphones and tablets, available through app stores like Google Play and Apple's App Store.
Web Applications: Applications accessed via web browsers, including online editors (Google Docs), email clients (Gmail), and social networks (Facebook).

**5. Images and Graphics:**

Visual resources used in various digital content, from websites and presentations to educational materials.
Stock Photos and Illustrations: Images available through platforms like Shutterstock, Getty Images, and Unsplash.
Infographics: Visual representations of data and information often used to simplify complex topics.
Digital Art: Artwork created using digital tools, such as graphic design software (Adobe Illustrator) and drawing tablets.

**6. Virtual and Augmented Reality:**

Immersive technologies that enhance or create new realities. Virtual Reality (VR): Fully immersive experiences that require VR headsets. Applications include gaming, training simulations, and virtual tours.
Augmented Reality (AR): Overlays digital information on the real world, accessible through smartphones, tablets, and AR glasses. Applications include navigation, education, and marketing.

**7. Learning Management Systems (LMS):**

Platforms designed to deliver, track, and manage learning and training programs.
Moodle: An open-source LMS widely used in educational institutions.
Canvas: A popular LMS for higher education and K-12.
Corporate LMS: Platforms like SAP Litmos and TalentLMS used for employee training and development.

**Challenges in Digital Resource Acquisition**

**1. Copyright and Licensing Issues:**

Securing the rights to digital content can be complex and costly. Libraries must navigate a landscape of various licensing agreements, which often come with restrictive terms and conditions. Unlike physical books, digital content typically does not allow for straightforward ownership but instead operates on a licensing basis, limiting how resources can be used, shared, and preserved.

**2. Financial Constraints:**

Digital resources can be expensive. Subscription fees for e-journals, databases, and eBooks often exceed the budgets allocated for library resources. Additionally, the need for continuous updates and renewals can strain financial resources.

**3. Technological Challenges:**

Maintaining and upgrading digital library infrastructures requires significant technological investment. This includes ensuring compatibility with various formats, integrating new technologies, and managing digital preservation to prevent data loss or corruption over time.

**4. Metadata and Standardization Issues:**

Creating and maintaining high-quality metadata is critical for resource discovery and management. Inconsistent metadata standards can lead to difficulties in indexing, searching, and retrieving digital content. Ensuring interoperability between different systems and platforms is also a significant challenge.

**5. Digital Divide and Access Issues:**

While digital libraries aim to democratize access to information, disparities in technology access (the digital divide) can limit their effectiveness. Users in underserved or rural areas may lack the necessary devices or internet connectivity to fully utilize digital resources.

**6. User Education and Digital Literacy:**

Even when digital resources are available, users may lack the skills to effectively navigate, evaluate, and utilize them. Digital literacy programs are essential to empower users, but these require additional resources and training for library staff.

**7. Sustainability and Preservation:**

Ensuring the long-term preservation and sustainability of digital resources is a major challenge. Digital formats can become obsolete, and the ongoing costs of maintaining digital repositories can be substantial.

**Strategies for Effective Resource Acquisition:**

Effective resource acquisition is fundamental to the success and sustainability of digital libraries. It involves a strategic approach to selecting, acquiring, and managing digital content to ensure the library meets the diverse needs of its users. Here are several strategies for effective resource acquisition:

**1. Developing a Collection Development Policy:**

A well-defined collection development policy provides a framework for acquiring resources that align with the library's mission and user needs. It outlines the criteria for selection, prioritizes content areas, and sets guidelines for evaluating and deaccessioning materials.(Johnson, 2018).

**2. Collaborative Acquisition and Consortia Participation:**

Joining consortia can significantly enhance a library's purchasing power and resource-sharing capabilities. Collaborative acquisition allows libraries to pool resources, negotiate better terms with vendors, and access a broader range of materials.(Collins & Grogg, 2011)

**3. Leveraging Open Access Resources**

Open access (OA) resources are freely available and can substantially supplement a library's collection without the financial burden. Libraries can support and integrate OA initiatives by including them in their acquisition strategies.(Suber, 2012)

**4. Patron-Driven Acquisition (PDA)**

PDA, also known as demand-driven acquisition (DDA), involves acquiring resources based on actual user demand. This user-centric approach ensures that the library's collection is relevant and immediately useful. (Swords, 2011).

**5. Utilizing Data Analytics**

Data analytics can provide insights into user behavior, preferences, and trends. By analyzing usage statistics, libraries can make informed decisions about which resources to acquire, ensuring a high return on investment. (Jantti & Heath, 2016)

**6. Negotiating Licensing Agreements:**

Effective negotiation of licensing agreements is crucial to obtaining favorable terms and conditions for access and usage. Libraries should aim for flexible and sustainable agreements that allow for broad access and long-term preservation.Smith, K. (2014).

**7. Digitization of Physical Collections:**

Digitizing existing physical collections not only preserves valuable materials but also makes them accessible to a wider audience. This strategy involves careful planning, prioritization, and adherence to best practices in digital preservation. (Deegan & Tanner, 2006).

**8. Continuous Evaluation and Feedback:**

Regular assessment of the collection's effectiveness and relevance is essential. Libraries should establish mechanisms for user feedback and ongoing evaluation to adapt to changing needs and technological advancements. (Kennedy, 2011)

**Impact of Digital Resource Acquisition on Libraries**

The acquisition of digital resources has profoundly transformed libraries, reshaping their operations, services, and overall role in society. This shift has had both positive and challenging impacts. Below, we explore these impacts in detail, supported by references to relevant literature.

**1. Enhanced Accessibility and Reach**

Digital resources have significantly improved access to information, allowing users to access a vast array of materials remotely and at any time. This has been particularly beneficial for distance learners, researchers, and individuals in remote areas.(Connaway & Radford, 2017)

**2. Cost Efficiency and Resource Management**

While the initial investment in digital infrastructure can be high, the long-term cost efficiency of digital resources is notable. Digital acquisitions reduce costs associated with physical storage, maintenance, and distribution. (Smith, 2014).

**3. Preservation and Longevity**

Digital resources facilitate the preservation of materials that might otherwise degrade over time. Digitization helps in safeguarding rare and fragile items, ensuring their availability for future generations.Deegan, M., & Tanner, S. (2006).

**4. User Engagement and Customization**

Digital platforms enable interactive and personalized user experiences. Features like search functionalities, hyperlinked content, and multimedia integration enhance user engagement and learning.

**5. Challenges in Digital Rights Management**

Navigating digital rights and licensing agreements can be complex. Libraries must ensure compliance with copyright laws while negotiating terms that allow broad and fair access to resources.(Collins & Grogg, 2011).

**6. Technological and Infrastructural Demands**

The acquisition and management of digital resources require robust technological infrastructure and skilled personnel. Continuous updates and cyber security measures are necessary to protect digital collections. (Johnson, 2018)

**7. Shift in Librarian Roles and Skills**

The digital age has transformed the roles of librarians from traditional custodians of physical collections to digital curators and information managers. This shift necessitates ongoing professional development in areas such as data management, digital literacy, and technology.(Swords(Ed.), 2011)

**8. Economic Implications and Budget Allocation**

Digital resource acquisition often requires reallocation of library budgets, prioritizing digital over physical resources. This shift can strain budgets, particularly in smaller libraries with limited funding. (Johnson, 2018).

**9. Impact on Physical Space and Infrastructure**

With the increased focus on digital resources, libraries are rethinking their physical spaces. There is a trend towards creating more collaborative and flexible learning environments,

often repurposing areas previously used for stacks and storage. (Montague & Donsbach, 2015)

**10. Inclusivity and Bridging the Digital Divide**

While digital resources offer unprecedented access, they also highlight issues related to the digital divide. Libraries play a crucial role in providing access to technology and the internet, ensuring that undeserved communities can benefit from digital resources.(Suber, 2012)

**Future Trends in Digital Resource Acquisition**

The landscape of digital resource acquisition is continuously evolving, driven by technological advancements, changing user expectations, and new models of content creation and distribution. Here are some key future trends in digital resource acquisition:

**1. Artificial Intelligence and Machine Learning**

Artificial intelligence (AI) and machine learning (ML) are revolutionizing how digital resources are acquired and managed. These technologies can enhance resource discovery, automate metadata generation, and personalize user recommendations. (Xu, & Shen, 2019)

**2. Blockchain Technology**

Blockchain technology offers potential for secure, transparent, and efficient transactions in digital resource acquisition. It can ensure the authenticity and provenance of digital assets, streamline licensing, and facilitate decentralized content distribution.(O'Donoghue & Vazquez, 2019)

**3. Integration of Augmented Reality (AR) and Virtual Reality (VR)**

AR and VR technologies are expanding the scope of digital collections by enabling immersive and interactive experiences. Libraries can acquire AR/VR content to enhance learning, training, and entertainment. (Yoon & Hughes, 2020)

**4. Open Educational Resources (OER)**

The movement towards open educational resources (OER) continues to grow, providing freely accessible, openly licensed materials for teaching, learning, and research. Libraries are increasingly incorporating OER into their collections to support affordability and accessibility in education. (Hilton, 2016)

**5. Big Data and Analytics**

Big data and analytics tools are becoming integral in digital resource acquisition. These tools help libraries understand user behavior, predict trends, and make data-driven decisions to optimize their collections. (Ewer & Zipperer, 2019)

**6. User-Generated Content (UGC)**

User-generated content is increasingly valuable for digital libraries. Platforms that allow users to contribute content, such as repositories, social media, and collaborative databases, are becoming more prevalent. (Tan & Salsbury, 2019)

**7. Subscription and Access Models**

New subscription and access models, such as Evidence-Based Acquisition (EBA) and Pay-Per-Use (PPU), offer flexibility and cost-efficiency. These models allow libraries to access a wide range of resources and pay based on actual usage.(Collins & Lea, 2016)

**8. Enhanced Metadata and Semantic Web**

Improved metadata standards and the adoption of the semantic web will enhance resource discoverability and interoperability. Linked data initiatives will allow for richer connections between digital resources and improved user search experiences. (Hooland & Verborgh, 2014)

**9. Mobile Access and Cloud Computing**

The increasing use of mobile devices and cloud computing is driving the need for mobile-friendly and cloud-based digital resources. Libraries are adopting cloud services for scalable storage, efficient resource management, and improved access. (Tyagi, 2016)

**10. Diversity, Equity, and Inclusion (DEI) Initiatives**

Future digital resource acquisition will increasingly focus on diversity, equity, and inclusion. Libraries are committed to building collections that reflect diverse perspectives and experiences, ensuring equitable access to information. (Bour & Byrd, 2017)

**Conclusion**

In conclusion, resource acquisition in the digital age for digital libraries is a dynamic and multifaceted process that requires strategic planning, collaboration, and the integration of advanced technologies. The transition from traditional to digital libraries has revolutionized access to information, offering unprecedented opportunities for enhancing the breadth and depth of collections. Effective resource acquisition strategies, such as developing comprehensive collection policies, leveraging open access resources, embracing patron-driven acquisition, and utilizing data analytics, are essential for meeting the diverse needs of modern users.

Emerging trends such as artificial intelligence, blockchain technology, augmented and virtual reality, and big data analytics are poised to further transform how digital libraries acquire and manage resources. These innovations promise to improve efficiency, enhance user experiences, and ensure the authenticity and security of digital assets. Additionally, the growing importance of open educational resources, user-generated content, and new subscription models highlights the need for libraries to remain adaptable and responsive to changing user demands and technological advancements.

Ultimately, the success of digital libraries in the digital age hinges on their ability to continuously

evaluate and refine their resource acquisition strategies, ensuring they provide relevant, accessible, and high-quality digital resources. By embracing these approaches, digital libraries can fulfill their mission of democratizing access to knowledge and fostering an inclusive, dynamic environment for learning and discovery.

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# From Dust to Diamonds: A Creative Review of Mulching Techniques in Vidarbha for Sustainable Agriculture

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**Abstract:**
This study explores the impact of mulching on agricultural practices in Vidarbha (India), a region characterized by variable climate and altitude, leading to diverse farming challenges. Mulching, the application of organic or synthetic materials on soil, enhances soil quality, moisture retention, and crop productivity. In Vidarbha, mulching significantly improves yields for crops like Nagpur mandarin, soybeans, and cotton by conserving soil moisture, regulating temperature, and reducing weed growth. Research shows that mulched soybean fields can achieve up to 15-20% higher yields, while cotton benefits from reduced soil erosion and improved soil structure. The study also highlights the role of mulching in enhancing soil moisture control, organic matter, water use efficiency, soil temperature regulation, and weed management. These findings underscore mulching as a vital practice for sustainable agriculture in Vidarbha, supported by government initiatives such as subsidized inputs and crop insurance to combat challenges like drought and pests.

**Keywords:** Mulching, Vidarbha, agriculture, sustainability, yields.

**Introduction:**

The study area, Vidarbha in east Maharashtra, India, presents variety of agriculture due to variation in climate and altitude. The climate remains unpredictable with instances of irregular rainfall and drought[1]. Some of the important crops grown in Vidarbha are cotton, which grows well in the regur soil. Cash crops include soybeans which grows well under the local environmental conditions[2]. Some of the well-known pulses include chickpeas, pigeon peas and black gram and these are usually planted in rotation to other crops to improve soil fertility[3]. Fruits such as oranges and pomegranates besides vegetables including tomatoes and potatoes are also grown in the region.

There is much concern with water supply and availability since farmers depend on well irrigation, traditional tanks, and recently, drip irrigation systems due to the unpredictability of the rainfall[4]. Still, Vidarbha has problems like regular drought, pests & diseases, and commercial feasibility of farming for the farmers. The government supports seeds, fertilizers, irrigation equipment subsidies, and crop insurance against weather[5].At the same time, there is a shift towards more practices that enhance sustainability of agriculture such as organic farming, water conservation practices including rain water harvesting and others to improve sustainability of agricultural production in the future. Mulching involves placing organic or synthetic materials on soil to enhance quality, moisture retention, and productivity, promoting sustainable agriculture by managing soil texture, water, and temperature[6]

**2. History:**

Mulching, as practiced since the early civilizations in agriculture, was in the past done using straw, leaves and manure to help in retaining moisture in the soil and also controlling weed growth. In the medieval Europe, they were required for proper soil management and moisture retention. The 19th century had already imposed comprehensive regulations for mulching with regard to its effects on temperature and soil moisture. Mulching is one method that has undergone development in terms of materials and technique to make it more effective for use in sustainable agricultural practices today[7].

**3. Types of Mulch:**

Organic mulch which may include straw and compost is effective in soil augmentation, water conservation, weed control, and moderation of soil temperature. Plastic sheeting and rubber chips do not biodegrade, but suppresses weeds and retains moisture, which is used to warm up the soil in commercial farming[8].


**Figure 1.** Types of organic Mulching.[8]

**4. Impact of mulching on the yields of crops**

Research shows mulching increases crop productivity in Vidarbha. Examples include black plastic, biodegradable films, and organic materials like farmyard manure, which improve moisture retention, regulate soil temperature, and suppress weeds, enhancing yields.[9-12]. Live mulching has been particularly effective in improving growth attributes and yield of forage crops, showcasing the importance of mulching management practices in optimizing agricultural productivity[10]. The combination of mulching with appropriate fertilizers has demonstrated significant impacts on plant growth, physio-morphological characteristics, and overall yieldwith black polythene mulch and a mix of vermicompost and chemical fertilizers showing promising results in terms of increased plant height, yield, and dry matter production[12].

Figure 2. Inorganic Mulching (Plastic)[8]

**5. Effect of mulching on qualities of the soil**

**5.1. Soil Moisture Control**

Mulching plays a crucial role in soil moisture conservation in Vidarbha (India), particularly in the cultivation of cotton. Research conducted in the region has shown that living mulches like gliricidia, sesbania, sorghum Sudan grass, and sunnhemp can generate significant dry matter, ranging from 1 to 13 tons $ha^{-1}$, while effectively suppressing weeds without the need for herbicides or inter-row tillage[13]. Additionally, the use of mulches, such as plastic silver mulch and rice straw mulch, has been found to improve soil moisture content, soil aeration, water retention, prevent erosion, and increase organic matter, ultimately enhancing water availability for crops like green beans in dry seasons[14]. Combining mulching with drip irrigation enhances water efficiency and soil management, vital for reducing water stress in arid regions like Vidarbha[15].

**5.2. Soil organic matter**

Mulching in Vidarbha improves soil fertility, structure, and moisture retention. Organic mulches degrade, enhancing nutrient-poor soils and improving water absorption. Mulching also slows soil erosion, suppresses weeds, and regulates temperature, providing a stable habitat for crops and microorganisms in the region's semi-arid climate[16].

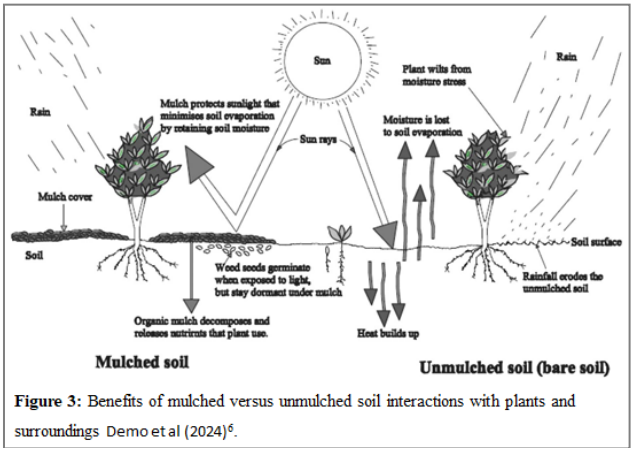
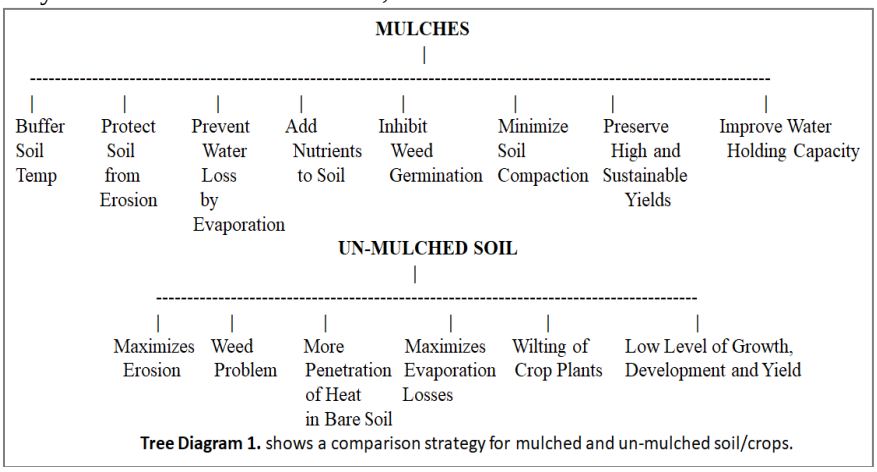



**Figure 3:** Benefits of mulched versus unmulched soil interactions with plants and surroundings Demo et al (2024)[6].

### 5.3 Water Use Efficiency

Mulches enhance water use efficiency (WUE) in agriculture. Biodegradable mulches improve precipitation utilization, with optimal degradation rates varying by rainfall conditions[17]. Metalized-polyethylene mulch and regulated drip irrigation significantly boost WUE in citrus trees, increasing water uptake and soil moisture. Plastic films, like transparent and black, raise soil water content, topsoil temperature, crop growth, and WUE in maize[18]. Colored plastic mulches reduce irrigation needs and enhance WUE in cucumber, with black mulch showing the highest WUE[19].




**Tree Diagram 1.** shows a comparison strategy for mulched and un-mulched soil/crops.

### 5.4. Soil Temperature:

Mulches significantly impact soil temperature in Vidarbha. Research shows mulches like plastic films, grass, and plant residues can alter soil temperature by 2 to 4˚C compared to bare soil. Materials like sugarcane leaves and paddy straw conserve soil moisture up to 20.17% more effectively. Thus, mulching material choice is crucial for regulating soil temperature and plant growth[20].

### 5.5. Weed Growth:

Mulches are vital for weed management in Vidarbha, India. Living mulches like gliricidia and sunnhemp suppress weeds effectively. Combining herbicides with cover crops like Sesbania reduces weed density in rice. Organic and polyethylene mulches conserve soil moisture, reduce weeds, and improve crop yield and quality, especially in Nagpur mandarin[21].

### Mulching uses for vidarbha agriculture:

Vidarbha, located in the eastern section of the Indian state of Maharashtra, is noted for its agricultural economy and various crop farming. Mulching, a soil management practice, has gained popularity in this area due to its potential to improve agricultural sustainability[22].

In Nagpur mandarin farming, mulching with organic materials such as sugarcane leaves or polyethylene mulch has been demonstrated to maintain soil moisture, limit weed growth, and boost fruit output and quality. Similarly, in soybean production, mulching helps to stabilize soil temperature and reduce evaporation losses, resulting in healthier plants and higher yields. Research in Vidarbha has shown that mulched soyabean fields can yield up to 15-20% more than unmulched areas. Mulching in cotton cultivation also reduces soil erosion, improves soil structure, and maintains regular moisture levels, resulting in greater growth and higher lint production[23].

### Conclusion:

Mulching significantly enhances agricultural sustainability in Vidarbha by improving soil moisture retention, reducing weed growth, stabilizing soil temperature, and increasing crop yields. This practice proves beneficial for various crops, including Nagpur mandarin, soybeans, and

cotton, leading to healthier plants and higher productivity.

**Conflicts of Interest:** There is no conflict of interest between the authors.

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# Synthesis and Characterization of $Ba_{0.5}Sr_{0.5}TiO_3$ Nanoparticles for Ethanol Vapor Sensing Applications

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**DOI- 10.5281/zenodo.13622804**

**Abstract:**
The study reports on the preparation of nanocrystalline $Ba_{0.5}Sr_{0.5}TiO_3$ using the sol-gel method and the characterization of its morphological, and gas sensing properties. X-ray diffraction analysis confirmed the cubic structure of $Ba_{0.5}Sr_{0.5}TiO_3$, with a crystallite size of approximately 54 nm. Scanning electron microscopy was employed to examine the material's morphology. The sensor fabricated from these nanocrystalline $Ba_{0.5}Sr_{0.5}TiO_3$ demonstrated high sensitivity and rapid response/recovery to ethanol at 300 °C. The sensitivity reached up to 59.23% when exposed to ethanol concentrations ranging from 50 to 200 ppm. A linear relationship between sensitivity and ethanol concentration was observed within the 50-200 ppm range. Thus, the findings suggest that nanocrystalline $Ba_{0.5}Sr_{0.5}TiO_3$ is a promising material for high-performance ethanol sensors.

**Keywords:** $Ba_{0.5}Sr_{0.5}TiO_3$, Ethanol, Thick film, Nanocrystalline

**Introduction:**

Semiconductors metal oxide-based gas sensors have garnered significant attention over the decades due to their distinct advantages, such as high sensitivity, low cost, ease of fabrication, and compatibility with silicon microfabrication technologies [1-3]. Perovskites, in particular, hold great potential for use as gas sensors because of their high electrical conductivity and ability to catalyze oxidation-reduction reactions. $ABO_3$ type perovskite oxides have been extensively utilized as gas sensors, and their structure allows for substitutions at the A-site and/or B-site to achieve desirable sensitivity and selectivity [4–10]. For gas sensors, it is essential that the perovskite material remains stable in reducing atmospheres and maintains reasonably high electrical conductivity.
Nanomaterials are ideal for gas sensing applications because the sensing process involves adsorption and desorption on the surface, and nanomaterials offer significantly increased surface areas [11]. This advantage is further enhanced as the depletion depth is only a few nanometers [12]. Understanding and exploring the impact of nanostructure features, such as particle size, specific surface area, and crystallinity, on sensing properties is crucial for developing better sensors [13, 14].

Ethanol gas sensing is vital for various industrial and environmental applications. Accurate ethanol detection is essential for monitoring air quality in workplaces and ensuring safety in environments where ethanol vapors pose fire and health risks. In the automotive industry, ethanol sensors help optimize engine performance and emissions control. Additionally, they play a crucial role in the food and beverage industry for quality control and fermentation monitoring. Reliable ethanol sensors contribute to safety, efficiency, and quality assurance across these sectors. Numerous researchers [15-20] have provided overviews of metal oxide gas sensors, emphasizing their sensitivity and the factors that influence their performance, including ethanol sensing applications. In this paper, we have synthesized $Ba_{0.5}Sr_{0.5}TiO_3$ nanoparticles by sol gel method. One of our aims is to develop a general synthesis method and explore the gas sensing properties of the $Ba_{0.5}Sr_{0.5}TiO_3$ nanopowder. We found that the process is a convenient, environment friendly, inexpensive and efficient. Furthermore, the $Ba_{0.5}Sr_{0.5}TiO_3$ obtained possesses excellent gas-sensing responses towards Ethanol vapors.

**Experimental:**

**Preparation of materials:**

For the present study, polycrystalline $Ba_{0.5}Sr_{0.5}TiO_3$ powder was prepared by sol gel route. The materials used as precursors were Barium nitrate hexahydrate Ba $(NO_3)_2 6H_2O$, Strontium Nitrate Tetrahydrate Sr $(NO_3)_2.4H_2O$, Titanium nitrate tetrahydrate Ti $(NO_3)_2.4H_2O$ (all

these were procured from A.R. Grade) and Citric acid. Citric acid possesses a high heat of combustion. It is an organic fuel and provides a platform for redox reactions during the course of combustion. Initially the Barium nitrates, Strontium nitrates, Titanium Nitrates and Citric acid are taken in the 1:1:4 stoichiometric amounts and dissolved in 250 ml beaker slowly string with glass rod clear solution was obtained. Solution formed was evaporated on hot plate in temperature range $70^0$C to $80^0$C gives thick gel. The gel was kept on a hot plate for auto combustion and heated in the temperature range $170^0$C to $180^0$C. The nanocrystalline $Ba_{0.5}Sr_{0.5}TiO_3$ powder was formed within few minutes and sintered at about $800^0$C for about 4 hours got brown colour shining powder of nanocrystalline $Ba_{0.5}Sr_{0.5}TiO_3$.

**Result and Discussion:**

The powder XRD patterns of $Ba_{0.5}Sr_{0.5}TiO_3$ are presented in Fig.1. The XRD pattern of $Ba_{0.5}Sr_{0.5}TiO_3$ show peaks corresponding to a cubic perovskite structure. Typical diffraction peaks for the cubic phase appear at specific 2θ values, such as 22.9°, 32.5°, 39.7°, 46.8°, 52.6°, and 57.8°, corresponding to the (100), (110), (111), (200), (210), and (211) planes, respectively. Use the Scherrer equation to estimate the crystallite size from the XRD peak broadening:

$D = K\lambda/\beta\cos\theta$

Where:

D is the crystallite size.

K is the shape factor (typically 0.9).

λ is the wavelength of the X-ray source.

β is the full width at half maximum (FWHM) of the diffraction peak.

The calculated crystallite size ~54 nm, indicates that the material consists of nanoscale crystallites, consistent with the sol-gel synthesis method. XRD analysis is a powerful tool for confirming the phase purity, crystalline structure, and estimating the crystallite size of $Ba_{0.5}Sr_{0.5}TiO_3$. The results validate the successful synthesis of the cubic perovskite phase and provide insights into the material's nanostructure, crucial for its application in various fields, including gas sensing.

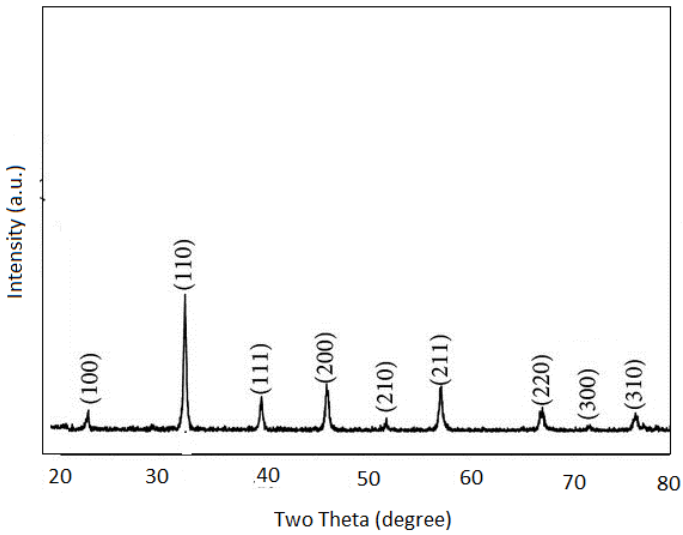


**Figure (1): X-ray diffraction patterns of $Ba_{0.5}Sr_{0.5}TiO_3$ as synthesized Powder**

Figure 2 shows the SEM image of the as synthesized $Ba_{0.5}Sr_{0.5}TiO_3$ nanopowder. It is observed that $Ba_{0.5}Sr_{0.5}TiO_3$ have uniformed size. The surface was smooth, spongy and pores were shown in the micrograph.

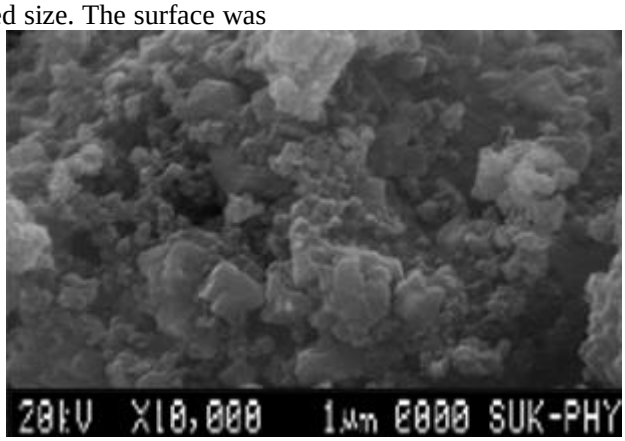


**Figure (2): SEM images of the $Ba_{0.5}Sr_{0.5}TiO_3$ nanopowder**

At the operating temperature, oxygen molecules from the air adsorb onto the metal oxide surface and capture electrons from the conduction band of the metal oxide, forming negatively charged

oxygen species ($O^{2-}$, $O^{-}$, $O_2^{-}$). This creates a depletion layer near the surface, increasing the sensor's resistance. When ethanol molecules come into contact with the sensor, they react with the adsorbed oxygen species on the metal oxide surface. The typical reaction can be simplified as:

$$C_2H_5OH + 6O^{-} \rightarrow 2CO_2 + 3H_2O + 6e^{-}$$

Ethanol oxidation releases electrons back into the conduction band of the metal oxide, reducing the width of the depletion layer and thus decreasing the sensor's resistance.

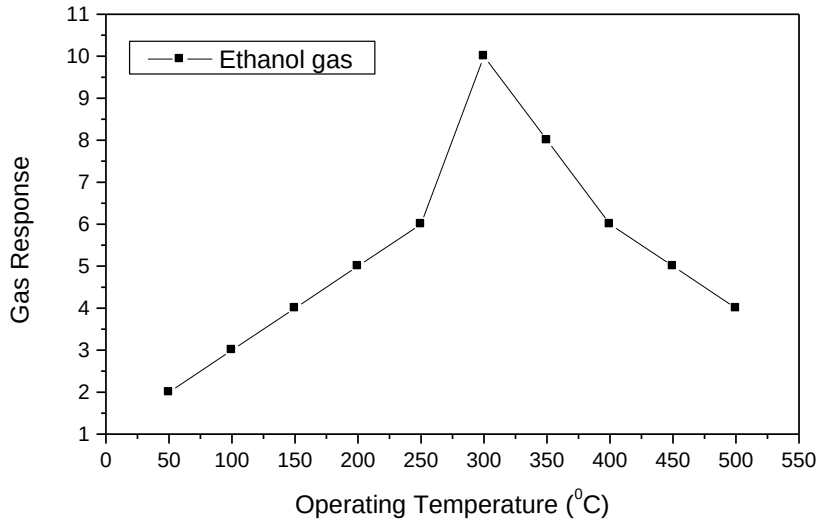


**Figure 3. The sensitivity of a tin oxide layer varies with temperature at different ethanol Concentration**

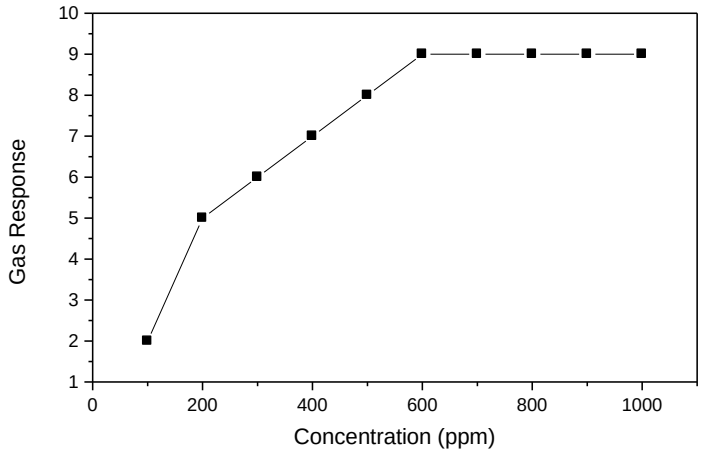


**Figure 4. Sensitivity variation with ethanol concentrations at 300$^0$C.**

Figure 3 illustrates the ethanol gas sensitivity of $Ba_{0.5}Sr_{0.5}TiO_3$ nanopowder across different temperatures, measured at an ethanol concentration of 500 ppm. The highest sensitivity is observed at 300°C, indicating that at this temperature, the majority of adsorbed oxygen species react with the OH group of ethanol vapor. It is known that the highly active $O^{-}$ ion is the dominant species in $Ba_{0.5}Sr_{0.5}TiO_3$ nanopowder between 50 and 500°C. Therefore, the major adsorbed species in the films is likely $O^{-}$. This adsorbed oxygen creates a space charge region near the film surface by extracting electrons from the material. Ethanol, being a reducing agent, removes the adsorbed $O^{-}$ species from the surface and re-injects electrons back into the material, thereby decreasing the resistance. The peak sensitivity at 300°C suggests that the equilibrium density of chemisorbed $O^{-}$ ions is highest at this temperature. Additionally, the figure shows that as ethanol concentration increases, sensitivity also increases. This is likely due to more adsorbed species coming into contact with ethanol, reducing resistance and resulting in higher sensitivity.

Figure 4 depicts the relationship between the gas sensitivity of $Ba_{0.5}Sr_{0.5}TiO_3$ nanopowder and the alcohol concentration at 300°C. The graph shows that sensitivity increases linearly with the concentration of $C_2H_5OH$ up to 200 ppm, after which it levels off. This linear increase at low concentrations suggests that there are enough available surface states to interact with ethanol vapour.

**Conclusions:**

A study was conducted on the alcohol sensing properties of nanocrystalline $Ba_{0.5}Sr_{0.5}TiO_3$ prepared using the sol–gel technique. X-ray diffraction analysis confirmed the material's cubic structure, with a crystallite size of about 54 nm. Scanning electron microscopy was used to examine

the material's morphology. The film exhibited peak sensitivity at around 300°C, likely due to the saturation point of the redox reaction between ethanol vapor and adsorbed oxygen species. Sensitivity was observed even at low alcohol concentrations, with the gas being detectable at 200 ppm. The results from the sol–gel technique are promising for developing sensitive and low-cost ethanol sensors.

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# Data-Driven Decision Making in Management: A Review

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**DOI- 10.5281/zenodo.13622822**

**Abstract:**
Data-driven decision-making (DDDM) is revolutionizing modern management by harnessing data to improve decision quality and operational efficiency. This paper explores the significance of DDDM, emphasizing its impact on forecasting accuracy, resource optimization, and actionable insights derived from complex data. Despite notable challenges—such as data quality, integration, and privacy—technological advancements, including machine learning, cloud computing, and IoT, are progressively addressing these issues. The future outlook for DDDM is highly promising, with continuous innovations expected to further embed advanced analytics into business practices. As organizations increasingly adopt data-driven strategies, they are likely to achieve enhanced innovation, competitive advantage, and agility, setting new standards in the data-centric digital landscape.

**Keywords**: Data-driven decision-making, DDDM, management, forecasting accuracy, resource optimization, actionable insights

## Introduction:

**Overview of Data-Driven Decision Making (DDDM)** Data-Driven Decision Making (DDDM) refers to the process of making organizational decisions based on data analysis and interpretation rather than intuition or observation alone(Balachandran & Prasad, 2017). This approach involves collecting relevant data, analyzing it using various tools and techniques, and leveraging the insights gained to inform strategic and operational decisions(Wu et al., 2022), (Alovisi et al., 2022).

**Importance and Relevance in Modern Management** In today's highly competitive and fast-paced business environment, DDDM is crucial for several reasons. It enhances decision accuracy, helps identify trends and patterns, improves efficiency, and drives innovation. By relying on empirical evidence, managers can make more informed choices, reduce risks, and achieve better outcomes. The integration of advanced technologies such as big data analytics, machine learning, and IoT further underscores the importance of DDDM in achieving sustainable growth and maintaining a competitive edge.

(Wu et al., 2022)'s work on data-driven decision-making in bridge operation and maintenance identifies several implementation challenges, such as the absence of standardized data requirements, insufficient data integration, and the lack of established procedures. Wu suggests future research opportunities to overcome these obstacles, aiding bridge O&M teams in selecting appropriate data and applications for informed decision-making, which also serves as a foundation for further research. (Bousdekis et al., 2021)explores methods for Industry 4.0 maintenance, emphasizing the integration of decision-making with augmented reality, IoT, cloud services, and big data, while also addressing uncertainties and enhancing security. (Rejikumar et al., 2020)'s empirical analysis on Lean Six Sigma highlights the importance of reliable data infrastructure to boost managers' confidence in adopting data-driven methods, noting that complexity perceptions significantly influence adoption intentions. (Ma et al., 2020)presents a prototype system for equipment maintenance decision-making, demonstrating reduced labor costs and decision-making difficulties, with potential improvements through IoT technology for better data acquisition. (Awan et al., 2021)'s research indicates that big data analytics (BDA) capability and business intelligence and analytics (BI&A) enhance decision-making quality, particularly when manufacturers utilize data-driven insights, offering valuable managerial insights for circular economy performance. (Elgendy et al., 2022)introduces DECAS, a modern data-driven decision theory that integrates big data and analytics with human decision-making, proposing a collaborative rationality beyond classical bounded rationality. (Troisi et al., 2020)examines growth hacking strategies in three B2B firms, revealing how cognitive computing and big data analytics inform data-driven marketing decisions. (Andronie et al., 2021)discusses AI-based decision-making in cognitive manufacturing systems, emphasizing predictive maintenance, real-time analytics, and sustainable production. (Basile et al., 2023)demonstrates that a data-driven decision support system (DSS) in healthcare can more

accurately estimate costs and improve clinical decision-making for oncological treatments. (Kavitha & Chinnasamy, 2021)surveys AI integration in IoT resource management, proposing an intelligent decision-making model to address IoT's inherent limitations and suggesting future research directions.

**Challenges in Data-Driven Decision Making**

Data-driven decision-making (DDDM) in management faces several significant challenges that can impede its effectiveness(Provost & Fawcett, 2013). One of the primary issues is data quality and integrity; inaccurate, incomplete, or outdated data can lead to flawed insights and poor decision-making(Yu et al., 2021). The integration of disparate data sources is another major challenge, as organizations often collect data from various platforms and systems that are not inherently compatible, necessitating complex data harmonization processes(Gill et al., 2014). Standardization of data and procedures is crucial to ensure consistency and reliability across different departments and use cases, yet achieving this standardization can be difficult(Mandinach, Honey, et al., 2006). Additionally, handling big data and real-time analytics requires advanced technological infrastructure and expertise to manage the sheer volume, velocity, and variety of data generated(Mandinach, Honey, et al., 2006). Finally, privacy and security concerns are paramount, as the use of sensitive data must comply with regulations and protect against breaches, necessitating robust security measures and governance frameworks (Mandinach, 2012). Addressing these challenges is essential for the successful implementation of DDDM in management.

**Methodologies and Tools**

The methodologies and tools essential for data-driven decision-making (DDDM) in management encompass a wide range of technologies and techniques(Bratasanu, 2018). Common data analytics tools and platforms, such as Tableau, Power BI, and SAS, facilitate the analysis and interpretation of complex data sets, allowing managers to derive actionable insights(Kurilovas, 2020). Machine learning and artificial intelligence (AI) play a pivotal role in DDDM by enabling predictive analytics, pattern recognition, and automated decision-making processes. These technologies can process vast amounts of data and generate accurate predictions, thus enhancing the decision-making capabilities of organizations(Mandinach, Rivas, et al., 2006). Cloud computing and the Internet of Things (IoT) further integrate into DDDM by providing scalable infrastructure and real-time data collection from various devices and sensors. This integration ensures that data is continuously updated and accessible, supporting timely and informed decisions(Ikemoto & Marsh, 2007). Visualization and business intelligence (BI) tools are crucial for presenting data in an understandable and actionable format. Tools like QlikView and D3.js help in creating interactive dashboards and visualizations, making it easier for decision-makers to grasp complex information and trends. Collectively, these methodologies and tools form the backbone of effective data-driven decision-making in contemporary management practices.

**Table 1: Summary of Key Studies on Data-Driven Decision-Making (DDDM) across Various Sectors**

| Authors | Methodology | Key Findings | Limitations |
|---|---|---|---|
| (Gul et al., 2023) | Analysis of primary and secondary data from Pakistan's banks (2016-2020) | Adoption of DDDM practices results in a 4–7% increase in productivity | Limited to Pakistan's banking sector |
| (Varvne et al., 2020) | Semi-structured interviews (Single-case study) | Identified challenges: organizational structure, consumer behavior data, execution, and culture | Specific to a single B2B MNC |
| (Ramakrishna et al., 2022) | Conceptual model development and course implementation | Importance of Business Analytics in MBA education | Limited to introductory MBA courses |
| (Roes, 2022) | Participant observation and semi-structured interviews | Influence of organizational learning processes on DDDM adoption | Observational and may not generalize |
| (Kaufman et al., 2014) | Theoretical perspectives and model research | Effective local DDDM implementation in K-12 education | Focused on K-12 educational settings |
| (Adeyeye & Akanbi, 2024) | Literature review and continuous improvement suggestions | Recommendations for leveraging DDDM in engineering management | Generalized recommendations |
| (Bisschoff & Grobbelaar, 2022) | Scoping literature review (mining industry) | Identified DDDM tools, benefits, enablers, and lessons | Specific to the mining industry |
| (Chavez et al., 2022) | Literature review and interviews | Conceptual model linking DDDM to sustainability in manufacturing | Conceptual model may need empirical |

| | | | |
|---|---|---|---|
| | | | validation |
| (Östlund & Gustafsson, 2024) | Qualitative multiple case study | Balance between data-driven insights and intuitive decision-making | Focus on qualitative managerial practices |

**Applications in Different Sectors**

Data-driven decision-making (DDDM) finds diverse applications across various sectors, significantly enhancing operational efficiency and strategic planning(Zaitsava et al., 2022). In bridge operation and maintenance, DDDM helps address challenges such as data standardization and integration, enabling teams to make informed decisions about maintenance needs and resource allocation(Elragal & Elgendy, 2024). For Industry 4.0 maintenance, DDDM integrates advanced technologies like augmented reality, IoT, and cloud computing to manage and predict maintenance activities, thus minimizing downtime and improving productivity(SARIOGUZ & MISER, 2024). In the context of Lean Six Sigma, DDDM provides a robust framework for collecting and analyzing data to identify inefficiencies and optimize processes, fostering a culture of continuous improvement(Colombari et al., 2023). Equipment maintenance also benefits from DDDM by leveraging IoT technology to acquire real-time data, facilitating proactive maintenance strategies that reduce labor costs and decision-making difficulties(Raad, 2024). Each of these sectors demonstrates the transformative potential of DDDM in improving operational outcomes and strategic decision-making.

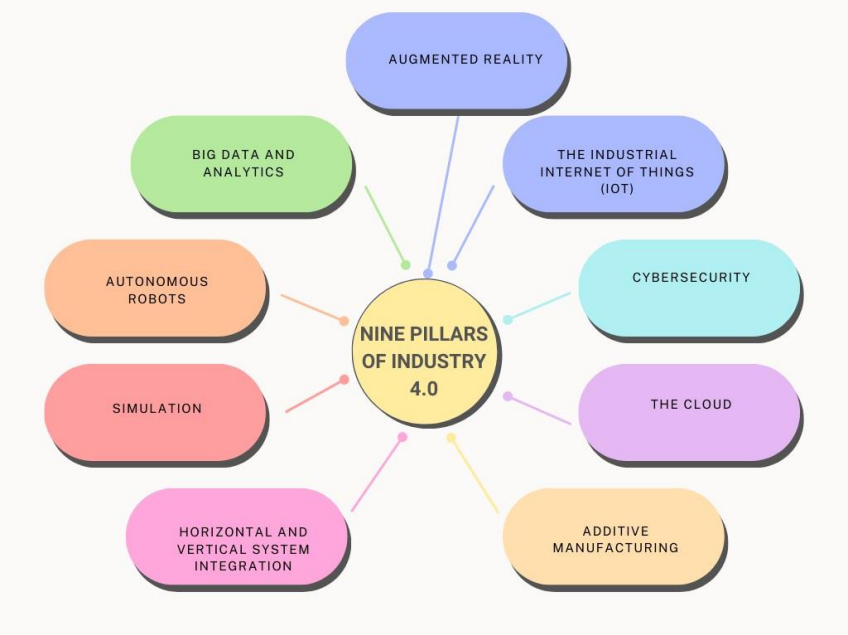


**Figure 1: The nine pillars of Industry 4.0maintenance**

**Future Research Directions:**

Future research directions in data-driven decision making (DDDM) are poised to address several pressing challenges and limitations while exploring emerging trends and technologies. Key challenges include ensuring data quality and integrity, integrating disparate data sources, and standardizing data and procedures across different systems. Researchers need to focus on developing robust methods for managing big data and real-time analytics while also addressing privacy and security concerns. Emerging technologies such as artificial intelligence, machine learning, and advanced analytics tools offer promising avenues for enhancing DDDM. These technologies can help tackle current limitations by providing more sophisticated data processing capabilities and improved decision-making accuracy. Additionally, the integration of Internet of Things (IoT) devices and cloud computing presents new opportunities for real-time data acquisition and analysis. Future research should explore how these advancements can be leveraged to refine decision-making processes and overcome existing barriers. Potential areas for further study include the development of frameworks for seamless data integration, the creation of standardized procedures for data use, and the application of new technologies in various industry sectors. As these trends evolve, continued investigation into their implications will be essential for advancing the field and improving the effectiveness of data-driven decision-making.

**Conclusion:**

In conclusion, data-driven decision-making (DDDM) has emerged as a crucial approach in modern management, leveraging data to enhance

decision quality and operational efficiency across various sectors. The key points highlight the transformative impact of DDDM, including improved accuracy in forecasting, optimized resource allocation, and the ability to derive actionable insights from complex data sets. Challenges such as data quality, integration, and privacy remain significant, yet advancements in technology—such as machine learning, cloud computing, and IoT—continue to address these issues effectively. Looking ahead, the future of DDDM in management is promising, with ongoing developments expected to further integrate sophisticated analytics tools and methodologies into everyday business practices. As organizations increasingly adopt and refine data-driven strategies, they will likely achieve greater innovation, competitive advantage, and agility, setting new benchmarks for success in the data-rich digital era.

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# A systematic Review of Research Gaps and Limitations in Green Synthesis of Copper Based Nanoparticles

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**Abstract:**
Nanotechnology research focuses on producing and utilizing nanoparticles, with applications in molecular diagnostics, cancer treatment, and more. Green synthesis methods for copper nanoparticles (CuNPs) use environmentally friendly plant extracts and fungal isolates. For instance, the Cu@APS-TDU-PMO catalyst, a recyclable and heterogeneous catalyst, efficiently synthesizes tetrazole derivatives and aligns with green chemistry principles. Copper nanoparticles are also investigated as eco-friendly fungicides against Fusarium oxysporum. However, concerns about $Cu^{2+}$ ion buildup in soil suggest a need to use CuNPs instead. In this review despite advancements, challenges remain in achieving consistent particle size, shape, and stability. There is also a lack of comprehensive research on the environmental toxicity and effects of CuNPs, highlighting the need for further exploration of these areas.

**Keywords:** Nanotechnology, nanoparticles, green synthesis, CuNPs, anticancer activity.

## Introduction:

Research on nanotechnology is a rapidly developing and extremely promising area of study in many scientific fields, including the biological sciences, chemistry, and medicine. It focuses on producing and using nanoparticles (NPs), which are particles with sizes ranging from one to one hundred nanometers[1]. When compared to bigger bulk materials, these nanoparticles have special characteristics such as small dimensions, a high surface-to-volume ratio, and particular forms. These properties boost the surface activity of NPs, increase their catalytic potential, and make it easier for them to interact with other particles. Nanoparticles have a wide range of uses due to their various characteristics. They find widespread application in molecular diagnostics, cancer cell treatment, drug delivery systems, environmental applications such as wastewater management and dye degradation, and therapeutic interventions[2-5]. In general, there are two types of nanoparticles: inorganic and organic. Because organic NPs like chitosan and Poly-L-lysine are heat-sensitive and have unique benefits, more stable inorganic NPs have been developed as a result. Metals such as gold and silver, as well as oxides like iron oxide, titanium oxide, copper oxide, and zinc oxide, are examples of inorganic nanoparticles[1].

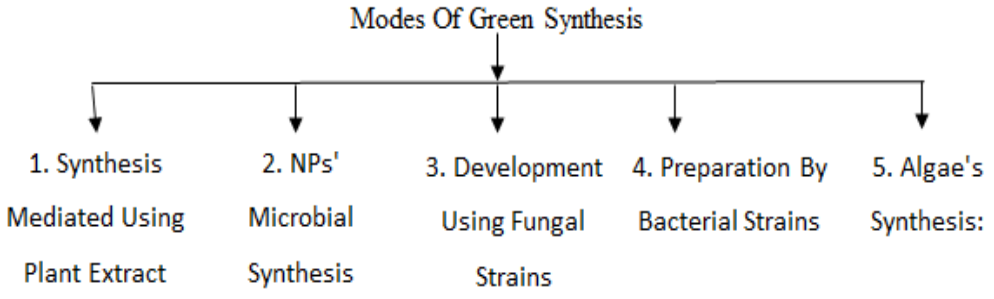
Physical, chemical, or biological techniques which are further divided into top-down and bottom-up methods can be used to synthesize nanoparticles. With the use of these techniques, scientists may accurately modify the size, content, and form of nanoparticles to create customized ones for a variety of uses in various industries[6-7]. Green synthesis of copper nanoparticles (CuNPs) involves environmentally friendly methods that reduce resource consumption and environmental harm. Various studies have explored green synthesis techniques using different plant extracts like Tecoma stans leaves[10] and Ocimum sanctum (Tulsi) leaves[11]. These methods utilize natural compounds such as ascorbic acid as reducing agents to create CuNPs with specific properties like antioxidant, antimicrobial, and anticancer activities[8]. The green synthesis approach ensures non-toxicity and sustainability in nanoparticle production, offering a cost-effective and safe alternative to traditional chemical methods. By utilizing plant extracts and bio-friendly reagents, researchers can tailor the synthesis process to obtain CuNPs with desired shapes, sizes, and surface characteristics for various applications in pharmaceuticals, optoelectronics, and other industries[9].

## Types of Green Synthesis:

In the process of creating green nanoparticles, plants, microbes (such as bacteria, algae, or fungi), or their extracts are used. This environmentally friendly method which uses plant extracts for synthesis in particular is well-researched, safe, and economical. Green synthesis methods for copper (Cu) nanoparticles (NPs) have been explored using various plant species (Figure-1) and fungal isolates. Plant-based green synthesis involved species like Asparagus aethiopicus, Asparagus densiflorus, Nyctanthes arbor-tristris,

Gardenia jasminoides, Tabernaemontana divartica, Cascabela thevetia, Clerodendrum inerme, Hibiscus rosa-sinensis, Allamanda cathartica, and Pimpinella anisum[12-14]. Fungal isolates, particularly Alternaria species, have also been utilized for the green synthesis of Cu nanoparticles[15].

These methods utilize plant extracts or fungal mycelium-free supernatants to reduce copper salts and form Cu nanoparticles, as confirmed by various analyses such as UV-visible spectroscopy, FTIR, SEM, TEM, and DLS[10,12-15]. The green synthesis of Cu nanoparticles offers an eco-friendly, cost-effective, and efficient alternative to traditional chemical methods, showcasing potential applications in antibacterial, antioxidant, and catalytic fields. Shape, size, surface area, and dispersity are the usual characteristics of nanoparticles. Characterization methods that are frequently used are energy dispersive X-ray spectroscopy (EDX), atomic force microscopy (AFM), scanning electron microscopy (SEM), transmission electron microscopy (TEM), Fourier transform infrared spectroscopy (FTIR), and X-ray diffraction (XRD).




**Tree Diagram 1. Show the NPs' green synthesis process[16].**

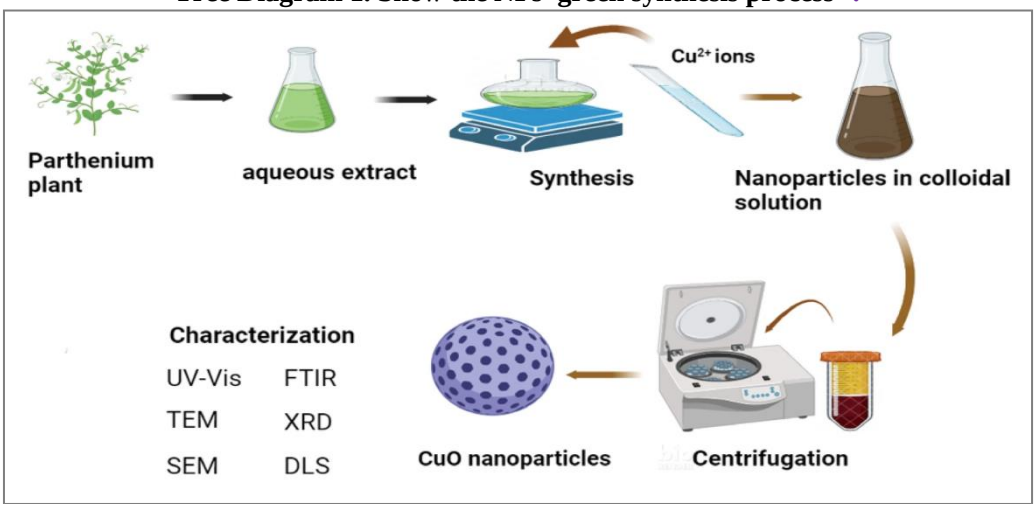



**Figure 1. Diagram illustrating the generation and characterisation of CuO nanoparticles from Parthenium hysterophorus aqueous extract[17].**

**The Research Gaps and Limitations in Cu-Based Nanoparticle Green Synthesis**

Cu-based nanoparticle green synthesis presents a number of research gaps. At bigger sizes, consistency in particle size, shape, and stability is still a challenge when it comes to scalability. Comprehensive research on the toxicity and effects of these nanoparticles on the environment is also lacking (Table-2). There is frequently little control over the synthesis parameters, which causes variation in the final nanoparticles. Furthermore, a more thorough comprehension of the underlying principles and the development of economical, environmentally friendly techniques are required for large-scale sustainable production.

**Table 2. Summarizes the Research Gaps and Limitations in Cu-Based Nanoparticle Green Synthesis.**

| Sr. No. | Nanoparticles | Methods Used | Limitations | Research Gap | Applications | Reference |
|---|---|---|---|---|---|---|
| 1 | CuNPs | CuNPs are produced sustainably by employing plant species and characterisation methods such as UV-VIS, FTIR, | Agglomeration and size maintenance issues in synthetic CuNPs derived from plant extracts. | Insufficient discussion on antimicrobial properties, toxicity, and synthesis factors' influence. | Study antimicrobial properties and environmental toxicity. | 2023 (13) |

| | | | | | | |
|---|---|---|---|---|---|---|
| | | DLS, and TEM. | | | | |
| 2 | CuO NPs | Mechanochemical synthesis of CuO nanoparticles for photocatalytic dye degradation. | Green-synthesized CuO nanoparticles face stability, scalability, uneven size, and limited selectivity and efficiency in dye degradation. | No discussion on CuO NP stability; lacks comparison with other dye degradation methods. | CuO NPs photocatalytic activity against industrial dyes. | 2023(18) |
| 3 | CuO-NPs | Biosynthesis of CuO-NPs using Portulaca oleracea extract, characterized by UV-vis, FT-IR, XRD, TEM, and EDX.DLS, zeta potential. | Challenges include stability, uneven size, scalability, variable activity, and limited efficacy in metal sorption and wastewater treatment. | No comparison with conventional synthesis methods; lacks stability and reusability studies for CuO-NPs. | CuO-NPs: antibacterial, antifungal activities; tanning wastewater treatment, heavy metal sorption. properties | 2023(19) |
| 4 | Cu NPs | Cu NPs biosynthesized with N. cataria leaf extract, characterized by FTIR, UV-Vis, TEM, SEM, and XRD. | Limited phytochemical concentrations info; lacks detailed discussion on environmental impacts. | No comparison with other plant-based syntheses; lacks long-term environmental assessment. | Antibacterial effects on E. coli, En. faecalis, S. aureus; larvicidal impact on mosquitoes listed | 2022 (20) |
| 5 | Cu-doped ZnO | Green coprecipitation with water hyacinth extract; characterization and methylene blue removal study. | ZnO's wide bandgap and high recombination rate make it impractical alone. Cu-based doping enhances visible light response. | No discussion on drawbacks; lacks comparison with similar Cu-doped ZnO studies. | Cu-doped ZnO catalyst using water hyacinth plant extract for preparation. | 2022 (21) |
| 6 | Ag, Zn, Cu NPs | Green synthesis of Ag, Zn, Cu nanoparticles using plant extract, characterized by UV-Vis, FT-IR, SEM; antibacterial activity assessed. | Limited crystal growth control in green synthesis affects nano-technological applications broadly | No comparison with chemically synthesized nanoparticles; lacks clinical applications discussion. | Green synthesis of Ag, Zn, Cu nanoparticles; antibacterial activity tested against specific bacteria. | 2020 (22) |
| 7 | CuO NRs | Green synthesis with Tilia tomentosa leaf extract; thermal analysis, antibacterial testing conducted. | Rare to produce CuO nano-rods from plant leaves; challenges with others. | Rare CuO nano-rods synthesis from plant leaves; limited antibacterial activity data. | CuO nano-rods antibacterial activity; investigation into activation energy. | 2020 (23) |
| 8 | Cu NPs | Copper nanoparticles from Holoptelea integrifolia fruit extract; characterized by | Green synthesis avoids harsh conditions, toxic chemicals, conserving environment. | Lacks detailed application discussion; no comparison with other green synthesis | Eco-friendly nanoparticles for industries; potential applications in medical | 2019 (24) |

| | | | | | | |
|---|---|---|---|---|---|---|
| | | FTIR, UV-vis, SEM. | Phytochemicals stabilize copper nanoparticles formation. | methods. | sciences. | |
| 9 | Cu(In,Ga)Se2 NPS | Large-scale synthesis of Cu(In,Ga)Se2 nanoparticles; inclusion in water-based screen printing ink. | Scarce methods to obtain structures other than tetragonal chalcopyrite. | Limited methods for structures beyond tetragonal; more Cu(In,Ga)Se2 synthesis studies needed. | Cu(In,Ga)Se2 nanoparticle synthesis for screen printing in photovoltaic systems. | 2021 (25) |
| 10 | Cu/SiO2 | Green synthesis: water, ascorbic acid, stabilizers; solvothermal method: diethylene glycol, sodium hypophosphite, stabilizers. | Metal-support mixture: low conversion; key factors: nanoparticle size, distribution, interaction. | Insufficient catalyst stability and long-term performance exploration in discussion. | Cu/SiO2 catalysts reduce NOX with H2; CuNP colloidal suspensions synthesized greenly. | 2019 (26) |

**Application of Cu-Based Green Synthesis Nanoparticles:**

Cu-based green synthesis nanoparticles offer a wide range of uses, including as environmental remediation (e.g., lead and dye removal from wastewater), antibacterial activity against different pathogens, and catalytic efficiency in organic reactions like 4-nitrophenol reduction. Their environmentally friendly synthesis, which promotes both industrial and environmental benefits, uses plant extracts as a sustainable alternative to conventional procedures.Bellevalia flexuosa leaf extract was used to create silver nanoparticles, which showed antibacterial efficacy against the tested bacterial strains[27]. To remove carbamazepine, green production of FB-ZVI/Cu nanoparticles was used. Under some circumstances, FB-nZVFe/Cu attained a 95% removal efficiency[28]. Using medicinal plants to produce copper oxide nanoparticles, antibacterial efficacy against human infections was established[29]. Catalytic activity was demonstrated in the synthesis of HBIW by Ni-Cu-Mg ferrite nanoparticles that were produced using tragacanth gum[30]. When using CuO nanoparticles produced from Simarouba glauca, the following ideal parameters were met: pH = 6, 0.05 g of catalyst, and $Pb^{2+}$ = 10 mg/L [31].

Excellent catalytic activity was demonstrated by CuO nanoparticles biosynthesized with Murraya koenigii leaf extract in the reduction of 4-nitrophenol[32]. CuO nanoparticles with antibacterial and anticancer properties were produced utilizing plant extract from Nilgirianthus ciliates[33]. Pumpkin seed-derived Cu-Mn bimetallic nanoparticles shown notable antitumor activity against colon adenocarcinoma cell lines[34]. The green copper nanoparticles that were produced using Saponaria officinalis demonstrated a moderate level of antibacterial activity against both S. aureus and E. coli. Overall, though, the CuNPs' antibacterial effectiveness was moderate to low. To comprehend the processes underlying their poor antibacterial activity, more research is necessary[35]. Studies conducted in the lab and in the field compared the effects of green-synthesised CuNPs on freshwater snails. After being exposed to CuNP, the experimental snails showed signs of necrosis and bioaccumulation[36].

Cu (II) nanoparticles are supported by new urea-bridged PMO for catalysis. The Cu@APS-TDU-PMO catalyst is a heterogeneous, recyclable catalyst that complies with green chemistry principles. It demonstrated efficiency in the synthesis of tetrazole derivatives. The areas of future research remain unidentified[37]. At different concentrations, copper nanoparticles were created as environmentally benign fungicides that prevented Fusarium oxysporum from growing. Nonetheless, the buildup of $Cu^{2+}$ ions in the soil ecosystem suggests that copper nanoparticles should be used in place of $Cu^{2+}$ ions[38].

**Conclusion:**

Research on nanotechnology, particularly in the field of green synthesis of copper nanoparticles, shows promising applications. The environmentally friendly methods using plant extracts offer cost-effective and sustainable alternatives to traditional chemical synthesis, showcasing potential in antibacterial, antioxidant, and catalytic fields. The text highlights the existing research gaps and limitations in Cu-based nanoparticle green synthesis. The challenges include issues with particle size, shape, stability, toxicity, and scalability, emphasizing the need for more comprehensive research and development of

environmentally friendly techniques for large-scale production.

**Conflicts Of Interest:** There is no conflict of interest between the authors.

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# Solving Fuzzy Transportation Problem Using Newly Proposed Ranking Method

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**Abstract:**
Numerous approaches to solve transportation issues in fuzzy environments have been offered in the literature; nonetheless, in all of these approaches, the parameters are represented by standard fuzzy numbers. A recent research introduced the idea of generalized fuzzy numbers and noted that it is frequently not viable to limit the membership function to the standard form. To our knowledge, no one has yet used generalized fuzzy numbers to the solution of transportation-related issues, despite the fact that generalized fuzzy numbers have been employed in a number of studies in the literature to solve real-world issues.This study proposes a novel approach to solve fuzzy transportation issues by assuming that the decision maker is unsure about the exact values of the product's demand, availability, and transportation cost. Transportation cost, product availability, and demand are represented by generalized trapezoidal fuzzy numbers in the suggested manner. A numerical example is solved to demonstrate the suggested strategy, and the outcomes are compared to those of previous approaches. Since the suggested technique is a straightforward extension of the classical method, decision makers will find it relatively simple to comprehend and apply to actual transportation challenges.

**Introduction:**
Organizations are under increasing pressure to develop more effective methods to produce and provide value to consumers in the fiercely competitive market of today. It gets harder to figure out how and when to provide the goods to clients in the amounts they desire while still staying within their budget. A strong foundation for addressing this topic is offered by transportation models. They guarantee the timely and effective flow of raw materials and completed items. Hitchcock came up with the fundamental transportation conundrum first. The transportation issues may be represented as a typical linear programming issue that the simplex approach can then be used to address[1]. It was early realized, however, that the simplex method used to the transportation problem may be made highly efficient in terms of how to assess the essential simplex method information due of its very particular mathematical structure. The stepping stone approach, which offers an alternate means of obtaining the information from the simplex method, was discovered through research. A different research applied the primal simplex transportation method a simplex approach to the transportation problem. Vogel's approximation approach, row minima, column minima, matrix minima (least-cost), and the north-west corner (NWC) rule can all be used to find an initial basic feasible solution (IBFS) for the transportation issue. The transportation problem can be optimally solved with the help of the modified distribution approach [2-6].
Conventional transportation issues presume that the decision-maker is certain of the exact figures for product availability, demand, and transportation costs. Because of unpredictable circumstances, it may not be possible to exactly determine all the parameters of transportation difficulties in real-world applications. Choosing a random variable from a probability distribution to describe this kind of imprecise data is not always the best option. This data may be represented by fuzzy numbers. Thus, in this case, fuzzy decision making is required. According to a research, fuzzy linear programming always yields efficient solutions. Zimmermann's fuzzy linear programming has now evolved into a number of fuzzy optimization techniques for handling transportation-related issues.An approach for handling transportation issues with fuzzy sets of capacities and needs and linear or triangular membership functions was presented in a different paper. A group of academics proposed a fuzzy linear programming technique to solve fuzzy supply and demand values and crisp cost coefficients in transportation issues. Another study devised an algorithm to find the best solution and offered the idea of the optimal solution for the transportation issue using fuzzy coefficients written as fuzzy

numbers. A researcher talked about the technique for resolving the transportation issue in a fuzzy setting [7-10].

An extension principle-based approach to handling fuzzy transportation problems was presented in a research. Another research introduced a two-stage fuzzy transportation problem (FTP) with trapezoidal fuzzy numbers for supply and wants. The goal of the issue is to minimize costs. To get a fuzzy answer, a parametric technique is utilized, and the goal is to minimize the total of the transportation expenses for both phases. Two researchers used level*(k,q)* interval-valued fuzzy numbers to alter historical data about the quantity of supply at the $i^{th}$ supply point and the amount of demand at the $j^{th}$ demand point in order to address the uncertainty surrounding the supply and demand parameters. FTP was examined in a different investigation using trapezoidal fuzzy numbers.A fuzzy modified distribution approach is suggested to determine the best answer expressed in fuzzy numbers. In order to determine the fuzzy optimal solution for these fuzzy transportation problems in which the supply, demand, and transportation cost are represented by trapezoidal fuzzy numbers a research developed a novel approach called the fuzzy zero point method[11-14].

A research suggested the idea of generalized fuzzy numbers and noted that it is frequently not possible to limit the membership function to the standard form. The majority of the studies employ a normalization procedure to transform generalized fuzzy numbers into regular fuzzy numbers, which are subsequently utilized to address real-world issues. Another investigation revealed that the normalizing method had a significant drawback. In essence, we have lost knowledge because we have converted a measurement of an objective value into an assessment of a subjective value. This process reduces the amount of information accessible in the original data, even though it is technically valid, thus we should avoid it[15-17].To the best of our knowledge, no one has yet applied generalized fuzzy numbers to the solution of transportation-related problems, despite the fact that they have been utilized in a number of studies to solve real-world issues[18-20].

Assuming that a decision maker is unsure of the precise values of the transportation cost, product availability, and product demand, a novel approach to tackling fuzzy transportation issues is put forward in this work. The generalized trapezoidal fuzzy values in the suggested technique indicate the product's availability, demand, and transportation cost. An example numerical problem is solved to demonstrate the suggested approach, and the outcomes are contrasted with those of previous techniques. The suggested approach is extremely simple for decision makers to comprehend and use on actual transportation issues since it is a straightforward extension of the classical method.

**Different generalized trapezoidal fuzzy numbers**

This section presents the current approach for comparing generalized trapezoidal fuzzy numbers that is utilized in the numerical examples[21].The following procedures may be used to compare two generalized trapezoidal fuzzy numbers, let $B=(b_1,c_1,d_1,e_1;\ x_1)$ *and* $C=(b_2,c_2,d_2,e_2;\ x_2)$

**First Step:**

Find $x = minimum\ (x_1,x_2)$

**Second Step:**

Find $R(B)=x(b_1,c_1,d_1,e_1)/4$ and $R(C)=x(b_2,c_2,d_2,e_2)/4$

**First Case:**

If $R(B)>R(C)$ then $B>C$ i.e., minimum $(B,C)=C$

**Second Case:**

If $R(B)<R(C)$ then $B<C$ i.e., minimum $(B,C)=B$

**Third Case:**

If $R(B)=R(C)$ then $B=C$ i.e., minimum $(B,C)=B=C$

**Fuzzy Transportation Problems (FTPs)**

Conventional transportation issues presume that the decision-maker is certain of the exact figures for product availability, demand, and transportation costs. Due to unpredictable circumstances, it may not be possible to exactly determine all these characteristics of the transportation difficulties in real-world applications. For instance, the following circumstance could arise in real-world issues: There will be ambiguity over the cost of transportation if a product is being carried for the first time to a location and no expert knows how much it will cost. When a new product is introduced to the market, there is never a guarantee that it will be in high demand.In everyday situations, it is evident that when a customer asks a supplier if a certain product is available or not, the provider will occasionally respond, "Yes, it is," but other times, the supplier will say, "Sorry, this product is not available at this time." Occasionally, a provider can say with confidence whether or not the product is available. When a customer requests a certain product, the supplier responds, "Yes, the product is available." However, if the customer requests a big number of the product, the supplier then adds, "I check that so much quantity is available or not," indicating that there is some degree of uncertainty over the product's availability.Fuzzy set theory is used in literature to

answer transportation difficulties in order to cope with such scenarios. Numerous writers have put forth various approaches to address these kinds of transportation issues by depicting the cost, availability, and demand of transportation as typical fuzzy numbers [22-25]. The following formulation can be used to describe fuzzy transportation situations, when a decision-maker is unsure of the exact values of transportation cost, availability, and demand:

Minimize $y_0$

Subject to:

$\sum y_{jk} \le b_j, \quad j = 1,2,3,\ldots,n$

$\sum y_{jk} \ge c_k, \quad k = 1,2,3,\ldots,o$

Where

$y_0 = \sum\sum d_{jk} \times y_{jk}$ = overall expense of fuzzy transportation

$b_j$ = the product's overall hazy availability at the source

$c_k$ = the product's overall hazy demand at the specified destination

$d_{jk}$ = unit fuzzy transportation expense between the kth destination and the *jth* source

$y_{jk}$ = fuzzy decision variables or the estimated quantity of the product that has to be carried from the *jth* source to the kth destination

The fuzzy transportation problem (FTP) is classified as balanced if $\sum b_j = \sum c_k$; otherwise, it is termed an unbalanced fuzzy transportation issue.

**Newly Proposed Method:**

Various approaches have been proposed in the literature to address balanced fuzzy transportation issues; however, none of the aforementioned approaches employ generalized fuzzy numbers or ranking functions to determine the fuzzy optimum solution and IFBFS[26-28].

**Methods to find initial fuzzy basic feasible solution (IFBFS)**

This section presents three novel approaches to discover the IFBFS of the following FTP: the generalized fuzzy north-west corner technique, the generalized fuzzy least-cost method, and the generalized fuzzy vogel's approximation method.

Minimize: $y_0$

Subject to:

$\sum y_{jk} \le b_j, \quad j = 1,2,3,\ldots,n$

$\sum y_{jk} \ge c_k, \quad k = 1,2,3,\ldots,o$

Where $y_0 = \sum\sum d_{jk} \times y_{jk}$ and $y_{jk} \ge 0$.

The following are the steps to determine the IFBFS of the aforementioned problem:

**First Step:** Give the given real-world transportation scenario a formulation for a fuzzy linear programming (FLP) issue.

**Second Step:** Organize the fuzzy transportation table (FTT), a tabular format, with the FLPP formulation. Give the price, availability, and demand of the product as generic trapezoidal fuzzy numbers.

**Third Step:**

Examine whether $\sum b_j = \sum c_k$ or $\sum b_j \ne \sum c_k$.

**First Case:**

If $\sum b_j = \sum c_k$, then go to forth step.

**Second Case:**

Add a fake column with a total cost of zero generalized trapezoidal fuzzy number if $\sum b_j > \sum c_k$. Proceed to the fourth step after assuming that the fuzzy demand at this dummy destination, $\sum b_j$, is roughly equal to $\sum c_k$.

**Third Case:**

In the event when $\sum b_j < \sum c_k$, add a fake row with a generalized trapezoidal fuzzy number of zero for all of its costs. Proceed to the fourth step after assuming that $\sum b_j$ roughly equals $\sum c_k$ as the fuzzy availability at this dummy source.

**Forth Step:**

Use the generalized fuzzy vogel's approximation technique (GFVAM), generalized fuzzy least-cost method (GFLCM), or generalized fuzzy north-west corner method (GFNWCM) as suggested to determine the IFBFS.

**Generalized fuzzy north-west corner method (GFNWCM)**

The following are the steps to use GFNWCM to find the IFBFS:

**First Step:**

Choose the FTT's NWC cell, then determine the minimal values of $b_j$ and $c_k$. The following three scenarios might occur:

**First Case:**

In the NWC of $n \times o$ FTT, assign $y_{jk} = b_j$ if $\text{minimal}\left(b_j, c_k\right) = b_j$. To obtain a new FTT of order $\left(m-1\right) \times n$, disregard the $i^{th}$ row. Proceed to the second step after replacing $c_k$ in the acquired FTT with $c_k = b_j$.

**Second Case:**

In the NWC of $n \times o$ FTT, assign $y_{jk} = c_k$ if $\text{minimal}\left(b_j, c_k\right) = c_k$. To obtain a new FTT of order $\left(m-1\right) \times n$, disregard the $i^{th}$ row. Proceed to the second step after replacing $c_k$ in the acquired FTT with $c_k = b_j$.

**Third Case:**
If $b_j = c_k$, go to the second step and either the first case or the third case but not both at the same time.
**Second Step:**
To decrease the acquired FTT to a FTT of order *1 x 1*, repeat Step 1 until the FTT is reduced.
**Third Step:**
In the *(j, k)* $^{th}$ cell of the provided FTT, allocate all $y_{jk}$.
**Forth Step:**
The initial fuzzy transportation cost and derived IFBFS are $y_{jk}$ and $\sum\sum d_{jk} \times y_{jk}$, respectively.

**Generalized fuzzy least-cost method (GFLCM)**
The following are the steps to use GFLCM to discover the IFBFS:
**First Step:**
Find the FTT fuzzy cost that is the least. Let's say $d_{jk}$. Determine $y_{jk} = min\left(b_j, c_k\right)$. The following three scenarios might occur:
**First Case:**
Allocate $y_{jk} = b_j$ in the $\left(j, k\right)^{th}$ cell of *m* × *n* FTT if minimal $\left(b_j, c_k\right) = b_j$. To obtain a new FTT of order *(m - 1)* × *n*, disregard the $j^{th}$ row. Proceed to the second step after replacing $c_k$ in the acquired FTT with $c_k = b_j$.
**Second Case:**
Allocate $y_{jk} = c_k$ in the $\left(j, k\right)^{th}$ cell of *m* × *n* FTT if minimal $\left(b_j, c_k\right) = c_k$. To get a new FTT of order *m* × *(n-1)* ignore the kth row. Proceed to the second step after changing $b_j$ to $b_j = c_k$ in the acquired FTT.
**Third Case:**
If $b_j = c_k$, go to the second step and either the first case or the third case but not both at the same time.
**Second Step:**
To decrease the acquired FTT to a FTT of order 1 x 1, repeat Step 1 until the FTT is reduced.
**Third Step:**
In the $\left(j, k\right)^{th}$ cell of the provided FTT, allocate all $y_{jk}$.
**Forth Step:**
The initial fuzzy transportation cost and derived IFBFS are $y_{jk}$ and $\sum\sum d_{jk} \times y_{jk}$, respectively.

**Generalized fuzzy vogel's approximation method (GFVAM)**
The following are the steps to use GFVAM to discover IFBFS:
**First Step:**
The result should be written in front of the row on the right after taking the smallest entry from the first row and subtracting it from the next smallest entry. The fuzzy penalty for the first row is this. Each column's fuzzy penalties should be calculated in the same way, and they should be noted at the bottom of the FTT under the pertinent columns.
**Second Step:**
Choose the maximum fuzzy penalty and look up the corresponding row or column. Find the row or column that has the least fuzzy cost. Let's say $d_{jk}$. Determine $y_{jk} = min\left(b_j, c_k\right)$. The following three scenarios might occur:
**First Case:**
Allocate $y_{jk} = b_j$ in the *(j, k)th* cell of $m \times n$ FTT if minimal $\left(b_j, c_k\right) = b_j$. To obtain a new FTT of order $\left(m - 1\right) \times n$, disregard the *jth* row. Proceed to the second step after replacing $c_k$ in the acquired FTT with $c_k = b_j$.
**Second Case:**
Allocate $y_{jk} = c_k$ in the *(j, k)th* cell of $m \times n$ FTT if minimal $\left(b_j, c_k\right) = c_k$. To get a new FTT of order $m \times \left(n-1\right)$ ignore the *kth* row. Proceed to the second step after changing $b_j$ to $b_j = c_k$ in the acquired FTT.
**Third Case:**
If $b_j = c_k$, go to the second step and either the first case or the third case but not both at the same time.
**Second Step:**
To decrease the acquired FTT to a FTT of order *1 x 1*, repeat Step 1 until the FTT is reduced.
**Third Step:**
In the *(j, k)*$^{th}$ cell of the provided FTT, allocate all $y_{jk}$.
**Forth Step:**
The initial fuzzy transportation cost and derived IFBFS are $y_{jk}$ and $\sum\sum d_{jk} \times y_{jk}$, respectively.

**Comparison of the Newly Proposed Methods**

In crisp transportation issues, the best solution is found by applying the fuzzy modified distribution method to the generated IBFS, which is initially produced using techniques such as the north-west corner approach, least-cost method, or Vogel's approximation method, among others. In general, it is assumed that the total number of iterations in the fuzzy modified distribution method will be less than as compared to the other mentioned methods if the modified distribution method is applied to the IBFS, which is obtained by using Vogel's approximation method, to find the optimal solution. That is to say, in most cases, Vogel's approximation method is the best among the previously mentioned methods, but this statement is

not always true.This section solves a fuzzy transportation issue using every suggested approach and demonstrates that selecting the optimal strategy among GFNWCM, GFLCM, and GFVAM is not feasible.

**Applications of Newly Proposed Methods:**

The product's estimated availability ($b_j$) throughout its three origins Table 1 displays the estimated unit transportation cost ($d_{jk}$) of the product from each origin to each destination, denoted by a generalized trapezoidal fuzzy number, together with the approximate demand ($c_k$) of the product at three destinations (Ek, k = 1, 2, 3). Find the fuzzy optimum product transportation such that the overall fuzzy transportation cost is as low as possible. Table 2 displays the outcomes of the fuzzy transportation problem, which was selected in the applications of proposed methods, after employing several suggested techniques.The results, displayed in Table 2, make it clear that the rank of the fuzzy optimal solution obtained by applying the fuzzy modified distribution method on the IFBFS, obtained by using different proposed methods, is the same. However, the total number of iterations in the fuzzy modified distribution method applying on the IFBFS, obtained by GFNWCM, is less than as compared to other methods, meaning that you cannot select between GFNWCM and GFLCM as the best method for obtaining the fuzzy optimal solution.

**Results and Discussions**

The majority of the studies employ a normalization procedure to transform generalized fuzzy numbers into regular fuzzy numbers, which are subsequently utilized to address real-world issues. A recent study revealed that the normalization method has a significant drawback[29, 30]. In essence, we have lost knowledge because we have converted a measurement of an objective value into an assessment of a subjective value. This process reduces the amount of information accessible in the original data, even though it is technically valid, thus we should avoid it. The fuzzy transportation issue, selected for the application of the suggested approaches, is solved using the proposed method both with and without the normalizing process in order to illustrate the drawbacks of the normalization process. The results are then described in the following lines.

The findings achieved (with and without normalizing method) are discussed in the following lines if all the parameters, represented as generalized trapezoidal fuzzy numbers, are gathered from the same decision maker based on decision maker's experience. The fuzzy optimum value y0=(-209.35, 64.85, 258.6, 531; 0.2) is produced if all the parameter values used in the example are first normalized and then the generalized fuzzy modified distribution technique is used on the IFBFS, as obtained by GFNMCM.

**Table 1: Fuzzy cost of transportation for a product unit quantity between several origins and destinations**

| | Demand1 | Demand2 | Demand3 | Availability (bj) |
|---|---|---|---|---|
| Supply1 | 2,5,10,20; 0.6 | 2,3,6,10; 0.5 | 3,6,9,19; 0.6 | 2,6,8,10; 0.3 |
| Supply2 | 9,10,13,27; 0.6 | 4,6,9,13; 0.3 | 8,10,14,29; 0.5 | 5,8,9,11; 0.6 |
| Supply3 | 12,13,21,28; 0.6 | 1,6,11,16; 0.9 | 5,6,9,12; 0.7 | 5,6,9,12; 0.7 |
| Demand(ck) | 4,6,9,13; 0.5 | 5,9,10, 11; 0.3 | 3,5,7,9; 0.4 | |

**Table 2: Comparison of Different Newly Proposed Methods**

| Method | Iterative Fuzzy Optimization via IFBFS Refinement | Least Cost of Fuzzy Transportation | Rank |
|---|---|---|---|
| GFNWCM | 2 | -209.35, 64.85, 258.6, 531; 2 | 41.35 |
| GFLCM | 4 | -356.35, 17, 304.35, 678; 3 | 41.35 |

The analysis above yielded the following conclusions:

1. The decision-maker states that the minimum transportation cost will be less than 531 units and more than -209.35 units.
2. The decision-maker expressed 20% overall satisfaction with the assertion that the minimum transportation cost will be between 56.85 and 258.6 units.
3. The decision-maker's total degree of satisfaction with the remaining minimum transportation cost values may be found below: Let y be the lowest possible transportation cost, and let $y=\mu(y)\times100$ be the decision-maker's total happiness.
4. The fuzzy optimum value $y_0=(-209.35, 64.85, 258.6, 531; 0.3)$ is achieved by applying the generalized fuzzy modified distribution technique to the IFBFS, which is obtained if the parameters of the same example are not normalized.
5. The analysis above yielded the following conclusions:
6. The decision-maker states that the minimum transportation cost will be less than 531 units and more than -209.35 units.
7. The decision-maker is generally 30% satisfied with the assertion that the minimum transportation cost will be between 56.85 and 258.6 units.
8. The decision-maker's total degree of satisfaction with the remaining minimum transportation cost values may be found below: Let y be the lowest possible transportation cost, and let y=μ(y)×100 be the decision-maker's total happiness.
9. The aforementioned sections provide clear explanations of the results, which indicate that

the decision maker believes the minimum transportation cost range to be the same in both scenarios that is, less than 531 units and greater than -209.35 units but that the normalization process alters the overall level of satisfaction for varying minimum transportation cost values.

The decision maker's overall degree of satisfaction with the statement that the minimum transportation cost will be between 64.85 and 258.6 units is 20% according to the results with the normalization procedure, compared to 30% in the absence of the process. The decision maker's overall level of satisfaction for the identical values of minimal transportation cost differs in both situations when different values of y are entered into μ(y). This indicates that genuine information is lost throughout the normalization procedure. Therefore, it is preferable to utilize generalized fuzzy numbers which are produced through the normalizing process instead of conventional fuzzy numbers. The outcomes, acquired using an alternative approach, might also be described in the comparable

**Conclusion:**

This study presents novel techniques for determining the fuzzy optimum solution and the IFBFS of fuzzy transportation issues where the product's demand, availability, and transportation cost are represented as generalized trapezoidal fuzzy numbers. The advantages of the suggested approaches are examined, and they are demonstrated by solving a numerical example. The suggested techniques for resolving the hazy transportation issues that arise in practical settings are quite simple to comprehend and implement.

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# Exploring Nonlinear Optical Properties of L-Tartaric Acid: A Computational Study Using DFT Approach

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**Abstract:**

In the present study, L-tartaric acid (LTA)compound have been modeled and analyzed for optical and nonlinear optical (NLO) properties using density functional theory (DFT) with global hybrid functionals (GHs) - B3LYP with the 6–311++G (d, p) basis set. The study includes HOMO-LUMO analysis, vibrational frequency calculations, FTIR spectrum, FT-Raman activity, and Frontier Molecular Orbitals (FMO) analysis. Also, dipole moment and linear polarizability were determined to investigate the nonlinear optical properties.

The theoretically optimized geometric parameters and vibrational frequencies align well with experimental data and literature results. To evaluate the thermal stability of the material, self-consistent field (SCF) energy, global reactivity parameters, and thermodynamic functions, including enthalpy (H), entropy (S), and Gibbs free energy (G), were calculated.The total dipole moment (μ_tot) and isotropic polarizability (α) were compared with a reference compound, indicating that the studied complexes exhibit promising nonlinear optical properties.

**Keywords:** Density Functional Theory, Nonlinear Optical property.

## Introduction

Density Functional Theory (DFT) is a cost-effective theoretical modeling and analysis method that provides accuracy comparable to traditional techniques. Quantum chemical calculations using DFT can predict essential molecular properties for Nonlinear Optical (NLO) applications and device fabrication [1], [2], [3]. By theoretically investigating NLO properties such as dipole moment and polarizability, researchers can gain insights into the relationship between molecular structures and optical performance. This understanding is crucial for advancing the development and design of organic NLO materials.Organic nonlinear optical (NLO) crystals are highly sought after due to their fast response times and suitability for various optical applications [4], [5]. These materials offer significant advantages, including structural diversity, design flexibility, high chemical stability, and an extensive bonding network for charge mobility, attracting researchers' interest. Among these materials, carboxylic acids stand out, exhibiting prominent π-electron activity in both linear and nonlinear optical properties [6], [7]. However, the bulk growth of carboxylic acid single crystals remains a challenge.

L-tartaric acid (LTA) is a promising candidate in this context. Its unique structural and electronic properties make it a potential material for NLO applications. Earlier research has investigated multiple facets of LTA, such as its growth, molecular structure, NLO analysis, vibrational spectral characteristics, etc. V. Sasikala et al. conducted comprehensive analyses [8], while Mohd Anis et al. combined experimental and computational approaches to study single crystals grown at optimized pH[9]. S. Arulmani et al. examined the doping effects of tartaric acid on Ammonium Dihydrogen Phosphate for enhancing Nonlinear Optical applications [10]. Influence of tartaric acid on linear and nonlinear optical and electrical properties of $KH_2PO_4$ crystal by Baig M et al. [11]

This study analyses LTA crystals using quantum calculations with Density Functional Theory (DFT) through Orca software version 5.03. By using DFT parameters, we aim to uncover the full potential of LTA for nonlinear optical applications. This potential application could lead the way for its use in advanced photonic devices, including signal processing, optical data storage, optical switching, and frequency conversion.

**Computational procedure**

Quantum chemical calculations in this study were conducted using Orca software version 5.03[12]. The molecular structure of LTA was optimized using Berny's optimization algorithm at the DFT level with the B3LYP functional and the 6-311++G (d, p) basis set[13]. The resulting geometry, representing the minimum on the potential energy surface, was obtained through iterative self-consistent field equations.The scaled quantum mechanical (SQM) method was applied to address frequency overestimations, involving selective scaling in the natural internal coordinate system. Vibrational frequencies and intensities, including Raman and IR wavenumbers of normal vibrations, were computed at the same DFT level[8].The study assessed FTIR, and Raman activity to gain a detailed understanding of molecular reactivity and stability. Analysis of frontier molecular orbitals (HOMO and LUMO) provided insights into the molecule's electronic and optical properties. Key quantum chemical properties such as ionization potential (IP), electron affinity (EA), electronegativity (χ), electrophilicity index (ω), chemical hardness (η), softness (S), and chemical potential (μ) were derived from the HOMO and LUMO[14].Thermodynamic properties including entropy, thermal energy, rotational constants, and zero-point vibrational energy (ZPVE), were computed using the same DFT level and basis set.Below is a table outlining the formulas used for each parameter.

| Parameter | Formula | Parameter | Formula |
|---|---|---|---|
| Energy Gap (Eg) | $Eg = E_L - E_H$ | Global Softness (σ) | $\sigma = \frac{1}{\eta}$ |
| Electron negativity (χ) | $\chi = (IP+EA)/2.$ | Electrophilicity Index (ω) | $\omega = \frac{\mu^2}{2\eta}$ |
| Isotropic Polarizability (αiso) $\alpha_{iso}$ | $\alpha_{iso} = \frac{1}{3}(\alpha_{xx} + \alpha_{yy} + \alpha_{zz})$ | Global Hardness (η) | $\eta = \frac{[ELUMO - EHOMO]}{2}$ |
| Ionization Potential (IP) | $IP = - E_{HOMO}$ | Binding Energy ($E_B$) | $E_B = E_G - E_{EX}$ |
| Electron Affinity (EA) | $EA = - E_{LUMO}$ | Chemical Potential (μ) | $\mu = (\frac{EHOMO + ELUMO}{2})$ |

**Table no. 1 Different parameters and formulas**.

**Results and discussion**

**1. Optimised geometry and HOMO–LUMO analysis:**

The molecular structure for LTA was optimized using the B3LYP/6-311G++ (d, p) level of theory.Figure 1 shows the optimized molecular structure of LTA at the DFT level [15]. The HOMO-LUMO analysis provides crucial information about the stability and reactivity of L-tartaric acid (LTA). The calculated HOMO-LUMO energy gap is 7.031 eV, which indicates that LTA is highly stable with low reactivity [8].

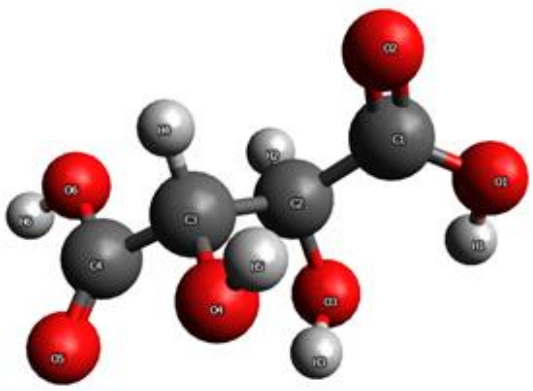

**Figure 1: Optimised molecular structure of LTA.**

In this analysis, the HOMO (Highest Occupied Molecular Orbital) is mainly localized over the inner carbon bonds and hydroxyl groups, as well as one of the carboxyl groups not involved in intramolecular hydrogen bonding. The LUMO (Lowest Unoccupied Molecular Orbital) is distributed across most of the molecule except the $O_6$-$H_{14}$ hydroxyl group.This distribution impacts how electrons are transferred inside the molecule. A large HOMO-LUMO gap means that the molecule is less reactive

but more stable, as it requires more energy to excite electrons from the HOMO to the LUMO. This energy gap also affects charge transfer interactions, which are significant for the molecule's nonlinear optical (NLO) activity [8], [9].

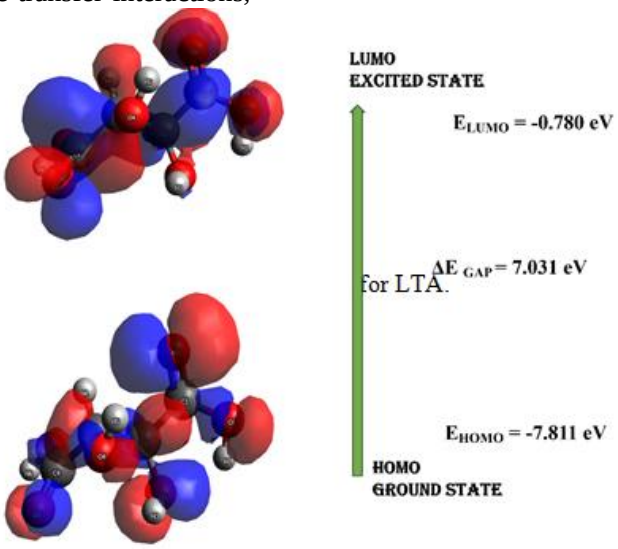


**Figure 2: HOMO-LUMO energy analysis for LTA.**

The HOMO and LUMO energies for LTA were calculated using the B3LYP/6-311++G (d, p) method, with the results shown in Table 2 and the orbital representations illustrated in figure 2. In these diagrams, the positive phase is shown in red and the negative phase is in blue.

| Parameters | HOMO energy (eV) | LUMO energy (eV) | HOMO–LUMO energy gap (eV) |
|---|---|---|---|
| L-Tartaric Acid | -7.811 | -0.780 | 7.031 |

**Table.2 HOMO–LUMO energy values of LTA**

The energy difference between these orbitals is crucial in charge transfer interactions and nonlinear optical (NLO) activity. A smaller HOMO-LUMO gap allows for easier excitation of electrons from the HOMO to the LUMO, enhancing intra-molecular charge transfer and thus improving the material's NLO properties. [16].

**2. Non-Linear Optical Response**

In a nonlinear optical (NLO) material, interactions between molecules can exist invarious fields. These interactions may change the dipole moment, quadrupole moment, frequency, polarization, or path of incident light [17].Therefore, to study the nonlinear optical properties of matter it isimportant to analyzethe dipole moment, quadrupole moment, and linear polarizability of the stated compounds [18].Table 3 shows the result of calculated dielectric parameters for LTA.

| Parameters | DipoleMoment(Debye) | Quadrupole moment (esu $cm^{-2}$) | Isotropic Polarizability (esu) |
|---|---|---|---|
| L-Tartaric Acid | 3.6734 | $-59.8762 \times 10^{-26}$ | $10.2642 \times 10^{-24}$ |
| Urea[8] | 1.3732 | - | $3.8312 \times 10^{-24}$ |

**Table 3 Calculated dipole moment, Quadrupole moment, Isotropic Polarizability for LTA.**

More reactivity is possible when the dipole moment is larger, which suggests the potential for significant intramolecular contact.Relating to the dipole moment value of urea (1.3732 Debye), it is observed that L-tartaric acid has a dipole moment that is twice as high and a polarizability that is three times greater, indicating that L-tartaric acid has a strong nonlinear optical (NLO) activity [19], [20].

**3. Global reactivity parameters and Thermal Properties.**

Global parameters of reactivity (GRP) derived from FMO analysis or HOMO/LUMO energies which provide information about different reactivity parameterscan be calculated by using equationsshown in Table 1[21]. Thesecalculated parameters are displayed in Table 4.

| Global reactivity parameters | | Thermodynamic properties Parameter (at 298 K and 1 atmospheric pressure) | |
|---|---|---|---|
| IP | 7.811 (eV) | Enthalpy | -607.1722 Eh |
| EA | 0.780 (eV) | Entropy (Kcal/Mol) | 28.07 kcal/mol |
| μ | -4.2955 (eV) | Gibbs Free Energy | -607.21600941 Eh |
| η | 3.5155 (eV) | SCF energy. | -16527.34839 eV after 14 cycles |
| σ | 0.1422 ($eV^{-1}$) | Zero-point vibrational energy. | 72.23 kcal/mol |
| ω | 2.6242 (eV) | Total thermal energy | 78.13 kcal/mol |
| χ | 4.2955(eV) | Entropy (Kcal/Mol) | 28.07 kcal/mol |
| | | Rotational constants $cm^{-1}$ | LTA |
| | | A | 0.083144 |
| | | B | 0.028179 |
| | | C | 0.025591 |

**Table 4 calculated the Global reactivity parameters and Thermal Properties of LTA.**

The calculated reactivity descriptors for LTA are shown in Table 2. Molecules with a positive electron affinity, i.e. 0.780 eV, act as electron acceptors and can engage in charge transfer reactions.Chemical hardness and electronegativity reveal a molecule's binding characteristics, stability, and reactivity. LTA's high electronegativity of 4.2955 eV indicates low nucleophilic behavior, while its high chemical hardness of 3.5155 eV suggests low reactivity and high stability due to a significant HOMO-LUMO gap.LTA's electrophilicity index of 2.6242 eV suggests electron transfer from the nucleophile (HOMO) to the electrophile (LUMO), enhancing reactivity. The charge transfer direction is influenced by the molecule's electronic chemical potential. A high electrophilicity index and low chemical potential (-4.2955 eV) confirm LTA's electrophilic nature [8]. The thermodynamic analysis of the LTA molecule reveals that the process is both exothermic and spontaneous. The enthalpy (H) is -607.1722 Eh, indicating that the reaction releases energy to the surroundings. The entropy (S) is 28.07 kcal/mol, suggesting an increase in disorder, which is typical for spontaneous processes. The Gibbs free energy (G) is -607.21600941 Eh, its negative value confirms the thermodynamic favourability and spontaneity of the LTA [20].

## 4. Vibrational Analysis

The LTA molecule has 16 atoms, leading to 47 normal vibrational modes, all of which are IR active. Predicted vibrational wavenumbers are typically higher than experimental values due to electron correlation effects and basis set limitations.

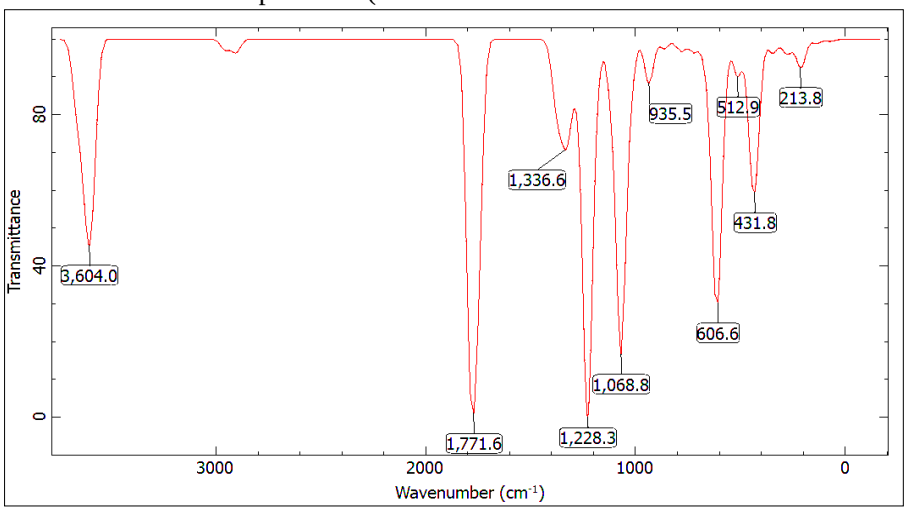


**Figure 4 IR Spectra of LTA.**

Vibrational spectral assignments were conducted using normal coordinate analysis and force field calculations at the same level of theory used for geometry optimization.Computed harmonic wavenumbers are scaled down to improve agreement with experimental data using a consistent factor. This adjustment ensures that theoretical calculations closely match experimental results.Figures 4and 5show IR spectra and Raman activity respectively at a scale factor of 0.96.

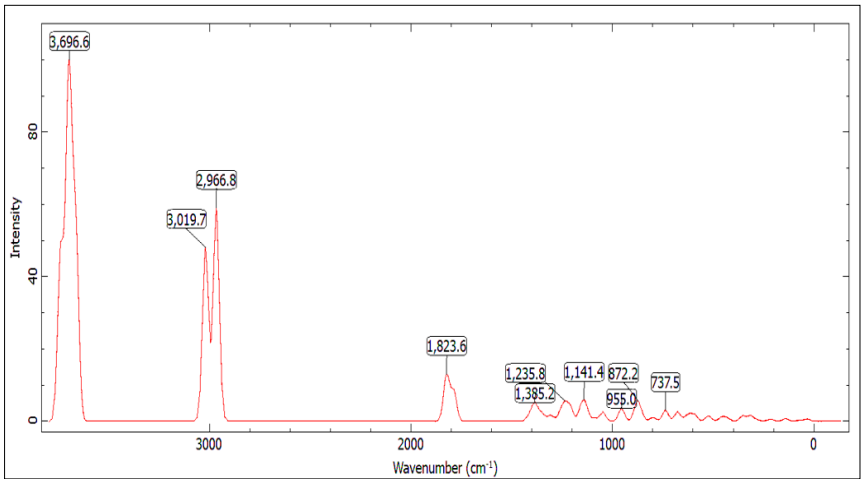


**Figure 5 Raman Spectra of LTA.**

**Conclusions:**

Molecular structure optimization and vibrational spectral studies were effectively conducted using DFT computations. FT-IR and FT-Raman spectral characterizations of LTA were performed, and the complete vibrational assignments were made using computed data, supported by normal coordinate analysis and scaled quantum mechanical force field methodology. The simulated infrared and Raman spectra show good agreement with the observed spectra.Isotropic polarizability, static dipole moment, quadrupole moment, quantum chemical molecular orbital properties, and thermodynamic properties of LTA were computed at the DFT level. The high HOMO-LUMO energy gap indicates low chemical reactivity, high chemical stability, and hardness of the LTA molecule. Thermodynamic properties in the gas phase were studied and found to correlate directly with temperature. The nonlinear optical (NLO) properties study suggests that LTA exhibits robust NLO characteristics comparable to Urea, highlighting its potential for applications in nonlinear optical devices.

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# Research Methodology and Innovations in Physical Education and Sports Science

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**Abstract:**

The National Education Policy has been eagerly awaited and brings joy to the whole of India and the education sector. Inactivity increases the risk of coronary artery disease, neck and breast cancer, diabetes, high blood pressure, osteoporosis, stress and depression. To ensure that research methodologies in tertiary education has traditionally been based on teaching master's courses. all children experience the magic of play and sport, and to create a nation of healthier and stronger children through the school system, we expect sport and play to be taught and valued with the same rigor and structure as core academic subjects. Focusing on vocational education contributes greatly to the overall development of children, and our hope is that students will be able to choose physical activity and sport as a vocational subject. It throws light on the entire education system in India as it is an ideal foundation for both primary and higher education. The curriculum must include guides for games, sports activities and health, as well as guides for technological competence and social studies, which make training versatile, reasonable and worthwhile. NEP suggests combining sports activities or incorporating physical interest into student management techniques and #039; physical and mental fitness while improving one's cognitive abilities.

**Keywords**: Physical activity, students, research methods, NEP

**Introduction:**

Sport ensures children's and social growth by giving them self-confidence, promoting leadership, teaching teamwork and encouraging participation and creativity. These values are difficult to learn through textbooks, but they can be practiced practically and enjoyably. Recent studies have shown that the global fitness effect of physical interest is similar to that of smoking-related deaths. Physical inactivity has been compared to virulent disease because of its prevalence and additional risk of disease. Interventions to sell physical advantage are recommended for changes in appearance, condition and life expectancy. Students interact with heart in style at positive sports events to strengthen and maintain their immunity, fight infectious diseases and live a disease-free life. Therefore, the faculties must consider the prescribed physical exercises to sell the form perfectly and maintain the condition of the child. Physical education is a real problem of educational needs and consists mainly of comprehensive assessment based on benchmarks and standards. The desire to move includes the development of motor skills, knowledge and activities that promote a healthy and active life, as well as motor skills, self-efficacy and emotional intelligence. The purpose of physical education at the faculties is to train students in the technological skills and practices of a physically active and healthy lifestyle. It provides space for participation in developmentally appropriate physical activities aimed at improving the child's fitness, health and fine and gross motor skills. Their potential contributes to the realization of the kingdom and its many growing development aspirations on the one hand, and on the other to an imaginative and visionary India that presents a simple and egalitarian society and a brand new life-touching training apparatus. every human citizen. One of the guiding principles of NEP is multidisciplinary and comprehensive education. The curriculum must include guides on play, exercise and health, as well as guides on technological competence and social studies, which make education versatile, reasonable and profitable. NEP recommends combining sports activities or incorporating physical interest into student management techniques and #039; physical and mental fitness while improving cognitive skills. In addition to exercise, students participating in sports activities expand their lifelong thinking about health and can measure their blood pressure through the Fit India program. In addition, it improves their cooperation, initiative, teamwork and responsibility. Other techniques for university students and # 039; In addition, NEP recommends publicizing sports activities and various

sports in faculties and universities. It offers more challenges and flexibility, allowing students to choose PE according to their desired course.

Teaching and learning strategies.

The teaching of research methods in higher education has traditionally been based on the teaching of master's courses. Such traditional suggestions do not motivate students, so work skills must be developed through motivational methods so that students can acquire new knowledge. Therefore, it is necessary to develop new teaching methods to obtain new interesting contents that arouse the interest of the student. That is why it is important to use new teaching strategies in learning, so that the learning processes of practical research are dynamic, functional and provide sufficient information to facilitate tasks and research methods that students can successfully apply in their professional future. In addition, new student profiles have increased investment in flexible learning and new ICT-based methods. Online tools are widely used and accepted by their users, especially if they have previous digital education. These new methods should be used through e-learning based on digital platforms. These digital platforms offer a lot of space for group development, interaction with students and easy, simple and appropriate structuring of tasks. It is necessary to use tools that enable communication with the student, simple, smooth and fast. This type of collaboration platform also allows you to complete tasks together to solve complex problems and tasks. These platforms are configured as a virtual space where teacher and student interact symbiotically in a teaching and learning process where knowledge is based on the knowledge gained through online learning.

Therefore, the faculties must consider the prescribed physical exercises to sell the form perfectly and maintain the condition of the child. Physical education is a real problem of educational needs and consists mainly of comprehensive assessment based on benchmarks and standards. The desire to move includes the development of motor skills, knowledge and activities that promote a healthy and active life, as well as motor skills, self-efficacy and emotional intelligence. The purpose of physical education at the faculties is to train students in the technological skills and practices of a physically active and healthy lifestyle. It provides space for participation in developmentally appropriate physical interests aimed at improving the child's fitness, health and fine and gross motor skills. Their potential will contribute to the realization of the kingdom and its many growing development aspirations on the one hand, and an imaginative and visionary India on the other, introducing a simple and egalitarian society and a brand new life-touching fitness device. every human citizen. One of the guiding principles of NEP is multidisciplinary and comprehensive education. The curriculum must include guides on play, exercise and health, as well as guides on technological competence and social studies, which make education versatile, reasonable and profitable. NEP recommends combining sports activities or incorporating physical interest into student management techniques and #039; physical and mental fitness while improving cognitive skills. Along with exercise, students participating in sports activities expand their lifelong thinking about health and can measure blood pressure through the Fit India program. In addition, it improves their cooperation, initiative, teamwork and responsibility. Other techniques for university students and # 039; In addition, the NEP recommends publicizing the sports activities and various sports of the faculties and universities. It offers more problem choices and flexibility, allowing students to choose physical education according to their desired course.

The study of research methods in higher education has traditionally been based on the teaching of master's courses. Such traditional suggestions do not motivate students, so work skills must be developed through motivational methods so that students can acquire new knowledge. Therefore, it is necessary to develop new teaching methods to obtain new interesting contents that arouse the interest of the student. That is why it is important to use new teaching strategies in learning, so that the learning processes of exercise research are dynamic, functional and provide sufficient information to facilitate tasks and research methods that students can successfully apply in their professional future. In addition, new student profiles have increased the focus on flexible learning and new ICT-based methods. Online tools are widely used and accepted by their users, especially if they have previous digital education. These new methods should be used through e-learning based on digital platforms. These digital platforms offer a lot of space for group development, interaction with students and easy, simple and appropriate structuring of tasks. It is necessary to use tools that enable communication with the student, simple, smooth and fast. This type of collaboration platform also allows you to complete tasks together to solve complex problems and tasks. These platforms are configured as a virtual space where teacher and student interact symbiotically in a teaching and learning process where knowledge is based on the knowledge gained through online learning.

**Research methods in Physical Education:**

A proposal based on the use of new methodological strategies, based on the combination and combination of traditional teaching and learning strategies and methodological discovery strategies with a communication base based on digital platforms, becomes an attractive educational and enriching proposal for students. With the help of teacher lectures and material development, they are achieved and form the pillars of our knowledge. In addition, validating the most important content with online surveys after the presentation, although not the most valuable area, helps to strengthen the foundation of the first stage of this training proposal. In contrast, communication channels enabled by online documents, such as the Google Classroom platform, enable and create collaborative information channels based on positive, rapid and continuous feedback from the student to the teacher. The students who participated in the survey rated the latter highly. Doubts can be resolved through various channels, either through the student-teacher or through other partners, who solve, share and recommend solutions through the Google Classroom platform. The creation of strategies from different methodologies is combined into a teaching and learning structure that is positively evaluated by students. Unlike traditional learning, this proposal is based on a teaching process based on the discovery of the technologies and tools it provides. In addition, the direct connection between theory and practice gives the student the opportunity to receive logical and structured feedback on the problems presented by the teacher. This is done through classroom discoveries and research through job offers.

In conclusion, this research states that the work proposal set for teaching practice research is a new proposal that creates interest and motivation in students that offers professional training and smooth communication as well as accurate, fast and enriching assimilation learning. New content from students.

**Conclusion:**

Physical activity in the learning methods of students and physical and mental health while improving their cognitive abilities. Students participating in sports integrated education develop a lifelong attitude towards fitness and achieve the fitness level prescribed by the Fit India programme. The updates in the national education policy have been eagerly awaited and are causing confusion in India's education sector. Wanting to know what to include and what to leave out. Every young academician and student in India can achieve their multiple goals thanks to this new change. It throws light on the entire education system in India as it is an ideal foundation for both primary and higher education. Vocational training is an important area of development for India's youth. The most important development goal is education in India, both urban and rural.

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# Bianchi Type-I Cosmological model in $f(T)$ Gravity with CMB Radiation

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**Abstract:**
The purpose of this paper is to examine the behavior of the model with physical and kinematical parameters. In particular, we have examined Plane Symmetric Bianchi type-I cosmological models with f(T) in the context of teleparallel gravity using the Hybrid Expansion Law, in which the energy source is the CMB radiation.

**Keywords:** Bianchi type I cosmological model, $f(T)$ Gravity, CMB radiation

**Introduction:**

Numerous theories of gravity, such as $f(R)$, $f(R,T)$, $f(T,\tau)$ and $f(R,L_m)$ have been altered and investigated by researcher like Nojiri & Odintsov (2007), Sotiriou & Faraoni (2010), Felice & Tsujikawa (2010), Houndjo (2012), Sadeghi et al. (2013), and Harko et al. (2014). Promising findings have been observed in the $f(T)$ theory of gravity, which is a generalization of teleparallel gravity. Studies of Bianchi type I universes have been conducted, with special attention to the accelerated expansion of the universe studied by Sharif and Rani (2011a). Cosmology relies heavily on the cosmic microwave background (CMB), which is fundamental to the study of homogeneous, isotropic models. Small disturbances are assumed to have initiated the development of galaxies and large-scale structures, and they are linked to anisotropies in the CMB.

Recent research has investigated several cosmological models. Two-fluid cosmological models in Bianchi type II spacetime were studied by Pant and Oli [8]. Within the context of general relativity, Patil et al. [9] investigated magnetized anisotropic Bianchi type-XI cosmological models. Gamal and Nashed [10] used linear and quadratic forms of $f(T)$ gravity for analysing anisotropic models with two fluids. These studies have shed more insight into alternative gravitational theories and how they affect cosmic occurrences. In order to investigate the impact of bulk viscosity, Eckart [11] developed the relativistic theory of non-equilibrium thermodynamics. The assessment of Bianchi cosmologies with bulk viscosity and particle creation was investigated by Kori and Mukherjee [12]. The impact of bulk viscosity on FRW models was examined by Desikan [13]. The cosmological equation of state in exponential, logarithmic, and their combination $f(T)$ models was examined by Bamba et al. [14]. Several $f(T)$ models with scalar fields were studied by Myrzalulov [15], who also provided an analytical solution for the scaling factor and scalar field. Employing various gravity $f(T)$ models, Sharif and Rani [16] were able to derive the Bianchi type-I universe. More recently, V. M. Raut [17] studied the bulk viscous cosmological model in $f(T)$ gravity utilizing a hybrid expansion law.

Inspired by the investigation mentioned earlier, we used a hybrid expansion law to investigate the dynamics of a plane-symmetric Bianchi type-I cosmological model with $f(T)$ gravity and CMB radiation as the energy source. We also explored the model's behavior with respect to physical and kinematical parameters.

**$f(T)$ Gravity**

The action of $f(T)$ gravity by generalizing teleparallel gravity $f(T)$ is given as,

$$S = \int \left[ T + f(T) + L_{matter} \right] e \; d^4x \qquad (1)$$

By altering the action about the Vierbein vector field $h_\mu^i$, the modified field equation of the teleparallel theory of gravity can be given by

$$\left[ e^{-1}\partial_\mu \left( eS_i^{\mu\nu} \right) - h_i^\lambda T^\rho{}_{\mu\lambda} S_\rho{}^{\nu\mu} \right] (1 + f_T) + S_i^{\mu\nu} \partial_\mu (T) \, f_{TT} + \frac{1}{4} h_i^\nu \left[ T + f(T) \right] = \frac{1}{2} k^2 h_i^\rho T_\rho^\nu \qquad (2)$$

Where $S_i^{\mu\nu} = h_i^{\rho} S_{\rho}^{\ \mu\nu}$, $f_T = \frac{df}{dT}$, $k^2 = 8\pi G$

Here we consider nonlinear $f(T)$ gravity of the form $f(T) = T + nT^2$

The Lagrangian density in teleparallel gravity is characterized by the torsion scalar $T$. This torsion scalar $T$ defines the dynamics of the gravitational field in the teleparallel framework as

$$T = S_{\rho}^{\ \mu\nu} T^{\rho}_{\ \mu\nu} \qquad (3)$$

Where $S_{\rho}^{\ \mu\nu}$ antisymmetric tensor; $T^{\rho}_{\ \mu\nu}$ is the torsion tensor which are respectively defined

$$S_{\rho}^{\ \mu\nu} = \frac{1}{2}\left(K^{\mu\nu}_{\ \ \rho} + \delta_{\rho}^{\mu} T^{\theta\nu}_{\ \ \theta} - \delta_{\rho}^{\nu} T^{\theta\mu}_{\ \ \theta}\right) \qquad (4)$$

$$T^{\lambda}_{\ \mu\nu} = \Gamma^{\rho}_{\ \nu\mu} - \Gamma^{\rho}_{\ \mu\nu} = h_i^{\rho}\left(\partial_{\mu} h_{\nu}^{i} - \partial_{\nu} h_{\mu}^{i}\right) \qquad (5)$$

Where, $\Gamma^{\rho}_{\ \mu\nu}$ is the Weitzenböck connection and the contorsion tensor $K^{\mu\nu}_{\ \ \rho}$ has the following form,

$$K^{\mu\nu}_{\ \ \rho} = -\frac{1}{2}\left(T^{\mu\nu}_{\ \ \rho} - T^{\nu\mu}_{\ \ \rho} - T_{\rho}^{\ \mu\nu}\right) \qquad (6)$$

**Cosmological Model and Field equations**

The plane symmetric Bianchi type- I cosmological model is given as,

$$ds^2 = dt^2 - L^2(t)\left[dx^2 + dy^2\right] - M^2(t)dz^2 \qquad (7)$$

Where, $L$ and $M$ are the cosmic scale factors and function of cosmic time $t$ only.

The corresponding torsion tensor for Bianchi type-I cosmological model is given by

$$T = -2\left(2\frac{\dot{L}\dot{M}}{LM} + \frac{\dot{L}^2}{L^2}\right) \qquad (8)$$

Let us assume that the energy momentum tensor for radiation field with density $\rho_r$, pressure $P_r = \frac{1}{3}\rho_r$ and four velocity $(u_i)^r = (1,0,0,0)$ Where $g^{ij}(u_i)^r(u_j)^r = 1$, so in the co-moving co-ordinate system which yields,

$$T_1^1 = T_2^2 = T_3^3 = -\frac{\rho_r}{3}, T_4^4 = \rho_r \qquad (9)$$

By using equations (8) and (9) the field equation (2) of teleparallel gravity for the cosmological model (7) can be written as,

$$\left(T + f(T)\right) - 4\left(2\frac{\dot{L}\dot{M}}{LM} + \frac{\dot{L}^2}{L^2}\right)\left(1 + f_T\right) = 2k^2\rho_r \qquad (10)$$

$$4\left(\frac{\dot{L}\dot{M}}{LM} + \frac{\ddot{L}}{L} + \frac{\dot{L}^2}{L^2}\right)\left(1 + f_T\right) - 16\frac{\dot{L}}{L}\left[\frac{\dot{L}}{L}\left(\frac{\dot{M}}{M} - \frac{\dot{M}^2}{M^2}\right) + \left(\frac{\dot{L}}{L} + \frac{\dot{M}}{M}\right)\left(\frac{\ddot{L}}{L} - \frac{\dot{L}^2}{L^2}\right)\right] f_{TT} - \left(T + f\right) = -\frac{2}{3}k^2\rho_r \qquad (11)$$

**Solution of Field Equations**

There are two highly non-linear differential equations with six unknowns viz. $L, M, f, \rho_r, P_r$ and $T$. Therefore, to find the above unknowns we must use the plausible condition.

The spatial volume is given as,

$$V = a^3 = L^2 M = a_1^3 t^{3\alpha} e^{3\beta t} \qquad (12)$$

Where $\alpha, \beta$ is a non-negative constant and is the present value of the scale factor, which is known as the hybrid expansion law, it is a combination of a power law and an exponential function. It can be seen that $\alpha = 0$ provides power law cosmology, while $\beta = 0$ gives exponential law cosmology. To solve the above set of highly non-linear equations, the relation between the metric coefficients is considered as,

$$M = L^m \qquad (13)$$

The expansion Scalar,

$$\theta = 3H \qquad (14)$$

The mean anisotropy Parameter,

$$A_m = \frac{1}{3}\sum_{i=1}^{3}\left(\frac{\Delta H_i}{H}\right)^2 \quad (15)$$

The shear Scalar,

$$\sigma^2 = \frac{1}{2}\left(\sum_{i=1}^{3} H_i^2 - 3H^2\right) = \frac{3}{2}A_m H^2 \quad (16)$$

Using equation (12) and (13) which yields,

$$L = \alpha_1 t^{\frac{3\alpha}{m+2}} e^{\frac{3\beta t}{m+2}}, \text{ where } \alpha_1 = a_1^{\frac{3}{m+2}} \quad (17)$$

$$M = \alpha_2 t^{\frac{3m\alpha}{m+2}} e^{\frac{3m\beta t}{m+2}}, \text{ where } \alpha_1 = a_1^{\frac{3m}{m+2}} \quad (18)$$

**Physical and Kinematical Properties:**

The Scalar Expansion is given by,

$$\theta = 3\left(\frac{\alpha}{t} + \beta\right) \quad (19)$$

The mean Hubble parameter given as,

$$H = \left(\frac{\alpha}{t} + \beta\right) \quad (20)$$

The Shear Scalar is,

$$\sigma^2 = \frac{3(m-1)^2}{(m+2)^2}\left(\frac{\alpha}{t} + \beta\right)^2 \quad (21)$$

The value of mean anisotropic Parameter is,

$$A_m = \frac{2(m-1)^2}{(m+2)^2} \quad (22)$$

The ratio of shear scalar with scalar expansion is given as,

$$\left(\frac{\sigma}{\theta}\right)^2 = \frac{1}{3}\left(\frac{m-1}{m+2}\right)^2 \quad (23)$$

Energy density of Radiation and Pressure of the universe which yields,

$$\rho_r = \frac{1}{2k^2}\left\{\frac{324n(2m+1)(4m^2+10m+5)}{(m+2)^4}\left[\frac{\alpha}{t}+\beta\right]^4 - \frac{36(4m+3)}{(m+2)^2}\left[\frac{\alpha}{t}+\beta\right]^2\right\} \quad (24)$$

$$P_r = \frac{1}{6k^2}\left\{\frac{324n(2m+1)(4m^2+10m+5)}{(m+2)^4}\left[\frac{\alpha}{t}+\beta\right]^4 - \frac{36(4m+3)}{(m+2)^2}\left[\frac{\alpha}{t}+\beta\right]^2\right\} \quad (25)$$

**Conclusion:**

In this paper we have investigated an exact solution of the plane symmetric model using CMB radiation field with the help of hybrid Expansion law. The provided cosmological model is expanding in the framework of $f(T)$ gravity. The ratio $\left(\frac{\sigma}{\theta}\right)^2 = \frac{1}{3}\left(\frac{m-1}{m+2}\right)^2 \neq 0$ implies that these models do not approach isotropy for large values of *t*. The said model comes out to be rotating as well as expanding, and the rate of expansion decreases with time, which can be treated as a realistic model.

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# Structural Properties of Spray Deposited Nickel Doped Zinc Oxide Thin Films

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**Abstract:**
Nanotechnology has become fundamental in modern society of innovation and science. Today structures have a tendency of getting miniaturized in all fields in an attempt to shrink circuits hence lowering the cost of fabrication while at the same time improving working efficiencies. Thin films nanostructure is of immense significance in this area due to factors such as electrical, optical property and probable applications. In this view it was panned to deposit thin films of pure and nickel doped zinc oxide using simple and economic spray pyrolysis technique. The structural studies were done by using X-pert Pro Diffractometer. The study reveals that the deposited films are polycrystalline in nature with mixed hexagonal wurtzite and cubic structure.

**Keywords:** Nanostructured; Doped ZnO; Thin Films; Structural studies.

## Introduction

Nano crystalline material has much attention from researchers owing to its features and potential use in the synthesis of nano devices. Zinc oxide (ZnO) has a direct wide band gap of 3.4 eV and possess n-type conductivity.As for the applications of zinc oxide materials, they have been widely employed in the optoelectronic devices including pH sensing, photodetector (PDs), nanogenerators (NGs), light emitting diode (LED), gas sensing, and field emission display [1-6].Manymethods have been discovered to synthesize a variety of materials of interest in the form of nanoparticles. Simple solution-based methods can be used to synthesize ZnO nanoparticles in large scale in low cost such as spray pyrolysis [7], SILAR method [8], co-precipitation [9], sol-gel [10], wet chemical precipitation method [11], chemical bath deposition [12], spin coating [13] and electrodeposition [14]. The current study utilized the spray pyrolysis method to examine how nickel doping affects the structural characteristics of ZnO thin films.

## Experimental details

Pure and zinc oxide thin films doped with nickel were synthesized by the spray pyrolysis technique in air ambient. It should be noted that the experimental setup and other experimental procedures are described in more details elsewhere [15]. The first spray solution was made with zinc chloride ($ZnCl_2$) at 0. 1 M concentration in deionized water before use in the reaction. Doping was done with nickel (II) chloride hexahydrate ($NiCl_26H_2O$) at 0. 1M concentration to the original solution, then the prepared solution was spread on the glass substrate at 623K. The spray rate of 5 mL/min was maintained for the film deposition.The crystal structure and the particle size of the thin films were identified using an X-pert Pro X-ray diffractometer.Prior to deposition the glass substrates were first rinsed in ethanol and then dried under vacuum.

## Results and Discussion

### Structural Analysis

Figure1 also illustrates the XRD pattern of the pure zinc oxide and the nickel doped zinc oxide thin films deposited by the spray pyrolysis at a deposition temperature of 623K. The size of the grains was calculated using Debye Scherrer formula (16).

$$D = \frac{k\lambda}{\beta Cos\theta} \text{------ [1]}$$

Where k is the shaping factor, 'λ' is the wavelength of the Cukα line, 'β' is the full width at half maxima (FWHM) in radians and 'θ' is the Bragg's angle.

The ZnO deposition's intense diffraction peaks can be seen at 31.890°, 34.230°, 36.236°, 47.708°, 56.712°, 62.630°, and 69.182°. These correspond to the (1 0 0), (0 0 2), (1 0 1), (1 0 2), (1 1 0), and (2 0 1) peaks with a hexagonal lattice and having orientation along the (1 0 1) plane. Similarly, the nickel oxide's diffraction peaks can be seen at 37.482°, 43.187°, 62.992°, 75.201°, and 79.182°, which correspond to the cubic phase with preferred orientation along (2 0 0) observed after matching with JCPDS data files (36-1451 and 04-0835)(Table 1). Additionally, a peak shifting was found in response to Ni doping. After doping, the doped sample's (1 0 2) and (1 1 0) peak positions 2θ

changed to a lower value, but the (1 0 0) peak moved to a higher value, possibly as a result of extrinsic doping in pure zinc oxide films. The grain size for pure zinc oxide films was found to be 43nm while it reduces to 32nm with the addition of dopant.

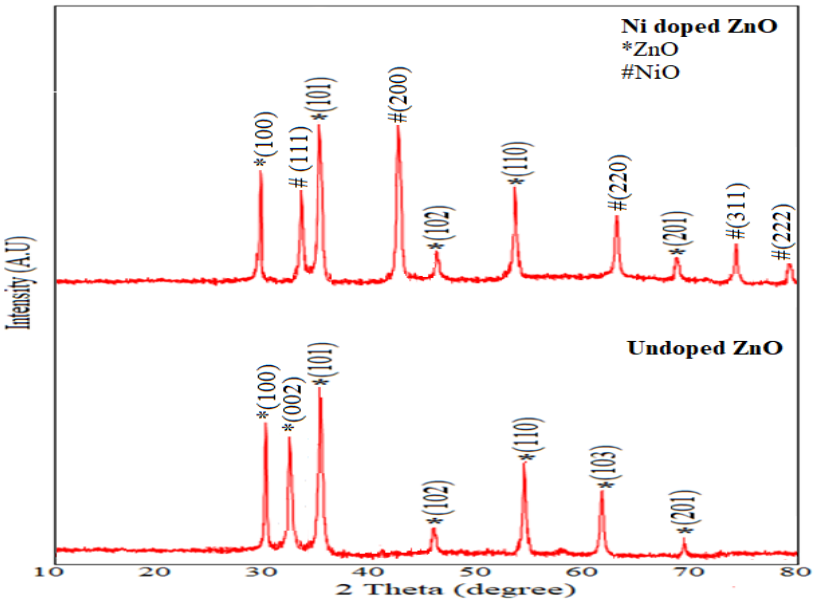


**Figure 1: XRD pattern of undoped zinc oxide and nickel doped zinc oxide thin films thin films**

**Table 2: Comparison of observed and standard XRD data of Pure zinc oxide thin films (JCPDS card 36-1451) and nickel oxide thin films (JCPD card 04-0835)**

| Film | Observed data | Standard data | h k l | phase | | |
|---|---|---|---|---|---|---|
| | 2θ (degree) | d (Å) | 2θ (degree) | d (Å) | | |
| Undoped ZnO Films | 31.890 | 2.760 | 31.770 | 2.814 | 1 0 0 | Hexagonal |
| | 34.230 | 2.701 | 34.422 | 2.603 | 0 0 2 | Hexagonal |
| | 36.236 | 2.496 | 36.253 | 2.475 | 1 0 1 | Hexagonal |
| | 47.708 | 1.826 | 47.539 | 1.911 | 1 0 2 | Hexagonal |
| | 56.712 | 1.590 | 56.603 | 1.624 | 1 1 0 | Hexagonal |
| | 62.630 | 1.513 | 62.864 | 1.477 | 1 0 3 | Hexagonal |
| | 69.182 | 1.329 | 69.100 | 1.358 | 2 0 1 | Hexagonal |
| Ni Doped ZnO Films | 31.908 | 3.001 | 31.770 | 2.814 | 1 0 0 | Hexagonal |
| | 37.428 | 2.382 | 37.281 | 2.410 | 1 1 1 | Cubic |
| | 36.236 | 2.496 | 36.253 | 2.475 | 1 0 1 | Hexagonal |
| | 43.187 | 2.182 | 43.298 | 2.088 | 2 0 0 | Cubic |
| | 47.490 | 1.813 | 47.539 | 1.911 | 1 0 2 | Hexagonal |
| | 56.480 | 1.661 | 56.603 | 1.624 | 1 1 0 | HexagonalC |
| | 62.992 | 1.411 | 62.917 | 1.476 | 2 2 0 | ubic |
| | 68.910 | 1.388 | 69.100 | 1.358 | 2 0 1 | Hexagonal |
| | 75.201 | 1.412 | 75.445 | 1.259 | 3 1 1 | Cubic |
| | 79.182 | 1.231 | 79.393 | 1.206 | 2 2 2 | Cubic |

**Conclusion:**

Nano crystalline, thin films of zinc oxide and nickel doped zinc oxide were prepared by spray pyrolysis technique. The structural analysis was carried out with an X-pert Pro Diffractometer and the results show that the deposited films is polycrystalline and including hexagonal wurtzite and cubic phase.

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# Rare Earth Metal Oxides for Carbon Dioxide Gas Sensing: A Brief Review

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**Abstract:**
Carbon dioxide ($CO_2$) sensing is critical for monitoring atmospheric conditions, controlling indoor air quality, and optimizing crop yields in agricultural settings. Traditional $CO_2$ sensing technologies, such as nondispersive infrared (NDIR) sensors, are often expensive and bulky, driving the need for low-cost, efficient alternatives. Rare earth metal oxides, particularly rare earth oxycarbonates like $La_2O_2CO_3$ and $Nd_2O_2CO_3$, have emerged as promising materials for chemoresistive $CO_2$ gas sensors due to their high sensitivity and lower operating temperatures. This review explores the synthesis, structural properties, and sensing mechanisms of rare earth metal oxides, emphasizing their potential to revolutionize $CO_2$ detection. The study highlights the superior performance of monoclinic $La_2O_2CO_3$ in $CO_2$ sensing applications, despite its metastable nature, and underscores the importance of additives such as $Na_2CO_3$ and CaO in enhancing sensor sensitivity. Additionally, the review addresses the challenges associated with the stability of these materials and the need for further research on more stable hexagonal phases and other rare earth oxycarbonates.

**Keywords:** rare earth metal oxides; $CO_2$ sensing; chemoresistive sensors

## Introduction:

Gas sensing technology is crucial for monitoring atmospheric conditions, ensuring indoor air quality, and optimizing agricultural practices. The monitoring of carbon dioxide ($CO_2$) is especially vital due to its significant role in global warming and its impact on human health and plant growth. The $CO_2$ concentration has risen markedly over the past decades, from 316 ppm in 1960 to 411 ppm in 2019 at the Mauna Loa observatory, highlighting the urgency of reliable $CO_2$ sensing technologies. Conventional $CO_2$ sensors are predominantly based on nondispersive infrared (NDIR) technology, which, despite its accuracy, is often expensive and cumbersome. Figure 1 shows the schematic diagram of non-dispersive infrared (NDIR) sensors [1-4].

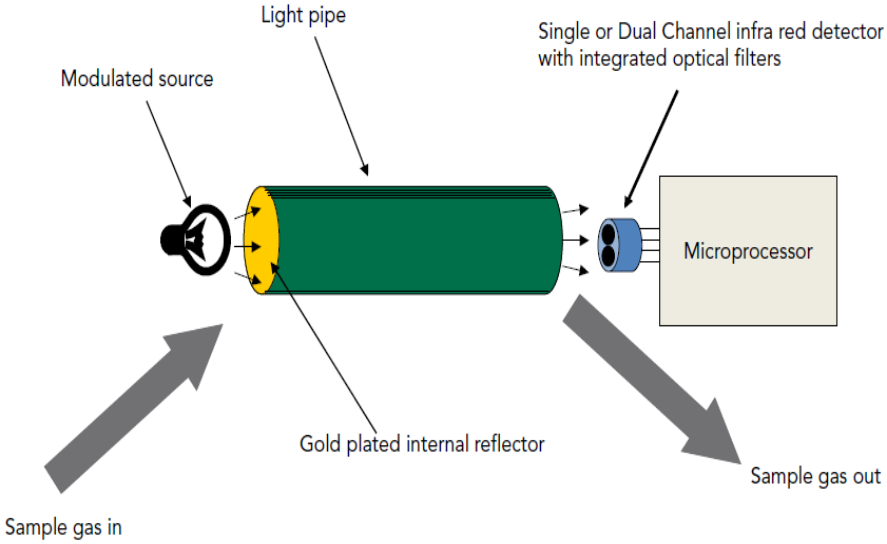


**Figure 1. Non-dispersive infrared (NDIR) sensors.**

In contrast, chemiresistive sensors, particularly those utilizing rare earth metal oxides, offer a promising alternative due to their cost-effectiveness, simplicity, and performance. This review focuses on the role and advantages of rare earth metal oxides in gas sensing, exploring their properties, synthesis methods, and applications. Figure 2 depicts the schematic diagram for chemiresistive sensors [5].

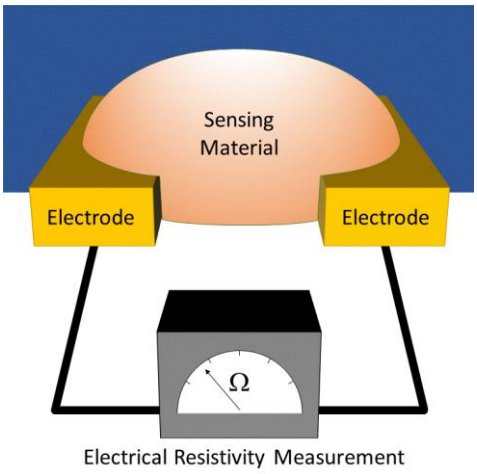


**Figure 2. Chemiresistive Sensors.**

**Properties and Advantages of Rare Earth Metal Oxides**

Rare earth metal oxides are favoured in gas sensing applications due to their unique chemical and physical properties. These materials, including lanthanum oxide ($La_2O_3$), neodymium oxide ($Nd_2O_3$), and praseodymium oxide ($Pr_2O_3$), exhibit high thermal stability, resistance to oxidation, and distinct electronic properties. The sensing mechanism of these oxides is primarily linked to their ability to form rare earth oxycarbonates ($Ln_2O_2CO_3$) upon exposure to $CO_2$. This transformation results in a measurable change in the electrical resistance of the sensor, providing a reliable means of detecting $CO_2$.

Among the rare earth metal oxides, lanthanum oxycarbonate ($La_2O_2CO_3$) has been identified as particularly effective for $CO_2$ sensing due to its high sensitivity and low operating temperature. However, $La_2O_2CO_3$ is metastable and can transform into a hexagonal phase, potentially affecting its long-term stability. Research has shown that the addition of alkaline metal carbonates and alkaline earth metal compounds, such as $Na_2CO_3$ and CaO, can enhance the gas sensitivity and stability of rare earth metal oxide-based sensors [6-8].

**Synthesis Methods**

The synthesis of rare earth oxycarbonates can be achieved through various methods, including heat treatment of rare earth oxides in pure $CO_2$ or rare earth hydroxides in air. The latter method is often preferred for sensors operating in air to ensure stability. Additionally, innovative techniques such as electrostatic spray pyrolysis and sol-gel processes have been employed to produce nanostructured rare earth metal oxides, enhancing their surface area and reactivity, which are critical for gas sensing applications [9].

**Applications and Performance**

Rare earth metal oxide-based sensors have been successfully utilized in various gas sensing applications, including environmental monitoring, industrial safety, and medical diagnostics. For instance, $La_2O_2CO_3$ sensors have demonstrated excellent $CO_2$ sensitivity in the concentration range of 300 to 10,000 ppm, making them suitable for both indoor air quality control and greenhouse monitoring. Furthermore, sensors based on $Nd_2O_2CO_3$ and $Pr_2O_2CO_3$ have also shown promising results in detecting $CO_2$ and other gases, such as methane ($CH_4$) and nitrogen dioxide ($NO_2$), highlighting the versatility of rare earth metal oxides in gas sensing technologies [10].

In addition to their high sensitivity and selectivity, rare earth metal oxide-based sensors offer rapid response times and independence from ambient humidity, which are essential characteristics for practical applications. For example, a newly developed sensor comprising a combination of $Na_2CO_3$, CaO, $BaCO_3$, and $Y_2O_3$ exhibited the highest gas sensitivity among tested samples, demonstrating the effectiveness of composite materials in enhancing sensor performance [11].

**Challenges and Future Directions**

Despite their advantages, rare earth metal oxide-based sensors face several challenges, including stability issues due to phase transformations and potential interference from other gases. Addressing these challenges requires continued research into the fundamental properties of rare earth metal oxides and the development of novel synthesis methods to enhance their stability and selectivity [12].

Future research should focus on exploring the gas-sensing properties of less-studied rare earth metal oxides and their composites. Additionally, the integration of rare earth metal oxides with advanced materials, such as graphene and carbon nanotubes, could further improve their sensitivity and operational stability. The use of in situ characterization techniques, such as operando spectroscopy and high-resolution X-ray absorption, can provide deeper insights into the gas-sensing mechanisms of these materials, facilitating the design of more efficient and reliable sensors [13-15].

**Conclusions:**

Rare earth metal oxides represent a promising class of materials for gas sensing applications, offering high sensitivity, selectivity, and stability. Their unique properties and the ability to form oxycarbonates upon exposure to $CO_2$ make them particularly suitable for $CO_2$ sensing. Advances in synthesis methods and material engineering have further enhanced their performance, making them viable alternatives to conventional NDIR sensors. Continued research into the properties and applications of rare earth metal oxides will pave the way for the development of next-generation gas sensors, addressing the growing need for efficient and cost-effective monitoring of atmospheric and indoor air quality.

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# Behaviour of bulk viscous higher dimensional Bianchi type III cosmological model in the framework of General relativity

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**Abstract:**
In this paper, cosmological solution of five-dimensional Bianchi type III cosmic strings has been studied in the presence of zero mass scalar field coupled with bulk viscosity. Solving of the general relativity field relations assuming (i) Special law of variation for Hubble's parameter which results in constant value of deceleration parameter and (ii) The shear scalar of the space-time is proportional to the expansion scalar. The Physical and kinematical parameters of the model are also discussed in detail.

**Keywords:** Higher dimensional Bianchi III universe, Zero mass scalar field, Bulk viscosity.

**Introduction:**

In latest years, the string cosmological problem has attracted enormous interest in the field of research because of their great position in the evolution of the universe in early era. The study of cosmic strings in relativistic framework was initiated by Stachel [1] and Letelier [2]. According to Kibble [3], strings, monopoles and vacuum domain wall are nothing but the topological stable defects which occur during phase transition. These domain walls, monopoles and strings can lead to very interesting cosmological implications [4].

Currently, the study of higher dimensional space time is an active field of research aiming to unify gravity with other forces in nature. It is believed that the universe had some higher dimensional era at its early stage of evolution which motivates us to investigate the cosmological model universe in five dimensional as well as higher dimensional space-times. Weinberg [5] studied the unification of the fundamental forces with gravity, which reveals that the space-time should be different from four. Since the concept of higher dimensions is not unphysical, the string theories are discussed in 10- dimensions or 26-dimensions of space-time. Because of this, studies in higher dimensions inspired many researchers to enter into such a field of study to explore the hidden knowledge of the universe.

Modern cosmology has been inculcating a lot of interest in the investigation of scalar fields because of the fact that they play an important role in cosmology. Physically they represent matter fields with spin less quanta and describe gravitational field in free space. It is also well known that they cause accelerated expansion of the universe. Scalar fields can be classified into two categories. They are mass less (zero mass) scalar fields and massive scalar fields. Mass less scalar fields represents long range interactions and massive scalar fields describe short range interactions. Here we are interested in the zero mass scalar fields. Cosmological models in the presence of scalar meson fields with different physical matter sources have been investigated by several authors. Rahaman et al. [6] studied Kantowski-Sachs model in the presence of zero mass scalar fields with a flat potential in Lyra's manifold. Venkateswarlu and Pavan kumar [7] investigated plane symmetric model in the presence mass less scalar fields with cosmic string source while Venkateswarlu and Satish [8] discussed Kantowski –Sachs cosmological model with mass less scalar field in the presence of bulk viscous comic strings. Reddy et al. [9] discussed Bianchi type-II dark energy cosmological model in the presence of scalar-meson fields. Venkateswarlu [10] investigated Kaluza-Klein Mesonic Cosmological Model with Two-Fluid Source. Kumar et al [11], Katore et. al. [12], [13] and Venkateswarlu et. al. [14] are some of the authors who have contributed to the study of zero-mass scalar fields. Reddy [15] investigated a spatially homogeneous and anisotropic Bianchi type V space time under scalar meson fields and anisotropic dark energy in general relativity. Also, Reddy et. al. [16] discussed five-dimensional anisotropic dark energy cosmological model in the presence of scalar-meson fields in General relativity. Recently, Mollah et. al. [17,18] studied the aspects of bulk viscous fluid cosmological model with quadratic equation of state in the presence of strings loaded with particles in a higher dimensional Bianchi type-III geometry in Lyra's Manifold. Mete et. al. [19] studied a five-dimensional Bianchi type-

III string cosmological model is studied with a one dimensional cosmic string in the presence of zero mass scalar field in the context of the Lyra manifold. In this paper, we obtain the solution of string cosmological model with bulk viscosity coupled with mass less scalar field in the context of the five-dimensional Bianchi type III cosmological model. We are also discussed geometrical and kinematical properties of the models.

**Metric and Field Equations:**

We consider five-dimensional Bianchi type –III metric as

$$ds^2 = -dt^2 + a^2dx^2 + b^2(e^{-2x}dy^2 + dz^2) + c^2dm^2 \quad (1)$$

Where $a, b, c$ are function of time $t$ and $m$ is extra dimensional.

The Einstein field equations in general relativity corresponding to interacting zero-mass scalar fields in proper units $(8\pi G = c = 1)$ is given by

$$R_{ij} - \frac{1}{2}g_{ij}R + \left(\phi_{,i}\phi_{,j} - \frac{1}{2}g_{ij}\phi_{,k}\phi^{'k}\right) = -T_{ij} \quad (2)$$

And $$\phi^k_{;k} = 0 \quad (3)$$

The energy momentum tensor for cosmic strings with bulk viscosity is

$$T_{ij} = \rho u_i u_j - \lambda x_i x_j - \xi\theta(u_i u_j + g_{ij}) \quad (4)$$

Here $\rho$ as the rest energy density of cloud of strings with particle attached to them, $\lambda$ is string tension density of string and are related by $\rho = \rho_p + \lambda$, $\xi$ is the bulk coefficient of viscosity, $\theta$ is the expansion scalar, $u^i$ the five velocity cloud particles, $x^i$ the unit space like vector representing the direction of the string.

$$u^i = (0,0,0,0,1) \quad \text{And} \quad x^i = (0,0,\frac{1}{c},0,0) \quad (5)$$

$x^i$ Represents the direction of string which will satisfy

$$u^i u_i = -x^i x_i = -1 \quad \text{And} \quad u_i x^i = 0 \quad (6)$$

From equations (2) - (6) line element (1) leads the following system of equations:

If R (t) be the average scale factor then the spatial volume is

$$V = ab^2c = R^4 \quad (7)$$

The Einstein field equations for the metric (1) leads to

$$2\frac{\ddot{b}}{b} + \frac{\ddot{c}}{c} + \frac{\dot{b}^2}{b^2} + 2\frac{\dot{b}\dot{c}}{bc} + \frac{1}{2}\dot{\phi}^2 = \xi\theta \quad (8)$$

$$\frac{\ddot{a}}{a} + \frac{\ddot{b}}{b} + \frac{\ddot{c}}{c} + \frac{\dot{a}\dot{b}}{ab} + \frac{\dot{b}\dot{c}}{bc} + \frac{\dot{a}\dot{c}}{ac} + \frac{1}{2}\dot{\phi}^2 = \xi\theta \quad (9)$$

$$\frac{\ddot{a}}{a} + \frac{\ddot{b}}{b} + \frac{\ddot{c}}{c} + \frac{\dot{a}\dot{b}}{ab} + \frac{\dot{b}\dot{c}}{bc} + \frac{\dot{a}\dot{c}}{ac} - \frac{1}{a^2} + \frac{1}{2}\dot{\phi}^2 = \lambda + \xi\theta \quad (10)$$

$$\frac{\ddot{a}}{a} + 2\frac{\ddot{b}}{b} + \frac{\dot{b}^2}{b^2} + 2\frac{\dot{a}\dot{b}}{ab} - \frac{1}{a^2} + \frac{1}{2}\dot{\phi}^2 = \xi\theta \quad (11)$$

$$\frac{\dot{b}^2}{b^2} + 2\frac{\dot{a}\dot{b}}{ab} + 2\frac{\dot{b}\dot{c}}{bc} + \frac{\dot{a}\dot{c}}{ac} - \frac{1}{a^2} - \frac{1}{2}\dot{\phi}^2 = \rho \quad (12)$$

$$\frac{\dot{a}}{a} = \frac{\dot{b}}{b} \quad (13)$$

$$\ddot{\phi} + \dot{\phi}\left(\frac{\dot{a}}{a} + 2\frac{\dot{b}}{b} + \frac{\dot{c}}{c}\right) = 0 \quad (14)$$

Where, overhead dot denotes ordinary derivative with respect to $t$.

**Solution of field equations:**

Equation (13) gives $a = kb$ where $k$ integrating constant is.

Without loss of generality, we take $k = 1$

Thus $a = b$ (15)

Using equation (15) in equations (8) to (14), we obtain

$$2\frac{\ddot{b}}{b}+\frac{\ddot{c}}{c}+\frac{\dot{b}^2}{b^2}+2\frac{\dot{b}\dot{c}}{bc}+\frac{1}{2}\dot{\phi}^2=\xi\theta \tag{16}$$

$$2\frac{\ddot{b}}{b}+\frac{\ddot{c}}{c}+\frac{\dot{b}^2}{b^2}+2\frac{\dot{b}\dot{c}}{bc}-\frac{1}{b^2}+\frac{1}{2}\dot{\phi}^2=\lambda+\xi\theta \tag{17}$$

$$3\frac{\ddot{b}}{b}+3\frac{\dot{b}^2}{b^2}-\frac{1}{b^2}+\frac{1}{2}\dot{\phi}^2=\xi\theta \tag{18}$$

$$3\frac{\dot{b}\dot{c}}{bc}+3\frac{\dot{b}^2}{b^2}-\frac{1}{b^2}-\frac{1}{2}\dot{\phi}^2=\rho \tag{19}$$

$$\ddot{\phi}+\dot{\phi}\left(3\frac{\dot{b}}{b}+\frac{\dot{c}}{c}\right)=0 \tag{20}$$

We have five highly nonlinear independent equations with seven unknowns $b, c, \phi, \lambda, \rho, \xi$ and $\theta$. Thus, for complete deterministic solutions of above equations we consider following two extra conditions:

i) The special law of variation for Hubble parameter proposed by [20] which yields constant deceleration parameter model of the universe and which is defined by

$$q=-\frac{R\ddot{R}}{\dot{R}^2}=Cons\tan t \tag{21}$$

ii) Also, we adopt the assumption that the shear scalar is proportional to scalar expansion $(\sigma\propto\theta)$ [21] which leads to condition

$$b=c^n \tag{22}$$

Where $n\neq 0$ is constant and it takes care of anisotropic nature of the model.

Solving equation (21) we get,

$$R=\left(\alpha t+\beta\right)^{\frac{1}{1+q}},\qquad q\neq -1 \tag{23}$$

Where $\alpha(\neq 0)$ and $\beta$ are constants of integration. This equation implies that the condition for accelerated expansion of the universe is $1+q>0$.

The scalar field in the model is obtained as

$$\phi=\phi_0\left(\frac{1+q}{q-3}\right)t^{\frac{q-3}{1+q}} \tag{24}$$

From equations (7), (15) and (22) the solution to the scale factors $a, b$ and $c$ are obtained as

$$a=\left(\alpha t+\beta\right)^{\frac{4n}{(1+q)(3n+1)}},\quad q\neq -1\qquad ,\ b=\left(\alpha t+\beta\right)^{\frac{4n}{(1+q)(3n+1)}},\quad q\neq -1 \tag{25}$$

and

$$c=\left(\alpha t+\beta\right)^{\frac{4}{(1+q)(3n+1)}},\quad q\neq -1 \tag{26}$$

With the suitable choice of constants the scale factors can be written as

$$a=b=t^{\frac{4n}{(1+q)(3n+1)}},\quad c=t^{\frac{4}{(1+q)(3n+1)}},\quad q\neq -1 \tag{27}$$

After a suitable choice of coordinates and constants the metric (1) can be written as

$$ds^2=-dt^2+t^{\frac{8n}{(1+q)(3n+1)}}\left(dx^2+e^{-2x}dy^2+dz^2\right)+t^{\frac{8}{(1+q)(3n+1)}}dm^2 \tag{28}$$

**Physical and kinematical parameters:**

Equation (28) represents five-dimensional Bianchi type III bulk viscous string cosmological model with the following physical and kinematical parameters:

The spatial volume $V$ is

$$V=t^{\frac{4}{(1+q)}} \tag{29}$$

The scalar expansion is

$$\theta = \frac{4}{(1+q)} t^{-1} \tag{30}$$

The average Hubble's parameter is

$$H = \frac{1}{(1+q)} t^{-1} \tag{31}$$

Now the energy density, and the string tension density of string is obtained as

$$\rho = \frac{48n(1+n)}{(1+q)^2(3n+1)^2} t^{-2} - t^{\frac{-8n}{(1+q)(3n+1)}} - \frac{1}{2}\phi_0^2\, t^{\frac{-8}{(1+q)}} \tag{32}$$

$$\rho_p = \frac{48n(1+n)}{(1+q)^2(3n+1)^2} t^{-2} - \frac{1}{2}\phi_0^2\, t^{\frac{-8}{(1+q)}} \tag{33}$$

$$\lambda = -\, t^{\frac{-8n}{(1+q)(3n+1)}} \tag{34}$$

The coefficient of bulk viscosity is

$$\xi = \frac{(2n+1)\,(3n-3nq-q)+3}{(1+q)(3n+1)^2 t} + \frac{(1+q)}{8}\phi_0^{\,2}\, t^{\frac{q-7}{1+q}} \tag{35}$$

Shear scalar is obtained as

$$\sigma^2 = \frac{6(n-1)^2}{(1+q)^2(3n+1)^2 t^2} \tag{36}$$

**Conclusion:**

In this paper we have investigated five-dimensional Bianchi type III string cosmological model coupled with zero mass scalar field. The solution of our model is obtained by using constant deceleration parameter and metric coefficient relations. The spatial volume increases as $t$ increases showing the accelerated expansion of the universe (since $1+q>0$) which is in accordance with the present-day observation of modern cosmology. The Hubble parameter and scalar expansion both tends to infinity when $t$ tends to zero and when time $t$ tends to infinity both Hubble parameter and scalar expansion become zero that means when time increases, both Hubble parameter and scalar expansion decreases. We also find that $\frac{\sigma}{\theta}$ tends to constant as $t$ tends to infinity for $n \neq 1$ which shows that the anisotropy in the universe is maintained throughout. However, for $n=1$, it approaches isotropy of universe.

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# Medicinal, Pharmaceutical Chemical Synthesis of Artificial Human Blood

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**Abstract:**

Blood transfusion can mean the difference between life and death, but it requires a match of blood type and depends on donors' goodwill. The development of artificial blood would be an ideal solution. One type of medical device the so-called human artificial organs can be designed and/ or evaluated based on chemical engineering principles. A ‘‘blood oxygenator’’ is used outside the body during surgery for oxygen transfer to, and $CO_2$ removal from, the blood. Approximately, 70% of a human being’s body weight is water, of which 40% is contained within the cells (intracellular fluid) and 20% outside the cells (extracellular fluid). The extracellular water consists of the water in the interstitial fluids (15% of body weight) that is, fluid in the interstices between cells and blood vessels, and the water in the blood plasma (5% of the body weight). Plasma, the liquid portion of the blood, is an aqueous solution of many organic and inorganic substances, such as water, salts and protein. Blood is a suspension in plasma of various blood corpuscles, such as erythrocytes (red blood cells), leukocytes (white blood cells), platelets, and others. The volumetric percentage of erythrocytes in whole blood is called the hematocrit, values of which are 42 - 50% in healthy men and 38 -42% in women. The cells that make up the blood are red blood cells, white blood cells and platelets. The blood plays several roles, including the transfer of oxygen and carbon dioxide between the lungs and cells in the body, balancing the body’s temperature; protecting the body by transferring white cells from the immune system to combat invasive organisms and infections, and creating clots that prevent blood loss during injury. Advantages of Artificial blood are many; it reduces dependency on blood donors, simultaneously eliminates the risk of contamination. Universally matched to all blood types, Longer shelf-life than natural blood, Quick and effective response to mass trauma events and Accessible to patients in the rural areas. Artificial blood stored as a powder could one day revolutionize emergency medicine and provide trauma victims a better chance of survival.

**Keywords**: - Artificial Blood, Oxygenator, Haemoglobin, Dialysis, Hallow Membrane.

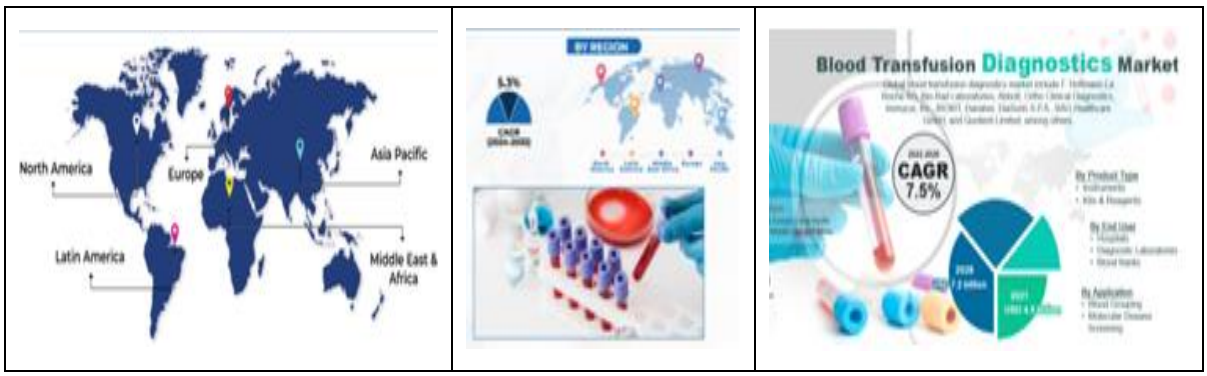


**Figure [1]: International Blood Transfusion Diagnostic Market by Regional Insights.**

## Introduction

Blood flows through our heart, lungs and body in a series of steps. After delivering oxygen and nutrients to all our organs and tissues, our blood enters our heart and flows to our lungs to gain oxygen and get rid of waste. It then flows back to our heart, which pumps the refreshed blood out through our aorta to nourish our body again. We need continuous blood flow through our heart and body to stay alive. In man, a 1ml blood sample will contain approximately 106 erythrocytes, with leukocyte and platelet numbers being approximately 1/600 and 1/20.The Lymphocytes exist as two types: (i) B cells, which produce antibodies (i.e., various immune-globulins); & (ii) T cells, which destroy foreign cells, activate macrophages, and regulate the

production of antibodies by B cells. Complements are proteins in plasma that assist the functions of antibodies in a variety of ways.The blood is a unique connective tissue; therefore artificial blood is designed for the sole purpose of transporting oxygen and removing carbon dioxide throughout the body, the global blood transfusion diagnostics market was valued at USD 4.21 billion in 2023 and is expected to grow at a CAGR of 5.3% during the forecast period as shown in Figure [1]. Blood is a special type of connective tissue that is composed of white cells, red cells, platelets, and plasma. It has a variety of functions in the body. Proteins in the plasma react with air and harden to prevent further bleeding. Plasma is the extracellular material made up of water, salts, and various proteins that, along with platelets, encourage blood to clot.

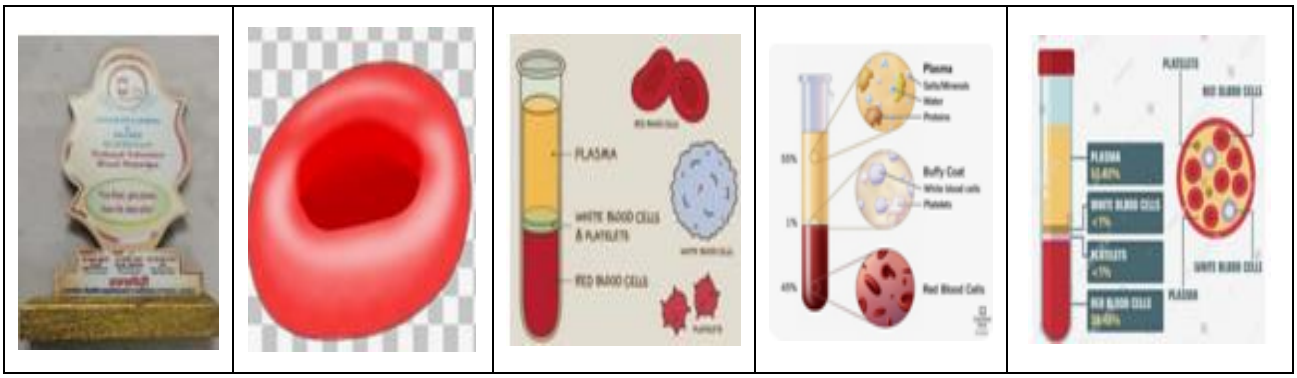


**Figure [2]:-Blood Cell, Plasma and importance of Blood Donations.**

The erythrocyte is disc-shaped, 7.5 - 8.5 mm in diameter, and 1 - 2.5 mm thick, but is thinner at its central region, as shown in Figure [2]. Functionally, erythrocytes contain haemoglobin, which combines very rapidly with oxygen. There are various types of leukocytes, the main function of which is to protect against infection. One type of leukocyte, the macrophage, engulfs and digests various foreign particles and bacteria that have passed into the interstitial spaces. This research work mainly focused on what kinds of Chemical Bonding and/or Elements are present in classifications of blood groups, like $A^+$, $A^-$, $B^+$, $B^-$ $AB^+$, $AB^-$,and O.

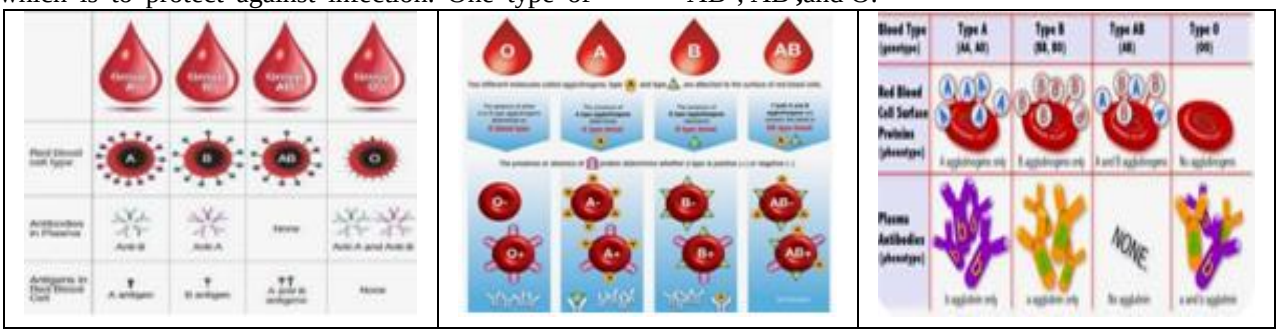


**Figure [3]:- Blood Grouping for the ABO Blood Systems.**

In case of an emergency requiring blood transfusion without blood from the same group, the minimum rule that must be followed when a blood as per their individual shown in Figure [3]. Blood will only be transfused when there is no red blood cell agglutination. The 30-minute rule states that red blood cell (RBC) units left out of controlled temperature storage for more than 30 minutes should not be returned to storage for reissue; the 4-hour rule states that transfusion of RBC units should be completed within 4 hours of their removal from controlled temperature storage. A blood transfusion is a routine medical procedure in which donated blood is provided to us through a narrow tube placed within a vein in our arm. This potentially life-saving procedure can help replace blood loss due to surgery or injury. Apparently, the blood tissue oxygen delivery is dependent on haemoglobin and cardiac output, past medical practice has supported this use of the "golden 10/30 rule," by which patients are transfused to a haemoglobin concentration of 10g/dL or a haematocrit of 30% regardless of symptoms.

**The Composition Of Blood Includes:**

1. Plasma (about 55%): The liquid portion of blood, mostly water (about 92%), proteins, nutrients, hormones, gases, and waste products.
2. Red Blood Cells (RBCs) or Erythrocytes (about 45%): Carry oxygen from lungs to body tissues. The RED Blood cells (Erythrocytes) create the bright red colour.
3. White Blood Cells (WBCs) or Leukocytes (about 1%): Part of the immune system, help fight infections. The white blood cells (Leukolytes) are responsible for the immune defence. They seek out invading organisms or materials and minimize their effect in the body.

4. Platelets or Thrombocytes (about 1%): Involved in blood clotting.

**The plasma component includes:**

1. Proteins (albumin, globulins, fibrinogen)
2. Nutrients (glucose, amino acids, fats)
3. Hormones (insulin, thyroxine, adrenaline)
4. Gases (oxygen, carbon dioxide, nitrogen)
5. Waste products (urea, creatinine, bilirubin)
6. Electrolytes (sodium, potassium, calcium, magnesium)
7. Water (about 92%)

**Literature Review**

In general, the blood flow through the arteries and veins is laminar in nature. In capillaries, the typical blood velocity is 0.5 - 1 mm per sec and the Reynolds number is on the order of 0.001 and its maximum velocity is about 3000. It is critical in transfusion therapy, providing vital information to healthcare professionals and ensuring the compatibility of donor and recipient blood samples with his / her blood group as shown in Figure [4]. The function of the lung is to absorb oxygen into the blood for distribution to the various parts of the body, while simultaneously desorbing carbon dioxide from the venous blood that is received from the organs and tissues. The lungs consist of a pair of spongy, sac-like organs, in which the air passages end in very small hemispherical sacs known as alveoli. The total surface area of the alveolar walls in both lungs is approximately **90 $m^2$**.

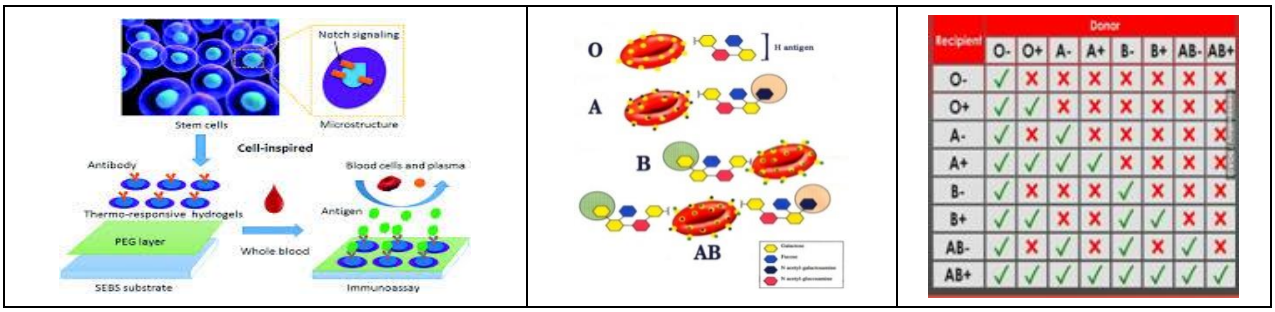


**Figure [4]:- Red Blood cell compatibility with the different Blood Group Table.**

Landsteiner [1], identified three different types of antigens, which he named A, B, and C (C was later renamed O for the German "Ohne", meaning "without"). Here is a more detailed timeline of the history of the ABO blood group system:

1. 1900: Karl Landsteiner discovers the ABO blood group system.
2. 1910: Alfred von Decastello and Adriano Sturli discover the ABO incompatibility reaction.
3. 1927: Philip Levine and Rufus Stetson discover the Rh blood group system.
4. 1940: Karl Landsteiner and Alexander Wiener discover the Kell blood group system.
5. 1945: The Lewis blood group system is discovered.
6. 1950: The Duffy blood group system is discovered.
7. 1960: The Kidd blood group system is discovered.
8. 1970: The MNS blood group system is discovered.
9. 1980: The P blood group system is discovered.
10. 1990: The Diego blood group system is discovered.
11. 2000: The Cartwright blood group system is discovered.

Today, there are over 30 known blood group systems, each with its own unique set of antigens. The ABO blood group is the most important blood group system in transfusion and organ transplantation medicine. The ABO antigens can also be found on many tissues like the kidneys, heart, bowel, pancreas and lungs and incompatible transplantation leads to acute hormonal rejection. The red blood cell (RBC) membrane is a thin, flexible bilayer that surrounds and protects the RBC. It is composed of phospholipids, cholesterol, and proteins. The RBC membrane is also responsible for maintaining the shape and integrity of the RBC, as well as regulating the transport of molecules into and out of the cell. The membrane is made up of 3 layers. The first layer consists of glycolipids, glycoproteins and carbohydrates. The second layer is a phospholipid bilayer and the third is a protein cytoskeleton.The vertical interaction mainly involves the glycolipids, glycoproteins and carbohydrates which stabilize the lipid bilayer. Whereas, the horizontal interaction of the cytoskeleton supports the structural integrity of the RBC.The RBC is a biconcave shaped cell of approximately 7.5 micron in diameter and 2 micron thick. The biconcave shape allows it to have a high surface to volume ratio for optimal gaseous exchange and able to be deformed to pass through microcapillaries of 3 micron in diameter. The membrane structure provides permeability to allow water and electrolytes to exchange via the cation pumps as shown in Figure [5].

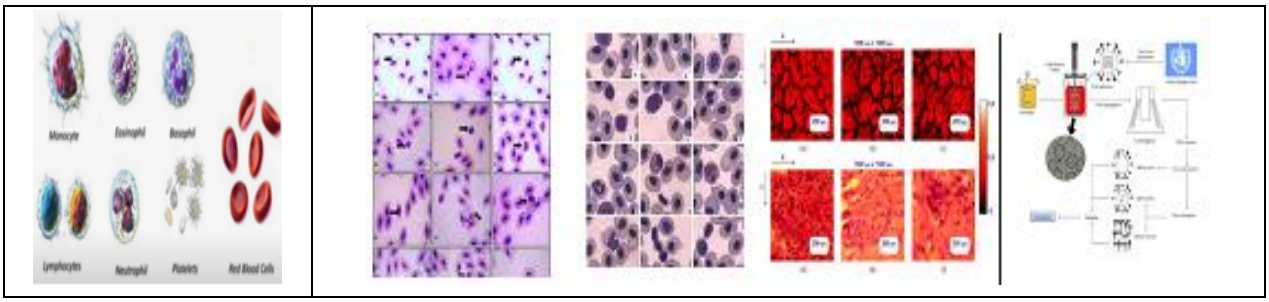

**Figure [5]:- Unveiling the Architectural Marvel of the Red Blood Cell Membrane:**

**Mathematical Results and Discussion:**

The alveolar walls are surrounded by capillaries, such that the gas transfer between the blood and the alveolar gas occurs through the alveolar wall, the interstitial fluid, capillary membrane, plasma, and the erythrocyte membrane. The so called ‘‘heart - lung machine,’’ which performs the functions of the heart and lungs, may be used for several hours during heart surgery. The system consists of a blood pump, a blood oxygenator, and a heat exchanger, where the blood-oxygenator performs the functions of lungs – that is, to absorb oxygen into, and desorb carbon dioxide from, the blood. Occasionally, the blood oxygenator may be used continuously for several days, or even for few weeks, to assist the lung functions of patients suffering from acute severe respiratory diseases.

**Oxygen in Blood:**

The absorption of oxygen into the blood is gas absorption with chemical reactions, known as ‘‘oxygenation.’’ Oxygenation is not oxidation, as the $\mathbf{Fe^{2-}}$ in haemoglobin is not oxidized. Oxygenation involves very rapid, reversible, loose reactions between oxygen and the haemoglobin contained in the erythrocytes. Typically, the haemoglobin concentration in blood is **15 g dl $^{-1}$**, when the hematocrit is 42%. Haemoglobin, a protein with a molecular weight of **68 000 Da**, consists of four subunits each with a molecular weight of **17 000 Da**, Oxygenation proceeds in the four steps as shown Figure [6].

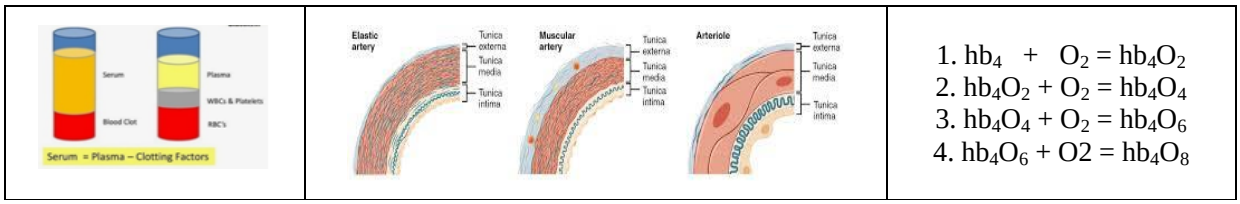


**Figure [6]:- Oxygenation proceeds in the four steps within the Capillaries Veins.**

where **hb** indicates one subunit of the haemoglobin molecule. From the above relationships and the law of mass action, the Adair equation [2] was obtained:

$$\frac{Y}{100} = \frac{K_1p + 2K_1K_2p^2 + 3K_1K_2K_3p^3 + 4K_1K_2K_3K_4p^4}{4(1 + K_1p - 2K_1K_2p^2 + 3K_1K_2K_3p^3 + 4K_1K_2K_3K_4p^4)} \quad (1)$$

where **y** is the oxygen saturation (**%**), **p** is the oxygen partial pressure (**mmHg**), the **Ks** are the equilibrium constants (–) of the above four reactions: (1) to (4). Their values at pH = 7.4 are $\mathbf{K_1}$ = 0.066, $\mathbf{K_2}$ = 0.018, $\mathbf{K_3}$ = 0.010, and $\mathbf{K_4}$ = 0.36 [3]. The increase of K values with **pH** is given by Equation 2 [4]:

$$\log K = \log K(\text{at Ph} = 7{:}2) + 0.48(\text{pH} - 7.2) \quad (2)$$

in which K values at pH = 7.2 are as follows:

$$K_1 = 0.0415;\ K_2 = 0.0095;\ K_3 = 0.0335;\ K_4 = 0.103$$

From the practical point of view, the EMPIRICAL equation of Hill [5] is;

$$\frac{\gamma}{100} = \frac{Hp^n}{(1 - Hp^n)} \quad (3)$$

Where **γ** is oxygen saturation (**%**), and **p** is oxygen partial pressure (mmHg). Values of the **EMPIRICAL** constants **H** and ***n*** vary with $\mathbf{pCO_2}$ (hence pH) and temperature. Equation (3) can be transformed into Equation (4)

$$\log\left[\frac{\gamma}{(1-\gamma)}\right] = \log H + n\log p \quad (4)$$

**Making Of Artifical Blood at Lab Level**

Figure [1] is a simplified diagram showing the main flows of blood in the human body. The heart consists of four compartments, but for simplicity we can consider the heart as a combination of two blood pumps, the right heart and the left heart. The blood coming from various parts of the body is propelled by the right heart pump through the lung (pulmonary) artery to the lungs, where the blood absorbs oxygen from the air and desorbs carbon dioxide into the air. The oxygenated blood returns from the lungs through the pulmonary

vein to the left heart. This blood circulation through the lungs is called the 'lesser circulation'. The blood vessels which carry blood toward the various organs and tissues are known as arteries, whereas blood vessels carrying blood from the organs and tissues towards the heart are called veins.

Thus, plotting experimental values of the left-hand side of Equation 3a against those of log p gives the values of H and n that are functions of pH and temperature. Figure 14.2 [7] is the so-called ''oxyhemoglobin dissociation curve'' which correlates hemoglobin saturation y (%) with the oxygen partial pressure $pO_2$ (mmHg), as shown in Figure [6].

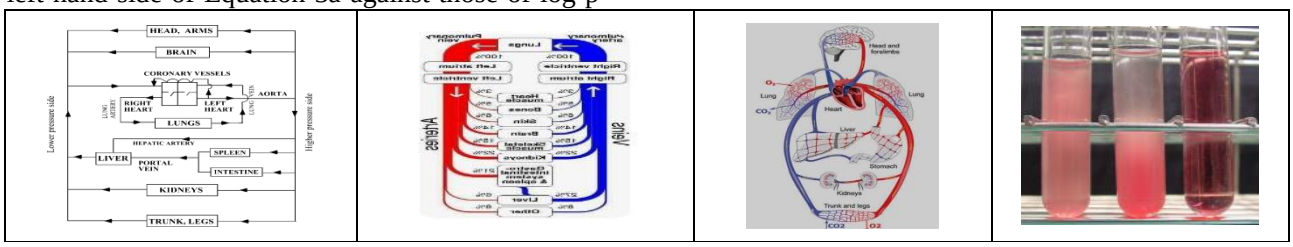


**Figure [7]:- Serum, Plasma Clotting factors of Human Blood**.

Table [1] lists the partial pressures (mmHg) of oxygen, carbon dioxide, water, and nitrogen in the inspired air, expired air, air in alveoli, arterial blood, blood in tissues, and venous blood.

| Gases | $O_2$ | $CO_2$ | $H_2O$ | $N_2$ |
|---|---|---|---|---|
| Inspired Air | 158 | 0.3 | 5.7 | 596 |
| Expired Gas | 116 | 32 | 47 | 565 |
| Alveolar Gas | 100 | 40 | 47 | 573 |
| Arterial Blood | 95 | 40 | 47 | 578 |
| Blood in Tissue | 40 | 46 | 47 | 627 |
| Venous Blood | 40 | 46 | 47 | 627 |

**Table [1]:- Partial pressures of gases in the body (mmHg).**

Haemoglobin is approximately 75% saturated at a $pO_2$ of 40 mmHg (venous blood) and approximately 97% saturated at a $pO_2$ of 90 mmHg (arterial blood). As shown in Figure [8] a lower pH (higher $pCO_2$) in tissues makes y smaller for a given $pO_2$, resulting in more oxygen transfer from blood to tissues (the Bohr Effect) [6], the oxyhaemoglobin dissociation curve.

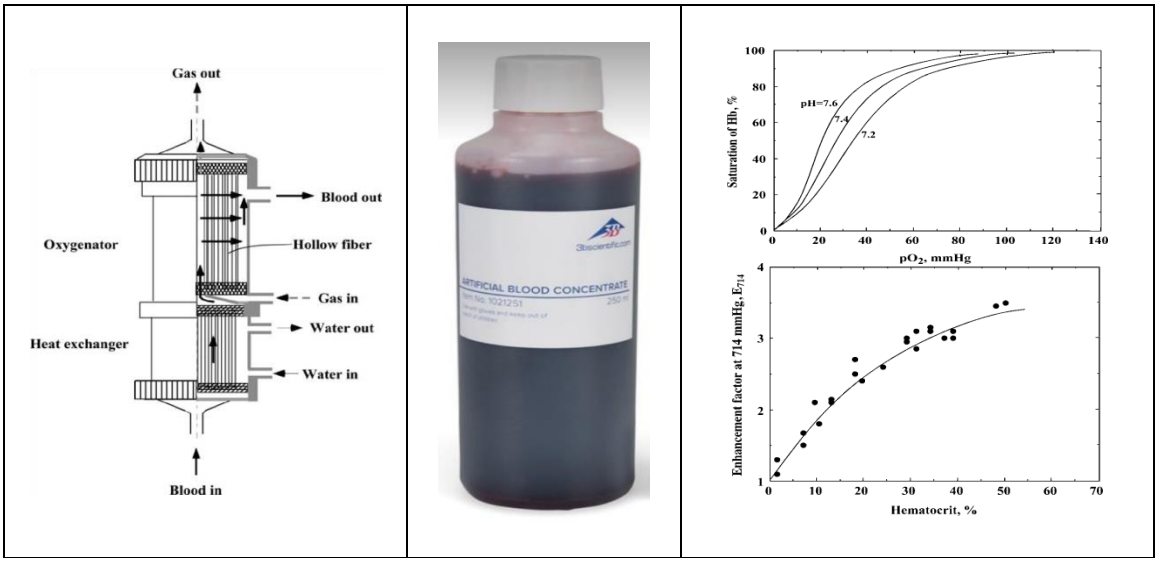


**Figure [8]:- Oxygenator at the oxy-haemoglobin dissociation & enhancement curve.**

**Carbon Dioxide in Blood** When the partial pressure of $CO_2$ is 40 mmHg, 100 ml of blood at 37ºC contains 50 $cm^3$ of $CO_2$, 44 $cm^3$ of which is bicarbonate ions $HCO_3^-$, 3$cm^3$ as physically dissolved $CO_2$, and the remainder as compounds with proteins such as haemoglobin.

The bicarbonate ion is produced by the following reversible reactions [7]:

$$CO_2 + H_2O \underset{[A]}{\overset{\leftrightarrow}{\longrightarrow}} H_2CO3 \underset{B}{\overset{\leftrightarrow}{\longrightarrow}} H+HCO_3 \qquad (5)$$

Reaction (B) is very rapid. Reaction (A) is slow but becomes very rapid in the presence of the enzyme carbonic anhydrase, which exists in the erythrocytes. Carbon dioxide produced by the gas exchange in tissues moves into erythrocytes, while bicarbonate ions produced by reactions (A) and (B) in the erythrocytes move out into the plasma. Carbonic acid, $H_2CO_3$, is a weak acid that

dissociates by the above reaction (B). In general, a solution of a weak acid HA which dissociates into $H^+$ and $A^-$ will serve as a buffer solution. Thus, respiration in the lungs contributes to physiological buffering actions [8]. The normal pH value of the extracellular fluids at 37ºC is about 7.4, while that of the intracellular fluids is about 7.2. This can be explained by the buffering action of carbonic acid. In general, when a weak acid HA dissociates into $H^-$ and $A^-$,

The relationship holds: $$\frac{[H^+][A^-]}{[HA]} = K \qquad (6)$$

Where K is the dissociation equilibrium constant.

$$\text{PH} = -\log [H^+] = \log \left[\frac{I}{K}\right] + log\, \frac{[A^-]}{[HA]} \qquad (7)$$

Most of the $CO_2$ which is physically absorbed by the blood becomes $H_2CO_3$ by the above mentioned reaction (A) in the presence of carbonic anhydrase. Hence$[H_2CO_3]$ is practically equal to $[CO_2]$, which should be proportional to the partial pressure of $CO_2$, that is $pCO_2$. That is $[CO_2]$ = sp $CO_2$, where the value of s at 37ºC is (0.0314mmol/l)/(p $CO_2$Hg). Hence,

$$\text{PH of Artificial Blood is} = 6.10 + \log \left\{\frac{[total\ CO_2 - \text{sp}CO_2]}{spCO_2}\right\} \qquad (8)$$

The membrane features a short peptide that dangles inside the cell and binds to a small molecule. In the lungs, where the pH is greater than 7.4, the molecule remains bound to the peptide, confined to the vesicle's inner wall. When the cell travels throughout the body and encounters oxygen-deprived tissue where the pH is less than 7.4, the peptide gains protons, breaking its bond with the small molecule. The molecule then binds haemoglobin, displacing and releasing oxygen.When the pH increases as the cell returns to the lungs, the peptide loses the protons and rebinds to the small molecule, allowing haemoglobin to take up oxygen again. This system mimics the red blood cell's acute regulation of haemoglobin's affinity for oxygen throughout the circulatory system using a complex network of trans-membrane enzymes and ion channels and HbCO purification procedure as dissipated in the Figure [9].

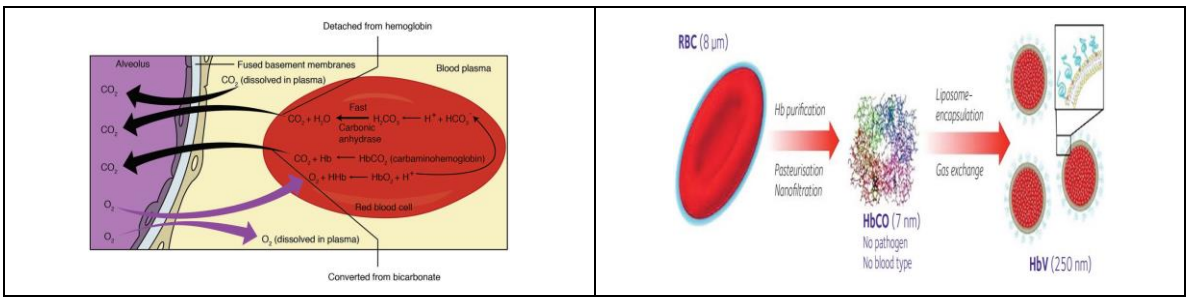


**Figure [9]:-Preparation of haemoglobin vesicles (HbV) from outdated NAT (nucleic-acid amplification testing)-inspected red blood cells (RBC) [8].**

WBCs recognise and remove foreign invaders, while platelets promote blood clotting. Together they maintain haemostasis and orchestrate our immune defences Plasma, though mostly water, also contains proteins (e.g. albumin, globulin, and fibrinogen) and other solutes (e.g. gases, ions, and hormones), one of the most important of which is albumin, which maintains colloid osmotic pressure and blood volume essential for haemodynamic stability. Centrifugation enabled the fractionation of blood into its constituent parts. Once RBCs, WBCs, platelets, and plasma were able to be sorted and stored, they could be used independently, giving rise to component transfusion the technology has developed further to fractionate albumin, globulins, and fibrinogen from plasma. The HbCO purification procedure as shown in Figure [9], includes pasteurization and nanofiltration for utmost safety from infection. Liposome encapsulation shields toxic effects of molecular haemoglobin (Hb).

**Conclusions & Summary:**

The easy availability of products and frequent purchases highlight the importance of screening both donor and recipient samples, serving as a significant catalyst for the growth of this segment. The increasing risk necessitates stringent screening to prevent the transmission of contaminated blood and blood products, thereby addressing the TTI challenge. The increased demand for blood transfusion diagnostics in emerging markets such as India and China are anticipated to drive market growth. Then it directed these stem cells to grow into red blood cells in the laboratory blood cells could be used in the treatment of disorders that affect red blood cells – such as sickle cell anaemia and thalassemia. Advances in lab-grown organs may provide an alternative for those waiting for transplants, and can be produced from a patient's own cells. Finally, the adult stem cells from the donor are used to create lab-grown blood; they are cultured for 18-21 days in a nutritional solution. This promotes cell growth and maturation with 1-2 teaspoons of nutritional solution for 24Liters.

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# Present Scenario of Mathematics Education in Meghalaya

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**Abstract:**
This study investigates factors influencing mathematics performance among Meghalaya Higher Secondary School students. It examines variables such as analytical problem-solving skills, study habits, adjustment patterns, mathematical intelligence, and dietary habits affecting learning. Previous research underscores the impact of student attitudes toward mathematics, shaped by classroom instruction, school support systems, and teachers' attitudes. Recommendations include altering teachers' perceptions of mathematics to enhance student performance. Addressing these factors is crucial for fostering educational equity and enabling socioeconomically disadvantaged communities to engage meaningfully in science and technology. Education officials, administrators, and mathematics teachers at the higher secondary level should consider these findings to improve teaching practices and student outcomes.

**KeyWords:** Mathematics achievement, Attitude, Study habit, socioeconomic status, Higher Secondary School.

**Brief History of Mathematics:**

Mathematics has been a cornerstone of human culture, evolving as a tool to understand and organize our world. Originating from our innate curiosity to explore and quantify natural phenomena, mathematics serves to decipher the mysteries of existence and explain relationships between diverse phenomena. As stated by Bhimsamkaram C V in 1979, it represents humanity's ongoing effort to refine concepts for comprehending the physical universe. Mathematical exercises play a crucial role in developing essential skills and knowledge needed to achieve these goals of understanding and quantifying our surroundings.

Counting forms the basis of mathematics, yet early counting alone did not constitute the mathematics we recognize today. Mathematics emerged when records of counting were preserved, establishing numerical representations. Symbolic systems and systematic rules became integral, laying the foundation for classical mathematics. This development facilitated systems for commerce and gave rise to "Euclidean Geometry," which idealizes three-dimensional space.

Mathematics evolved from Babylonian and Egyptian origins, inherited by the Greeks around 450 BC and further developed in Islamic civilizations like Iran, Syria, and India. This knowledge transitioned to the West through Latin translations, marking the rapid global expansion of mathematical discoveries and applications. Modern mathematics crystallized in the 1800s with a systematic synthesis of diverse mathematical knowledge. Its integration with social and behavioral sciences spurred new developments, especially post-World War II, heralding a golden age. Today, its pervasive applications in business, biology, medicine, economics, psychology, and politics have expanded its scope beyond traditional boundaries. The term "mathematical sciences" now encompasses both pure and applied mathematics, reflecting its broad interdisciplinary impact (Collier's Encyclopedia).

**An Overview of Indian Mathematics**

Indian mathematicians have historically made profound contributions, initially applying mathematical concepts in practical fields such as astronomy, astrology, architecture, and construction. Jain mathematicians used mathematics to solve celestial problems, while the Harappan civilization applied it in public works. The Shulba Sutras by Baudhayana demonstrated advanced mathematical techniques in constructing Vedic altars. By the sixth or fifth century BC, Indian scholars began studying mathematics for its intrinsic value and its wide-ranging applications across various domains of knowledge (V K Murthy, 2007).

Mathematics gained prominence as a distinct subject with Bhaskaracharya's "Leelavati" in the 12th century, though instructional methods remained largely unchanged post-1200. Despite ongoing political instability until the 18th century, India's indigenous education system endured until British colonization. Post-independence in 1947, school enrollment surged by 30-40%, aligning with constitutional mandates for free education up to age fourteen. Currently, approximately 80 million Indian schoolchildren are learning mathematics, with a

notable proportion—40-50%—being first-generation learners, lacking familial exposure to formal mathematics (J. N. Kapur, 1978).

**A Brief Overview of Mathematics Education**

Given the prominence of mathematics as a topic, mathematical education issues have taken on a significant deal of importance. The teaching and learning of mathematics was highly prioritized. Within mathematics, the field of mathematics education research exists. In its broadest sense, mathematics education is a scientific field that studies how people acquire mathematical knowledge and how their environment, social structures, and methods of instruction affect this process.

Mathematics education evolved significantly from the late 19th century onwards, driven by the need for well-prepared teachers and the establishment of teacher education programs. By the 20th century, it had become a distinct field of study, with the International Commission on Mathematical Instruction (ICMI) playing a pivotal role since its founding in 1893. The ICMI gained prominence in the 1960s, culminating in the inaugural International Congress on Mathematical Education (ICME) in 1969 and subsequent conferences every four years from 1972. These events have set standards for rigorous mathematical instruction in modern education, fostering both applied and theoretical advancements. In recent decades, mathematics education, along with science and technology education, has flourished with extensive research focused on improving teaching practices across all school levels.

Education in mathematics serves two primary goals: applied, which enhances instruction through practical applications, and pure, which seeks to deepen understanding of mathematical thinking, teaching, and learning (Schoenfeld, 2000). In India, significant efforts are being made in these areas. The International Commission on Mathematical Instruction (ICMI) awards recognize contributions to both research and the practice of mathematics education globally (Subramanium, 2005).

Mathematicians are increasingly focused on studying instructional issues and how students acquire mathematical knowledge. Concerns such as gender disparities, declining enrolment in advanced courses, and students' comprehension gaps have driven research into understanding mathematical thinking and improving educational strategies through empirical studies and surveys.

The intersection of mathematics education and psychology is crucial. Scholars like Schubring (1988) emphasize the connection between students' cognitive development and their grasp of mathematics. Educational psychology plays a pivotal role in researching effective mathematics learning strategies, given the subject's importance in school curricula.

Mathematics education draws from a diverse range of disciplines such as psychology, sociology, philosophy, and pedagogy to shape its foundational ideas and research findings. The landscape of learning mathematics has evolved alongside societal, technological, and educational shifts, influencing research directions. This expansive field encompasses topics like teaching and learning practices, societal perspectives on mathematics, the impact of attitudes towards math on academic success, and identifying areas where students face challenges. Recent advancements in research have broadened the applicability and underscored the growing importance of mathematics education.

The first significant study on mathematics achievement in India was conducted by Kulkarni (1970), covering 15 states and three educational levels (primary, middle, secondary) with samples of nearly 28,000 and 20,000 students at basic and secondary levels respectively. It found boys performed better than girls, socioeconomic status impacted learning environments, and no link between teacher qualifications and student achievement. Since then, Indian education has evolved, with a rise in mathematics education research focusing on curriculum, teaching methods, factors influencing achievement, and diagnostic exams (Miyan Md, 1983). Studies explore diverse impacts such as gender, IQ, personality, and cognitive levels on mathematics learning.

Mathematics education is pivotal for scientific and technological progress (Kapur, 1978). Research in this field aims to enhance classroom learning and teaching by studying successful educator traits, student mistakes, attitudes of stakeholders, and environmental influences. Collaboration among researchers, teacher trainers, curriculum designers, textbook authors, and policymakers is crucial to elevate mathematics education standards in schools.

This research provides a foundation for improving instructional quality and understanding the complexities of teaching and learning mathematics. It integrates theoretical insights to address challenges in mathematical comprehension, requiring a multidisciplinary approach encompassing psychology, mathematics history, and philosophy. Despite its interdisciplinary nature posing challenges for universities, many students and researchers find the field compelling due to its breadth and potential for discovery.

Research in mathematics education enhances instructional quality by identifying and explaining common systematic errors made by students. This research categorizes and analyzes these errors, contributing to a deeper understanding of learning processes. It also provides theoretical insights into cognition, mathematical thinking, and effective teaching methods. Ultimately, the goal is to equip stakeholders with the latest expert knowledge and

research findings to improve students' learning outcomes.

**Mathematics Education in Meghalaya**

Worldwide, mathematics is employed as a vital tool in numerous sectors, such as the social sciences, engineering, natural sciences, and medicine. "Mathematics is a creative or inventive process, deriving ideas and suggestions from real problems, idealizing and formulating relevant concept, posing questions, intuitively deriving a possible conclusion and then proving the hunch or intuitive arguments deductively," states Kline, M. (1967) in a debate on "Modern Mathematics."

Studying mathematics equips students with critical thinking, adaptability, problem-solving, and effective communication skills essential in today's information-driven world. Classroom experiences should cultivate mathematical understanding, essential skills, and a positive attitude towards math, benefiting students throughout their lives. Beyond proficiency, mathematics provides a framework for clear reasoning, supporting conclusions, and articulating ideas using mathematical language. It enhances comprehension, problem-solving, and technology proficiency applicable to daily life and careers. Mathematics serves as a versatile tool, enabling students to apply their knowledge across disciplines like physics, music, and language, bridging theoretical concepts with practical real-world applications.

In Meghalaya, the educational system spans 12 years (10+2+3), including seven years of elementary education and two years each of secondary and higher secondary schooling. Schools are affiliated with CBSE, ICSE, or the state board, teaching primarily in English. Science and mathematics are core subjects from middle school onwards. However, since 2012, the Meghalaya Board of School Education revised SSLC passing requirements, allowing students to pass with any five of six subjects, potentially excluding science or math. This change has led to a casual approach to these crucial subjects among students, affecting their commitment to excellence and overall learning outcomes in mathematics. Factors contributing to declining math proficiency include students' fear of the subject during higher secondary education and a curriculum gap between secondary and higher secondary levels.

**Causes of Failure and Under-Performance of Students in Mathematics**

From the review of literature, it is observed that there are many factors that causes for low performance of students in mathematics which can be categorized as follows:

a) Socio-economic status
b) Students' attitude towards the subject
c) Study habits of students
d) Syllabus & Text books content
e) Examination System
f) Impact of optional system adopted by the State Education Board

Although these factors are tremendous on a broader sense, this analysis is concerned only with the impact of these effects on the scenario of mathematics education in the state.

**Observations and Discussions**

**a) Socio-Economic Status:** "Socioeconomic status" (SES) refers to a person's position in a hierarchical social structure, combining social and economic factors like parental education, employment, and income. Research consistently shows SES significantly impacts children's academic achievement, particularly in subjects like mathematics. Das, Chandra, and Sinha (2017) found a strong correlation between parental income and students' math proficiency in Guwahati secondary schools. Similarly, Udayakumar et al. (2022) highlighted how mothers' occupations and education levels influence academic performance among higher secondary students. T. Lamare (2020) noted a diverse range of socioeconomic backgrounds among students interested in science and mathematics in Meghalaya. Despite these findings, definitive conclusions on SES's direct impact on mathematics achievement remain elusive. Understanding familial SES is crucial for assessing children's academic progress, underscoring its multifaceted role in educational outcomes.

**b) Students' Attitude towards the Subject:** Attitude towards mathematics reflects one's general predisposition to the subject, influenced by societal perceptions and educational experiences. Research by Dutt (1978) highlights how attitudes underlie significant behavioral aspects. Nongsiej & Syiem (2014) found male students tend to have higher attitude scores than females, possibly due to gender stereotypes in mathematics. Tribal students, compared to non-tribal peers, often exhibit lower attitudes, attributed to parental education levels and teacher competence (Rai, 1981; Ngailiankim, 1987). Lamar (2014) noted a generally positive attitude among both genders towards mathematics, possibly due to its perceived importance in modern life. Gidon (2018) and Bordoloi (2020) highlighted students' struggles with mathematics due to perceived difficulty and lack of teaching clarity. Overall, while attitude does not strongly correlate with mathematical achievement, societal perceptions and educational environments significantly influence students' attitudes towards the subject.

**c) Study Habits of Students:** Study habits, systematic approaches to learning, profoundly influence academic success and personal

development. Maddox (1963) emphasizes their importance alongside aptitude and diligence. Srivastava (1967) underscores that positive study habits and attitudes are crucial for academic performance. Lamar (2014) explores how study habits in mathematics differ among higher secondary students, noting distinctions between genders and tribal versus non-tribal backgrounds. Singh et al. (2019) found no significant differences in study habits across various school types in Meghalaya, yet observed marked variations in math achievement. Effective study habits encompass reasoning, focus, and punctuality, shaping students' academic trajectories regardless of their demographic backgrounds.

**d) Syllabus and Text Book Contents:** The National Policy on Education (NPE) of 1986 emphasized a unified core curriculum, managed by NCERT, leading to subsequent frameworks like NCF-88, NCFSE 2000, and NCF 2005. These frameworks aimed to structure school education with defined objectives, learning outcomes, and relevance to real-life applications. However, C. R. Kharlukhi (2023) criticized the Higher Secondary MBOSE Syllabus for lacking clear objectives and effective teaching strategies, especially in mathematics and science. The syllabus's shortcomings hinder student preparation for competitive exams like JEE. B. Tron (2018) also noted deficiencies in teaching and assessment strategies within the MBOSE curriculum, particularly in integrating historical contexts and aligning with NCF 2005's requirements for process skills and historical validity in science education. These issues underscore the challenges faced in implementing an effective curriculum that meets national educational standards and prepares students adequately for higher education and practical life applications.

**e) Examination System:** Examinations play a vital role in the education process, providing clear standards and goals for students and teachers alike. J. C. Mathur emphasized their importance, noting their role even in idealized societies like H. G. Wells' Utopia. The Secondary Education Commission supports external exams for their objective evaluation and motivational impact. They set targets and deadlines, fostering consistent effort and clear methodology. However, C. R. Kharlukhi (2023) critiqued the MBOSE Higher Secondary Science syllabus for inadequate question paper design, contrasting it unfavorably with CBSE standards. Specifically, the MBOSE papers were criticized for lacking emphasis on higher-order thinking skills. Nongkhlaw (2013) similarly found shortcomings in Meghalaya's higher secondary exams, indicating areas needing improvement in question design and assessment practices. These observations highlight the importance of robust examination frameworks that effectively measure and promote comprehensive learning outcomes.

**f) Impact of optional system adopted by the State Education Board:** Mathematics and science education are essential for fostering creativity, problem-solving skills, and critical thinking among youth, preparing them to address societal challenges and pursue fulfilling careers. However, in Meghalaya, the decision by the Meghalaya Board of School Education (MBOSE) to treat these subjects as electives in the Secondary School Leaving Certificate (SSLC) Exam has raised concerns. B. Tron (2022) criticizes this approach, noting that it prioritizes exam pass rates over educational rigor and student competitiveness. By relegating science and mathematics to elective status, fewer students are encouraged to pursue these fields at higher academic levels, potentially impacting future recruitment in crucial professions like medicine, engineering, and technology. This shift could hinder societal progress by limiting the number of qualified professionals in areas essential for advancement. The current policy may need reconsideration to ensure that mathematics and science education remains integral and compulsory components of secondary school curricula, fostering a generation well-equipped to meet future challenges and contribute meaningfully to society's development.

**Conclusions:**

Several studies have explored the complex interplay between various factors impacting students' performance in mathematics. Socioeconomic factors, including parents' income, show a strong correlation with math proficiency. While many students exhibit positive attitudes toward mathematics, this sentiment doesn't always translate into high academic achievement, suggesting the influence of other variables. Study habits significantly affect students' math performance in Higher Secondary education. Critiques of the syllabus and textbooks highlight deficiencies in objectives, learning outcomes, and content rationale, particularly in preparing students for competitive exams and fostering problem-solving skills. Textbooks also lack coverage of historical developments and critical thinking training. The examination system, criticized for its focus on rote learning and neglect of higher-order thinking skills, fails to adequately assess students' comprehensive understanding. Moreover, treating science and mathematics as optional subjects at the

Secondary School Leaving Certificate level discourages students from pursuing these disciplines at higher academic levels. This policy may impact future admissions into science programs and hinder the development of professionals crucial for societal advancement.

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# A Comparative Study of the Financial Performance of Selected Pharmaceutical Companies in India

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**Abstract:**
Indian pharma industry ranks 3rd globally in pharmaceutical production by volume. This research paper is conducted for a comparative study of the financial performance of pharmaceutical companies in India. For this study researcher selected five companies from BSE by using convincing sampling. The study is conducted from the financial year 2019-20 to 2023-24.to measure the financial performance of selected pharmaceutical companies ratio analysis, descriptive statistics, and One-way ANOVA were used for the study. The study concluded that all selected pharmaceutical companies have improved their financial performance. To better perform all companies need to focus on investment management and cash management.

**Keywords:** Pharmaceutical companies, Liquidity ratio, Profitability ratio.

**Introduction:**

The term financial performance includes profitability, liquidity, and efficiency performance. Financial performance is useful to indicate a company's performance as well as its financial situation. The present study aims to analyze the financial performance analysis of selected pharmaceutical companies. If the ratio meets the ideal ratio that means maintaining the company's financial situation. Due to COVID-19, it is very important to know the financial situation of pharmaceutical companies, and how they work in this situation. Hence, the researcher selected the pharmaceutical sector for this study.

**Overview of the pharmaceutical industry:**

The Indian pharma industry ranks 3rd globally in pharmaceutical production by volume. The pharmaceutical industry in India is expected to reach $65 BN by 2024 and $130 BN by 2030. The pharmaceutical industry in India is currently valued at $50 BN. India is a major exporter of pharmaceuticals with over 200+ countries served by Indian pharma exports. According to the annual report 2021, the Indian pharma sector has contributed 1.72% of the country's GDP.

**Literature review:**

This research attempted on oil companies and for analysis ratios and ANOVA were used. Result of this research paper shows that all selected companies need more focus to better financial performance **(Trivedi , 2020)**, This Research Paper attempted on two pharmaceutical companies. To analyze the result ratios were used and conclude that selected companies need more focus on companies' financial performance. **(Dr. T. Priyadharshini & Ms. K. Rajeshwari , 2021),** according to this research paper researcher selected two pharma company.to data analysis ratios and t-test were used and conclude that both company struggle in financial performance. **(Deuskar , 2022)**

**Research Gap:**

Based on past literature reviews research gap finalized that those companies selected for this study, which have high dividend yields based on the high market capitalization.

**3. Research Methodology:**

The Research Design used in this study is descriptive and conclusive.

**Objectives of the Study:**

1. To examine the current ratio of selected Pharmaceutical Companies.
2. To examine the liquidity ratio of selected Pharmaceutical Companies.
3. To examine the financial performance of selected Pharmaceutical Companies.

**Period of the Study:** The present study will be undertaken for a period of 5(five) accounting years starting from 2019-20 to 2023-24.

**Data Collection:**

The researcher used secondary data for this study from the annual reports of selected companies, related websites of selected pharmaceutical companies,

**Sample Selection:**

The researcher studied selected pharmaceutical companies. The sample was selected

considering the following criteria: The selected company should be working in India; the selected companies should be listed on BSE. The selected companies should have a high dividend yield based on the high market capitalization.

The list of selected pharmaceutical companies is as follows: GlaxoSmithKline Pharmaceuticals Ltd**,** Ajanta Pharma Ltd, Glenmark Life Sciences Ltd**,** Alembic Ltd and Jagsonpal Pharmaceuticals Ltd.

**Tools and Technique of Data Analysis:**

For the analysis of data, there were used various ratios and their mean.to test the hypotheses one way ANOVA was used. The ratios are as follows: Dividend per Share (DPS) ratio, Gross Profit Margin, Net Profit Margin Ratio, Return on Capital Employed, Current ratio and Quick ratio.

**Hypotheses Formulation:**

$H_{01}$: The Dividend per Share ratio does not differ significantly among different pharmaceutical companies.

$H_{02}$: The Gross Profit Margin ratio does not differ significantly among different pharmaceutical companies.

$H_{03}$: The Net Profit Margin ratio does not differ significantly among different pharmaceutical companies.

$H_{04}$: The Return on Capital Employed ratio does not differ significantly among different pharmaceutical companies.

$H_{05}$: The Current ratio does not differ significantly among different pharmaceutical companies.

$H_{06}$: The Quick ratio does not differ significantly among different pharmaceutical companies.

**Data Analysis and Discussion:**

After concluding steps of the data collection statistical analysis of the data has been done by using mean and one way ANOVA has been used to test hypotheses.

**1. Dividend per Share (in Rs. Cr.)**

**Table 1.1: Dividend per Share for Selected Pharma Companies**

| Year | GlaxoSmithKline Pharmaceuticals | Ajanta Pharma Ltd | Glenmark Life Sciences Ltd | Alembic Ltd | Jagsonpal Pharmaceuticals Ltd |
|---|---|---|---|---|---|
| 2019-2020 | 40 | 9.5 | 2.5 | 0.6 | 0.5 |
| 2020-2021 | 30 | 13 | 2.5 | 0.2 | 1 |
| 2021-2022 | 90 | 9.5 | 2.5 | 1.8 | 4 |
| 2022-2023 | 32 | 7 | 2.5 | 2.2 | 5 |
| 2023-2024 | 32 | 51 | 2.5 | 2.4 | 5 |
| Minimum | 30 | 7 | 2.5 | 0.2 | 0.5 |
| Maximum | 90 | 51 | 2.5 | 2.4 | 5 |
| Mean | 44.8 | 18 | 2.5 | 1.44 | 3.1 |
| S.D. | 25.56 | 18.57 | 0 | 0.98 | 2.19 |

Table 1.1 shows that GlaxoSmithKline Pharmaceuticals had the highest dividend per share on an average basis. The table also shows that GlaxoSmithKline Pharmaceuticals had the highest variation in this dividend per share during the study period. It also shows that on behalf of dividend per share, Glenmark Life Sciences Ltd has no change and the rest of the selected pharma have an upward trend. It is also observed from the table that there is the lowest dividend per share was 0.2 for Alembic Ltd. and the highest dividend was 90 for GlaxoSmithKline Pharmaceuticals in 2022-23.

**2. Gross Profit Margin (%)**

**Table 2.1: Gross Profit Margin for Selected Pharma Companies**

| Year | GlaxoSmithKline Pharmaceuticals | Ajanta Pharma Ltd | Glenmark Life Sciences Ltd | Alembic Ltd | Jagsonpal Pharmaceuticals Ltd |
|---|---|---|---|---|---|
| 2019-2020 | 17.85 | 29.62 | 17.36 | 0.66 | 4.66 |
| 2020-2021 | 17.77 | 20.1 | 22.98 | 9.42 | 9.87 |
| 2021-2022 | 21.37 | 24.51 | 18.77 | 11.07 | 10.73 |
| 2022-2023 | 22.81 | 16.77 | 15.67 | 25.69 | 13.91 |
| 2023-2024 | 24.38 | 24.86 | 13.17 | 32.04 | 10.25 |
| Minimum | 17.77 | 16.77 | 13.17 | 0.66 | 4.66 |
| Maximum | 24.38 | 29.62 | 22.98 | 32.04 | 13.91 |
| Mean | 20.836 | 23.172 | 17.59 | 15.776 | 9.884 |
| S.D. | 2.96 | 4.92 | 3.66 | 12.79 | 3.33 |

Table 2.1 shows that Ajanta Pharma Ltd had the highest gross profit margin on an average basis. The table also shows that Alembic Ltd had the highest variation in this gross profit margin during the study period. It also shows that on behalf of the gross profit margin, Alembic Ltd has continuously increased during the study period. It is also observed from the table that there is the lowest gross profit margin was 0.66% for Alembic Ltd. and the highest gross profit margin was 90% for Alembic Ltd. in 2023-24.

**3. Net Profit Margin Ratio (%)**

**Table 3.1: Net Profit Margin Ratio for Selected Pharma Companies**

| Year | GlaxoSmithKline Pharmaceuticals | Ajanta Pharma Ltd | Glenmark Life Sciences Ltd | Alembic Ltd | Jagsonpal Pharmaceuticals Ltd |
|---|---|---|---|---|---|
| 2019-2020 | 3.41 | 24.85 | 20.17 | 126.95 | 4.96 |
| 2020-2021 | 12.24 | 20.08 | 21.79 | 18.48 | 9.07 |
| 2021-2022 | 52.54 | 22.92 | 24.53 | 112.82 | 8.66 |
| 2022-2023 | 18.89 | 16.37 | 14.7 | 64.36 | 11.28 |
| 2023-2024 | 17.16 | 20.32 | 65.48 | 61.01 | 10.76 |
| Minimum | 3.41 | 16.37 | 14.7 | 18.48 | 4.96 |
| Maximum | 52.54 | 24.85 | 65.48 | 126.95 | 11.28 |
| Mean | 20.848 | 20.908 | 29.334 | 76.724 | 8.946 |
| S.D. | 18.71 | 3.21 | 20.52 | 43.64 | 2.49 |

Table 3.1 shows that Alembic Ltd had the highest Net Profit Margin Ratio on an average basis. The table also shows that Alembic Ltd had the highest variation in this Net Profit Margin Ratio during the study period. It also shows that on behalf of the Net Profit Margin Ratio, there was an up-down trend in all selected pharmaceutical companies during the study period. . It is also observed from the table that there is the lowest Net Profit Margin Ratio was 3.41% for GlaxoSmithKline Pharmaceuticals and the highest Net Profit Margin Ratio was 126.95% for Alembic Ltd. in 2019-20.

**4. Return on Capital Employed Ratio (%)**

**Table 4.1: Return on Capital Employed Ratio for Selected Pharma Companies**

| Year | GlaxoSmithKline Pharmaceuticals | Ajanta Pharma Ltd | Glenmark Life Sciences Ltd | Alembic Ltd | Jagsonpal Pharmaceuticals Ltd |
|---|---|---|---|---|---|
| 2019-2020 | 35.5 | 31.5 | 10.55 | 19.44 | 9.2 |
| 2020-2021 | 42.03 | 25.42 | 11.58 | 2.02 | 18.99 |
| 2021-2022 | 28.52 | 28.7 | 10.5 | 9.61 | 22.43 |
| 2022-2023 | 47.64 | 21.71 | 10.81 | 11.55 | 24.34 |
| 2023-2024 | 53.49 | 32.33 | 9.34 | 12.64 | 16.37 |
| Minimum | 28.52 | 21.71 | 9.34 | 2.02 | 9.2 |
| Maximum | 53.49 | 32.33 | 11.58 | 19.44 | 24.34 |
| Mean | 41.436 | 27.932 | 10.556 | 11.052 | 18.266 |
| S.D. | 9.83 | 4.41 | 0.81 | 6.26 | 5.93 |

Table 4.1 shows that GlaxoSmithKline Pharmaceuticals had the highest Return on Capital Employed Ratio on an average basis. The table also shows that GlaxoSmithKline Pharmaceuticals had the highest variation in this Return on Capital Employed Ratio during the study period. it also shows that on behalf of the Return on Capital Employed Ratio, there was an up-down trend in all selected pharmaceutical companies during the study period. . It is also observed from the table that there is the lowest Return on Capital Employed Ratio was 2.02% for Alembic Ltd and the highest Return on Capital Employed Ratio was 53.49% for GlaxoSmithKline Pharmaceuticals.

**5. Current Ratio (%)**

**Table 5: Current Ratio for Selected Pharma Companies**

| Year | GlaxoSmithKline Pharmaceuticals | Ajanta Pharma Ltd | Glenmark Life Sciences Ltd | Alembic Ltd | Jagsonpal Pharmaceuticals Ltd |
|---|---|---|---|---|---|
| 2019-2020 | 1.73 | 2.7 | 4.09 | 2.13 | 2.69 |
| 2020-2021 | 1.67 | 2.35 | 3.67 | 0.8 | 2.51 |
| 2021-2022 | 1.99 | 3.22 | 2.66 | 0.95 | 2.69 |
| 2022-2023 | 1.55 | 1.94 | 2.71 | 1.07 | 4.7 |
| 2023-2024 | 1.35 | 2.65 | 2.45 | 1.28 | 7 |
| Minimum | 1.35 | 1.94 | 2.45 | 0.8 | 2.51 |
| Maximum | 1.99 | 3.22 | 4.09 | 2.13 | 7 |
| Mean | 1.658 | 2.572 | 3.116 | 1.246 | 3.918 |
| S.D. | 0.24 | 0.47 | 0.72 | 0.52 | 1.94 |

Table 5.1 shows that Jagsonpal Pharmaceuticals Ltd had the highest Current Ratio on an average basis. The table also shows that Jagsonpal Pharmaceuticals Ltd had the highest variation in the Current Ratio during the study period. It also shows that on behalf of the Current Ratio, there was an up-down trend in all selected pharmaceutical companies during the study period. it is also observed from the table that there is the lowest Current Ratio was 0.8% for Alembic Ltd and the highest Current Ratio was 7 % for Jagsonpal Pharmaceuticals Ltd.

**6. Quick Ratio (%)**

**Table 6: Quick Ratio for Selected Pharma Companies**

| Year | GlaxoSmithKline Pharmaceuticals | Ajanta Pharma Ltd | Glenmark Life Sciences Ltd | Alembic Ltd | Jagsonpal Pharmaceuticals Ltd |
|---|---|---|---|---|---|
| 2019-2020 | 1.27 | 1.72 | 5.01 | 1.44 | 2.56 |
| 2020-2021 | 1.28 | 1.61 | 4.65 | 0.31 | 2.63 |
| 2021-2022 | 1.67 | 2.18 | 4.24 | 0.29 | 1.89 |
| 2022-2023 | 1.18 | 1.3 | 2.9 | 0.32 | 4.13 |
| 2023-2024 | 0.97 | 1.81 | 2.95 | 0.59 | 6.45 |
| Minimum | 0.97 | 1.3 | 2.9 | 0.29 | 1.89 |
| Maximum | 1.67 | 2.18 | 5.01 | 1.44 | 6.45 |
| Mean | 1.274 | 1.724 | 3.95 | 0.59 | 3.532 |
| S.D. | 0.25 | 0.32 | 0.97 | 0.49 | 1.83 |

Table 6.1 shows that Glenmark Life Sciences Ltd had the highest Quick Ratio on an average basis. The table also shows that Jagsonpal Pharmaceuticals Ltd had the highest variation in Quick Ratio during the study period. It also shows that on behalf of the Quick Ratio, there was an up-down trend in all selected pharmaceutical companies during the study period. . It is also observed from the table that there is the lowest Quick Ratio was 0.29% for Alembic Ltd and the highest Quick Ratio was 6.45 % for Jagsonpal Pharmaceuticals Ltd.

❖ **Result of ANOVA**

| Ratio | F | P-Value | $H_0$ | Remark |
|---|---|---|---|---|
| Dividend per Share | 8.551191 | 0.000342 | Rejected | Significant Difference |
| Gross Profit Margin | 2.950184 | 0.045606 | Rejected | Significant Difference |
| Net Profit Margin Ratio | 6.463704 | 0.001654 | Rejected | Significant Difference |
| Return on Capital Employed Ratio | 22.17823 | 4.07E-07 | Rejected | Significant Difference |
| Current Ratio | 6.028737 | 0.002372 | Rejected | Significant Difference |
| Quick Ratio | 11.34489 | 5.7E-05 | Rejected | Significant Difference |

The result of ANOVA shows that there is F-value is more than the P-value, the null hypotheses are rejected and there was a significant difference between selected pharmaceutical companies.

**5. Major findings of the study:**

1. The highest dividend paid by GlaxoSmithKline Pharmaceuticals during the study period. There is a stable dividend pay-out ratio in Glenmark Life Sciences Ltd during the study period. The highest dividend paid by GlaxoSmithKline Pharmaceuticals in 2021-22.
2. Ajanta Pharma Ltd has the highest Gross Profit Margin during the study period. Alembic Ltd has the lowest Gross Profit Margin during the study period.
3. Alembic Ltd has the highest Net Profit Margin based on Mean. Jagsonpal Pharmaceuticals Ltd has less Net Profit Margin compared to the ideal ratio and other selected pharmaceutical companies have more Net Profit Margin compared to the ideal ratio during the study period.
4. Glenmark Life Sciences Ltd and Alembic Ltd have the lowest Return on Capital Employed compared to the ideal ratio during the study period. GlaxoSmithKline Pharmaceuticals was in good condition during the study period.
5. GlaxoSmithKline Pharmaceuticals and Jagsonpal Pharmaceuticals Ltd have more Current ratios compared to other pharmaceutical companies and ideal ratios during the study period.
6. Glenmark Life Sciences Ltd has the highest Quick ratio based on average. Alembic Ltd has a lower Quick ratio compared to other pharmaceutical companies.
7. The result of ANOVA shows that there is F-value is more than the P-value so the null hypotheses were rejected and there were significant differences between selected pharmaceutical companies.

**Conclusion and Suggestions:**

GlaxoSmithKline Pharmaceuticals is the highest dividend-paying company during the study period. Ajanta Pharma Ltd is in good condition compared to the rest of the selected pharma for Gross Profit Margin. Alembic Ltd needs more focus on its Gross Profit Margin. Except Jagsonpal Pharmaceuticals Ltd rest of the selected pharmaceutical companies in a good NPM compared to the Ideal ratio during the study period. Glenmark Life Sciences Ltd is in very good condition as per Return on Capital Employed during the study period. GlaxoSmithKline Pharmaceuticals and Jagsonpal Pharmaceuticals Ltd have more Current Ratio compared to the Ideal Current ratio so they need beneficial investment and more focus on investment management. Alembic Ltd has a less-than-ideal ratio and the rest of the pharma has a more-than-ideal ratio so all companies need Cash management.

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# Optical study of modified polyvinyl alcohol conjugates and doped modified polyvinyl alcohol

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**Abstract:**
This study investigates the optical properties of modified polyvinyl alcohol (PVA) conjugates and doped modified PVA. Through various analytical techniques, we explore the structural, thermal, and optical behaviours of these materials. The research aims to understand how modifications and doping influence PVA's optical characteristics, potentially leading to enhanced applications in optics and photonics. Findings suggest significant changes in the optical absorption, emission spectra, and refractive index, pointing to promising applications in various technological fields.

**Keywords:** Polyvinyl Alcohol (PVA), Optical Properties, Doping, Conjugates, Photonics, Absorption Spectra, Emission Spectra, Refractive Index

## Introduction:

Polyvinyl alcohol (PVA) is a synthetic polymer known for its film-forming, emulsifying, and adhesive properties. Its versatility has led to widespread use in various industrial and technological applications. Recent advancements in materials science have focused on modifying PVA to enhance its optical properties, making it suitable for applications in optics and photonics. This study aims to delve into the optical characteristics of modified PVA conjugates and doped modified PVA, exploring how these modifications impact their performance in potential applications. Polyvinyl alcohol (PVA) is a remarkable synthetic polymer with a plethora of applications across various industries due to its unique properties such as high tensile strength, excellent film-forming ability, chemical resistance, and biodegradability. Originating in the early 20th century, PVA quickly found its place in adhesives, textiles, paper manufacturing, and pharmaceuticals. However, its utility extends beyond these traditional roles into more advanced and high-tech applications, particularly when its properties are modified and enhanced.

The intrinsic optical properties of PVA, such as its transparency and refractive index, make it a candidate for use in optical and photonic applications. However, to fully leverage PVA in these advanced fields, its optical characteristics often need to be finely tuned. This tuning is typically achieved through chemical modifications and doping with various elements or compounds. These modifications can significantly alter the material's absorption spectra, emission characteristics, and overall interaction with light, making it more suitable for specific technological applications.

### Significance of PVA Modifications

Modifying PVA involves introducing various functional groups or creating conjugates with other molecules. These modifications can enhance the polymer's properties, such as increasing its thermal stability, mechanical strength, or biocompatibility. In the context of optical properties, modifications can lead to changes in the polymer's electronic structure, which in turn affects how it interacts with light. For example, introducing chromophores or other light-absorbing groups into PVA can result in materials with tailored absorption and emission properties, useful for applications in sensors, displays, and other optoelectronic devices.

### Doping of PVA

Doping, on the other hand, involves incorporating small amounts of foreign elements or compounds into the PVA matrix. This process can introduce new electronic states within the polymer, thereby altering its optical and electronic properties. Common dopants include metals, metal oxides, and various organic compounds. The choice of dopant and its concentration are crucial parameters that determine the final properties of the doped PVA. For instance, doping with certain metal ions can enhance the polymer's conductivity and optical transparency, making it suitable for applications in flexible electronics and transparent conductive films.

### Applications in Optics and Photonics

The modified and doped PVA materials have shown great promise in the field of optics and

photonics. Their ability to exhibit tailored optical properties makes them suitable for use in light-emitting devices, photovoltaic cells, optical sensors, and waveguides. For example, PVA doped with rare-earth elements can be used in lasers and optical amplifiers due to their sharp emission lines and long fluorescence lifetimes. Similarly, PVA modified with organic dyes can be used in photodetectors and solar cells, where specific absorption characteristics are crucial.

**Research Objectives**

This study aims to provide a comprehensive analysis of the optical properties of modified PVA conjugates and doped modified PVA. The research focuses on understanding how different modifications and dopants influence the optical behavior of PVA. By employing various analytical techniques such as UV-Vis spectroscopy, fluorescence spectroscopy, and refractometry, the study seeks to characterize the changes in absorption, emission, and refractive index of these materials. Additionally, the structural and thermal properties of the modified PVAs will be examined using X-ray diffraction (XRD) and differential scanning calorimetry (DSC), providing a holistic understanding of how these modifications affect the polymer at both the molecular and macroscopic levels.

**Importance of Study**

Understanding the optical properties of modified and doped PVA is critical for advancing its application in modern technology. The insights gained from this research can lead to the development of new materials with optimized performance for specific applications, thereby broadening the scope of PVA in high-tech industries. Furthermore, the study can provide valuable guidelines for future research in polymer modification, contributing to the broader field of materials science. The optical study of modified PVA conjugates and doped modified PVA represents a significant step toward enhancing the functional properties of this versatile polymer. By exploring how various modifications impact the optical characteristics of PVA, this research aims to unlock new applications in optics and photonics, paving the way for innovative technological solutions. The findings of this study are expected to have far-reaching implications, driving further advancements in the design and application of advanced polymeric materials.

**Definitions:**

- **Polyvinyl Alcohol (PVA)**: A synthetic polymer with a repeating vinyl alcohol unit, known for its high tensile strength and flexibility.
- **Conjugate**: A compound formed by the combination of two or more molecules.
- **Doping**: The intentional introduction of impurities into a material to change its properties.
- **Optical Properties**: Characteristics of a material related to the interaction with light, including absorption, reflection, and refraction.

**Need:**

The modification and doping of PVA are essential to enhance its optical properties for advanced technological applications. Understanding these enhancements can lead to the development of new materials with superior performance in fields such as optoelectronics, photonics, and sensors.

**Aims**

The primary aim of this study is to investigate the optical properties of modified PVA conjugates and doped modified PVA, understanding how these modifications influence their structural and optical behaviors.

**Objectives**

1. To synthesize and characterize modified PVA conjugates and doped modified PVA.
2. To analyze the optical absorption and emission spectra of the modified materials.
3. To evaluate the changes in refractive index due to modifications and doping.
4. To explore potential applications of these materials in optics and photonics.

**Scope:**

This study covers the synthesis, characterization, and analysis of modified PVA conjugates and doped modified PVA. It focuses on their optical properties and explores potential applications in technological fields.

**Research Methodology**

1. **Synthesis**: Modified PVA conjugates and doped PVA will be synthesized using established chemical methods.
2. **Characterization**: Structural and thermal properties will be characterized using techniques such as X-ray diffraction (XRD) and differential scanning calorimetry (DSC).
3. **Optical Analysis**: Optical properties will be studied using UV-Vis spectroscopy, fluorescence spectroscopy, and refractometry.
4. **Data Analysis**: The data will be analyzed to understand the impact of modifications and doping on the optical properties.

**History:**

Polyvinyl alcohol (PVA) was first developed in the early 20th century and has since become a crucial material in various industries due to its unique properties. Modifications of PVA to enhance its characteristics began in the mid-20th century, with significant advancements in the last few decades focusing on its optical properties. Research into doping PVA has opened new avenues for its application in advanced technological fields, leading to the current interest in exploring its optical

behavior in more detail. **History of Optical Study of Modified Polyvinyl Alcohol Conjugates and Doped Modified Polyvinyl Alcohol**

Polyvinyl alcohol (PVA) has a rich history dating back to its initial synthesis in 1924 by Hermann Staudinger and his colleagues. As one of the earliest synthetic polymers to be produced, PVA quickly garnered attention for its remarkable properties, including water solubility, biodegradability, film-forming ability, and high tensile strength. These characteristics have led to its widespread use in industries ranging from textiles and paper to pharmaceuticals and adhesives.

**Early Developments and Initial Applications**

In the early years, PVA was primarily used in applications that leveraged its film-forming and adhesive properties. Its ability to form strong, flexible films made it ideal for use in textile sizing, where it served to protect yarns during weaving processes. Additionally, its adhesive properties found use in paper coatings and packaging materials. However, the optical properties of PVA were not a significant focus during these initial stages of its commercial exploitation.

**Emergence of Optical Applications**

The mid-20th century saw a growing interest in the optical properties of polymers, driven by the development of new technologies and the increasing demand for materials with specific optical characteristics. Researchers began to explore how synthetic polymers like PVA could be modified to enhance their optical properties. This period marked the beginning of significant research into the modification and doping of PVA to create materials suitable for optical and photonic applications.

**Modification of PVA**

Modifying PVA involves the introduction of functional groups or the creation of conjugates with other molecules to enhance its properties. In the 1960s and 1970s, research efforts focused on chemical modifications that could improve the thermal stability and mechanical strength of PVA. These studies laid the groundwork for later investigations into how such modifications could also affect the polymer's optical properties.

One of the key breakthroughs in this area was the introduction of chromophores into the PVA matrix. Chromophores are molecules that absorb light at specific wavelengths, and their incorporation into PVA opened up new possibilities for tuning the polymer's optical absorption and emission characteristics. This development was crucial for the creation of PVA-based materials with tailored optical properties, suitable for applications in optoelectronics and photonics.

**Doping of PVA**

The concept of doping, widely used in semiconductor physics, was adapted to polymers like PVA to further enhance their properties. In the 1980s and 1990s, researchers began to systematically investigate the effects of various dopants on PVA. Metal ions, metal oxides, and organic compounds were introduced into the PVA matrix to study their impact on the polymer's electrical and optical properties.

Doping PVA with metal ions, such as silver or copper, was found to significantly alter its optical properties. These dopants could create new electronic states within the polymer, changing its absorption spectra and refractive index. This opened up new avenues for the use of doped PVA in applications such as sensors, flexible electronics, and optical coatings.

**Advances in Analytical Techniques**

The advancements in analytical techniques played a crucial role in the study of modified and doped PVA. The development of sophisticated tools like UV-Vis spectroscopy, fluorescence spectroscopy, and X-ray diffraction (XRD) enabled researchers to gain deeper insights into the structural and optical properties of these materials. Differential scanning calorimetry (DSC) provided valuable information on the thermal behavior of modified PVA, further enhancing our understanding of how chemical modifications and doping influence the polymer at both molecular and macroscopic levels.

**Modern Research and Applications**

The turn of the 21st century marked a significant acceleration in the research and development of modified and doped PVA for optical applications. With the advent of nanotechnology and the increasing demand for advanced materials in fields such as photonics, optoelectronics, and biomedical engineering, the study of PVA's optical properties has become more relevant than ever.

Modern research focuses on creating PVA-based materials with highly specific optical characteristics. For instance, PVA doped with rare-earth elements is being explored for use in lasers and optical amplifiers due to its sharp emission lines and long fluorescence lifetimes. Similarly, PVA modified with organic dyes is being investigated for applications in solar cells and photodetectors, where precise absorption characteristics are critical.

**Future Directions**

Looking ahead, the future of optical studies of modified PVA conjugates and doped modified PVA is promising. Ongoing research aims to develop new synthesis methods and doping techniques to create materials with even more finely tuned optical properties. The integration of PVA-based materials into emerging technologies such as flexible electronics, wearable devices, and advanced sensors is expected to drive further innovation.

Moreover, the environmental sustainability of PVA, combined with its tunable optical properties, positions it as a key material in the development of green technologies. As the demand

for environmentally friendly materials continues to grow, the role of modified and doped PVA in sustainable technological solutions is likely to expand. The history of the optical study of modified PVA conjugates and doped modified PVA reflects the evolution of materials science and polymer chemistry over the past century. From its early use in industrial applications to its current role in cutting-edge optical technologies, PVA has demonstrated remarkable versatility and potential. The ongoing research and future advancements in this field hold the promise of unlocking new applications and further enhancing the functional properties of this already remarkable polymer.

**Current Research on Optical Properties of Modified Polyvinyl Alcohol (PVA) Conjugates and Doped Modified PVA**

Recent years have seen a surge in the research and development of polyvinyl alcohol (PVA) due to its versatility and potential for enhancement through chemical modifications and doping. As technological demands increase, especially in the fields of optics, photonics, and electronics, researchers are focused on innovating and optimizing PVA-based materials to meet specific requirements.

**Advanced Synthesis Techniques**

One of the primary areas of current research involves developing advanced synthesis techniques to modify and dope PVA with high precision. Researchers are utilizing methods such as:

1. **Sol-Gel Processing**: This method allows for the incorporation of metal oxides and other nanoparticles into the PVA matrix, leading to enhanced optical properties.
2. **Electrospinning**: Used to produce PVA nanofibers with embedded nanoparticles, resulting in materials with unique optical characteristics suitable for sensors and filters.
3. **Green Chemistry Approaches**: Focusing on environmentally friendly synthesis methods, researchers are exploring the use of bio-based dopants and solvents to produce modified PVA with minimal environmental impact.

**Nanocomposite Materials**

The creation of PVA nanocomposites is a significant focus area. These materials combine PVA with nanoscale fillers such as:

1. **Graphene Oxide**: Enhances the mechanical and optical properties of PVA, making it suitable for flexible electronics and transparent conductive films.
2. **Quantum Dots**: Semiconductor nanoparticles that provide unique optical properties such as tunable emission spectra, useful for light-emitting devices and bioimaging.
3. **Metal Nanoparticles**: Silver, gold, and other metal nanoparticles are used to enhance the refractive index and optical absorption of PVA, with applications in plasmonics and sensing.

**Functionalization with Organic Compounds**

Modifying PVA with organic compounds, such as dyes and chromophores, continues to be a rich area of research. These modifications aim to create PVA-based materials with specific optical properties, such as:

1. **Tailored Absorption and Emission**: By incorporating organic dyes, researchers can tune the absorption and emission spectra of PVA for applications in photodetectors and solar cells.
2. **Fluorescent Conjugates**: Conjugating PVA with fluorescent molecules to develop materials for bioimaging and diagnostic applications, where precise and stable fluorescence is crucial.

**Doping with Rare Earth Elements**

Doping PVA with rare earth elements like europium, terbium, and erbium has gained significant attention due to their unique luminescent properties. Research in this area focuses on:

1. **Enhanced Luminescence**: Rare earth-doped PVA materials exhibit sharp emission lines and long fluorescence lifetimes, making them ideal for lasers and optical amplifiers.
2. **Energy Transfer Mechanisms**: Investigating the mechanisms of energy transfer between the PVA matrix and doped rare earth ions to optimize the luminescent efficiency of the materials.

**Biomedical Applications**

The biocompatibility of PVA makes it an excellent candidate for biomedical applications. Current research is exploring:

1. **Drug Delivery Systems**: Developing PVA-based hydrogels and nanoparticles for controlled drug release, where the optical properties can be used for tracking and monitoring the delivery process.
2. **Tissue Engineering**: Utilizing modified PVA as scaffolds for tissue engineering, where its optical transparency and mechanical properties are advantageous for cell growth and imaging.

**Optical Sensors and Devices**

The development of PVA-based optical sensors and devices is a growing field, driven by the need for sensitive and selective detection systems. Research includes:

1. **Environmental Monitoring**: Creating PVA-based sensors for detecting pollutants and hazardous substances, leveraging the polymer's optical response to specific analytes.
2. **Biosensors**: Developing biosensors for medical diagnostics, where the optical properties of modified PVA can be used to detect biological molecules with high sensitivity.

**Characterization and Theoretical Studies**

Advancements in analytical techniques and theoretical modeling are crucial for understanding

and optimizing the optical properties of modified and doped PVA. Current research efforts include:

1. **Spectroscopic Analysis**: Using advanced spectroscopic methods such as Raman spectroscopy, FTIR, and NMR to characterize the structural and optical changes in modified PVA.
2. **Computational Modeling**: Employing computational techniques to simulate the electronic and optical properties of PVA-based materials, providing insights into the effects of modifications and doping at the molecular level.

**Conclusion:**

Current research on the optical properties of modified PVA conjugates and doped modified PVA is highly dynamic, with a focus on developing advanced materials for a wide range of applications. The integration of novel synthesis techniques, nanocomposite materials, functional organic compounds, rare earth doping, and biomedical applications is driving the field forward. As researchers continue to explore and understand the complex interactions within these modified polymers, the potential for innovative and high-performance PVA-based optical materials becomes increasingly promising. The optical study of modified polyvinyl alcohol (PVA) conjugates and doped modified PVA represents a significant advancement in materials science, driven by the need for versatile and high-performance materials in optical and photonic applications. Through chemical modifications and doping, PVA's intrinsic properties can be finely tuned to meet specific technological requirements, offering a wide array of applications ranging from flexible electronics and optoelectronics to biomedical devices and environmental sensors.

**Key Findings:**

1. **Enhanced Optical Properties**: Modifying PVA with functional groups and conjugates, as well as doping with various elements, significantly alters its optical properties. These modifications improve the absorption, emission, and refractive index of PVA, making it suitable for advanced optical applications.
2. **Advanced Synthesis Techniques**: The development of sophisticated synthesis methods, such as sol-gel processing, electrospinning, and green chemistry approaches, has enabled the creation of PVA materials with precisely controlled properties. These techniques have expanded the potential applications of PVA in high-tech fields.
3. **Nanocomposites and Organic Functionalization**: The incorporation of nanomaterials like graphene oxide, quantum dots, and metal nanoparticles, along with the functionalization with organic dyes and chromophores, has resulted in PVA-based materials with unique and tailored optical characteristics.
4. **Rare Earth Doping**: Doping PVA with rare earth elements has led to materials with exceptional luminescent properties, suitable for use in lasers, optical amplifiers, and other photonic devices. The study of energy transfer mechanisms within these materials is critical for optimizing their performance.
5. **Biomedical and Environmental Applications**: The biocompatibility and enhanced optical properties of modified PVA have opened new avenues for biomedical applications, including drug delivery systems, tissue engineering, and biosensors. Additionally, PVA-based optical sensors are being developed for environmental monitoring, offering sensitive and selective detection capabilities.

**Future Directions:**

The future of optical studies on modified PVA conjugates and doped modified PVA is promising, with ongoing research aimed at further refining the synthesis and characterization of these materials. Emerging trends include:

- **Integration with Nanotechnology**: Continued exploration of nanocomposites and nanostructured PVA materials to achieve even more advanced optical properties.
- **Sustainable Development**: Emphasis on environmentally friendly synthesis methods and the use of bio-based dopants to create sustainable PVA-based materials.
- **Multifunctional Applications**: Development of multifunctional PVA materials that combine optical, electrical, and mechanical properties for use in next-generation technologies.
- **Computational and Theoretical Studies**: Enhanced computational modeling to predict and optimize the behavior of modified PVA materials, providing a deeper understanding of the underlying mechanisms.

**Implications:**

The implications of this research are far-reaching, potentially transforming various technological fields. The ability to tailor the optical properties of PVA through modification and doping can lead to breakthroughs in photonics, optoelectronics, and biomedical engineering. Moreover, the environmental sustainability of PVA, combined with its enhanced functional properties, positions it as a key material for developing green technologies.

**Final Remarks:**

In conclusion, the optical study of modified PVA conjugates and doped modified PVA is a vibrant and evolving field that holds significant potential for innovation. By understanding and harnessing the changes in optical behavior brought about by modifications and doping, researchers can

develop new materials with superior performance, driving progress in a multitude of high-tech applications. The continued advancement in this area promises to unlock new possibilities and contribute to the development of cutting-edge technologies that address the needs of modern society.

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# The Study of Consumers' impulse buying behaviour

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**Abstract:**
Impulse buying is a practice that we have all engaged in at some point in our lives. Impulse buying is an unplanned purchase made by a consumer and is an important aspect of their purchasing activity. Often, our inner drive or temptation to buy a specific item becomes so strong that we make a purchase without thinking about it. Impulsive behaviour is not limited to children, adults with reasonable minds are also prone to it. Impulse buying can be influenced by various factors, including discount offers, salesperson behaviour, product display, client scenario, and personal attributes. Marketers try to use every trick possible to capitalize on the consumer's impulsive behaviour. This conceptual study aims to identify the aspects that influence customers' impulse purchase behaviours.

**Keywords:** consumers, impulse buying, temptation, unplanned purchase.

## Introduction:

### Consumer Buying Behaviour:

Consumer behaviour is the assessment of an individual's choice of `when, how, why, & where to buy or not buy a product. Its goal is to analyse how consumers make decisions, both individually and in groups. Consumer behaviour evaluates demographic and behavioural factors to create comprehensibility of customers' needs. Families, friends, and society are just a few of the numerous variables that affect customers. Any organization's marketing plans and methods are heavily influenced by the purchasing patterns of its customers. Businesses schedule their output in response to customer behaviour. Consumers take value addition and satisfaction into account when making decisions about purchases.

Let us take an example where a person buys a mobile phone and looks at several aspects, such as the programs it supports, the built-in and expandable capacity, the sound and picture quality, the pixels, and resolutions of the camera, whether it has a single SIM or two, etc. He also makes a comparison between the product and that of its rival company. It is crucial for businesses to pay attention to customer behaviour if they want to succeed in sales.

It covers the full process of purchasing, using, and discarding of goods and services. It is affected by a variety of factors, including personal qualities such as age, gender, income, education, and personality traits, as well as external ones such as societal conventions, cultural values, marketing and advertising, and economic conditions.

Kotler and Keller (2011) state that consumer buying behaviour is the study of the ways of buying and disposing of goods, services, ideas or experiences by the individuals, groups, and organizations in order to satisfy their needs and wants.

Michael R. Solomon, in his book "Consumer Behaviour: Buying, Having, and Being," define consumer behaviour as "the study of the processes involved when individuals or groups select, purchase, use, or dispose of products, services, ideas, or experiences to satisfy needs and desires."

### Impulsive Buying :

The tendency of consumers to make impulsive purchases without careful thought or planning is known as impulsive buying behaviour. These purchases are frequently done on the spur of the moment and are motivated more by psychological or emotional than by rational causes. It is frequently brought on by an emotional reaction to a product, such as a feeling of urgency, enthusiasm, or curiosity.

### Objective Of Research:

The aim of the study is to understand the concept of Impulse buying behaviour of consumers and analyse the factors that influence impulse buying.

### Hypotheses Of Research

H0- There is no significant relationship between consumers' buying behaviour and Impulsive buying.

H0- There is no effect of online shopping platforms and social media on Impulsive buying behaviour of consumers.

### Research Methodology

**Research Design:** This research study will follow Conceptual research approach and research is being conducted in India.

**Data Collection:** Secondary data is being used and collected with the help of internet, books, journals, articles, Etc.

**Some common triggers of impulsive buying behaviour include**:

1. **Emotional States:** When faced with unpleasant feelings like tension, boredom, or melancholy, consumers may act impulsively and make purchases. Many individuals believe that going shopping would make them happy, but they are unaware that this pleasure wears off and becomes less satisfying over time.
2. **Social Influences:** Having friends or relatives around can have an impact on impulsive purchasing behaviour.
3. **Marketing and advertising:** Effective marketing strategies, such time-limited deals, discounts, or eye-catching packaging, have the power to encourage impulsive purchases from customers.
4. **Personal qualities:** Impulsive purchase behaviour can be more likely in people who have certain personality qualities, such as compulsiveness or impulsivity.
5. **Situational Factors:** Time restraints, product availability, store location, sales & discounts and atmosphere can all have an impact on impulsive purchasing behaviour.
6. **Demographic factors**: Factors such as age, gender, income, and occupation might also impact consumers' impulsive purchases. It has been noted that younger buyers exhibit greater impulsivity than older ones. According to certain studies (Priyanka & Rooble, 2012; Jalees, 2009; Melnikas & Smaliukiene, 2007), women are more impulsive shoppers than males. However, other research indicates that women are more deliberate shoppers than men, with men being more impulsive (Cobb & Hoyer, 1986; Mai et al., 2003). It is reasonable to suppose that those in the high-income group who have more disposable income are more impulsive buyers than those in the low-income group. However, Ghani et al. (2011) and Yang et al. (2011) found no evidence of a substantial link between impulsive buying and income.

**Difference Between Impulsive & Compulsive Buying**

Buying is usually divided into two types: compulsive buying and impulsive buying. These two types of buying behaviours are governed by the brain. The differences between the two are as follows:

1. Impulsive buying involves poor decision-making and premature expression while in contrast compulsive shopping is a tendency that is repetitive in nature which is performed as per certain rules & more of a stereotype.
2. Impulse buying is generally unplanned and occurs in response to an external stimulus, such as seeing a desired item in a store, compulsive shopping is more inwardly motivated.
3. Impulsive buyers first enjoy pleasure, but this diminishes over time. Impulsive purchasing is typically done for enjoyment, while compulsive buying is done to relieve discomfort or anxiety.
4. There is a favourable correlation between compulsive buying and offline shopping, as well as impulsive buying and online shopping.

**Drawbacks Of Impulsive Buying**

1. **No control on budget:** Impulsive buying is when someone shops without planning or prior deliberation. Many people shop on the spur of the moment and then regret it. Spending on whim destroys budgets and diverts money from essentials to non-essential products.
2. **Wrong decisions:** In regular shopping, products are evaluated for quality and features before purchase. However, impulsive buying occurs without prior consideration. Shoppers sometimes buy products without bargaining or assessing them, leading to regret, and wasted money.
3. **Hampers rational thinking:** Impulsive shopping causes buyers to behave irrationally. Impulsive shopping can impair rational thinking and reasoning abilities, which are expected of all buyers. Impulsive thinking leads to a tendency to trust others and become vulnerable to deception.
4. **Wastage:** Visual attraction is the primary motivator for impulse buying. For impulsive purchasers, sight equals buying. People often purchase products they do not need, for example even though a person has crockery at home but on seeing
5. an attractive one he/she buys it.

**How To Prevent Impulsive Buying**

1. **Create a Budget:** Set clear limits on how much you can spend in different categories. Stick to this budget to avoid overspending.
2. **Make a Shopping List:** Before you go shopping, make a list of what you need. Stick to this list to avoid buying things on a whim.
3. **Avoid Tempting Environments:** Stay away from places that trigger impulsive buying, like malls or online shopping sites with tempting deals.
4. **Unsubscribe from Marketing Emails:** Reduce exposure to advertisements by unsubscribing from promotional emails and newsletters.
5. **Set Financial Goals:** Having clear financial goals, such as saving for a vacation or paying off debt, can help you prioritize your spending.
6. **Track Your Spending:** Keep a record of your expenses to see where your money is going.

This can help you identify and reduce impulsive purchases.

7. **Use Cash Instead of Credit Cards:** Paying with cash can make the spending feel more tangible and help you stick to your budget.
8. **Educate Yourself:** Learn about the psychology of marketing and consumer behaviour to understand how you might be influenced.
9. **Find Alternatives:** When you feel the urge to buy something impulsively, find alternative activities that can fulfil the same need or distract you from the impulse.

**Conclusion:**

At present India has its largest ever adolescent and youth population. According to UNFPA projections, India will continue to have one of the youngest populations in the world till 2030. As per a report by Ac Nielsen customers spend 51 per cent of their monthly expenditure on products in the grocery category (Peter, 2023) Gupta and Patel (2023) investigate the effect of mobile shopping apps on the impulse buying behaviour of Indian millennials. Their research shows that features like instant purchase options, push notifications, and user-friendly interfaces contribute to increased impulse purchases. According to Reddy el at. (2021) online shopping environments and targeted advertising on social media enhance impulse purchasing. The study shows that personalized recommendations and flash sales on e-commerce platforms are particularly effective in stimulating impulse buys. According to Kumar & Suresh (2020) environmental cues, like store layout and product placement, significantly influence impulse buying. They further added that promotions and discounts trigger spontaneous purchases. The study emphasizes the need for retailers to create an appealing in-store atmosphere to boost impulse purchases.

From the above studies, it can be concluded that consumers' impulse buying behaviour in India reveals a multifaceted phenomenon influenced by various factors including store environment, emotional states, promotional strategies, and cultural events. The interplay between traditional retail settings and modern digital platforms also plays a significant role in shaping impulse buying patterns. Future research could further explore the impact of emerging technologies and evolving consumer preferences on impulse buying behaviour.

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6. Leads to purchase decision: A positive consumer behavior leads to a purchase decision.

A consumer may take the decision of buying a product on the basis of different buying motives. The purchase decision leads to higher demand, and the sales of the marketers increase. Therefore, marketers need to influence consumer behavior to increas

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# Cosmological Implications of Holographic Dark Energy in f(T) Gravity

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**Abstract:**
We have examined the spatially homogenous and anisotropic Bianchi type-III cosmological model in the context of f(T) gravity, with the presence of holographic dark energy. Our work of a cosmological model contains a suitable function action, f(T). A straight forward power-law form of a metric potential is used to solve field equations by utilizing the relationship between the metric potentials $A = t^n$. The primary objective of this paper is to investigate certain physically relevant concerns about the universe's evolution. It is noted that the anisotropic parameter Am is constant and that the Hubble parameter (H) , scalar expansion (θ), and shear scalar (σ) diverge at the beginning era as they get nearly to zero for high values of time. The universe is currently accelerating, as shown by the negative value of deceleration parameters.

## 1. Introduction

Many high redshift supernovae experiments have proved that our current universe is indeed undergoing a late-time cosmic explosion [1-3]. Dark energy, an unidentified fluid connected to the negative pressure of the universe according to modern cosmology, is held responsible for this acceleration [4-6]. Many theoretical and experimental attempts have been undertaken to illuminate the aspects of the universe that remain hiding. A number of eminent scientists have recently developed distinct cosmological models inside different gravity theories in order to concentrate on these unknown features. Among these, general relativity-extended modified gravity theories such as f(R), f(T), f(R,T), f(G), and f(Q) have provided satisfactory solutions to cosmological problems [7–10].

The f(T) theory was proposed by Ferraro and Fiorini [11–12], who explored real-life problems and generated singularity-free solutions with a positive cosmological constant. Using curvature-free Weitzenböck connections, this concept generalizes teleparallel gravity and makes to general relativity if f(T) can be replaced with a constant [13–14].Cosmological models with equation of state (EoS) parameters in the f(T) theory of gravity have been given in recent works [15], indicating that the theory is a good fit for understanding the universe's accelerating phase. Additionally, Holographic Dark Energy (HDE) models have received a lot of attention recently from astrophysicists since they give an adequate explanation for observable data. Hybrid fluids made of HDE and matter have promise, according to studies into the properties and behaviors of HDE cosmological models [16–19].

Based on the assumption of an isotropic and homogeneous universe, for both the early and modern phases of the universe, the FLRW model is regarded as a valid approximation. The early cosmos would have been anisotropic at first, but new findings from experiments like the Planck collaboration [23], COBE [21], Wilkinson Microwave Anisotropy Probe [22], and CMB temperature [20] and polarization anisotropy investigations, suggest differently. The discovery has led to the Bianchi model—rather than the FLRW model—being taken into account for explaining an anisotropic cosmos. Since anisotropy and homogeneity are key aspects of the early cosmos, studying spatially homogenous and anisotropic models is vital to understanding cosmic evolution.

The simplest anisotropic model, the Bianchi type-III cosmological model, has drawn interest because it may describe the fundamental characteristics of the universe. As a result, a number of scholars have examined Bianchi type-III models in connection with different gravitational theories [24–25]. This motivates us to investigate a modified Holographic Dark Energy-filled, spatially homogenous, anisotropic Bianchi type-III universe in the framework of f(T) theory of gravity. The goal of this work is to explore this Bianchi type-III HDE model under f(T) modified gravity, paying special attention to late-time cosmic acceleration and cosmic anisotropy. The paper is organized as follows:

Section 2 explains the metric and field equations; Section 3 covers the construction of cosmological models; Section 4 covers the physical features of the models; and Section 5 compiles the results.

**2. Metric and field equation**

The Bianchi type-III space-time is given by

$$ds^2 = dt^2 - A^2dx^2 - B^2e^{-2mx}dy^2 - C^2dz^2 \quad (1)$$

where m is a constant and A, B, and C are functions of cosmic time t alone. The variational principle is used to obtain the field equations of f(T) gravity. The gravitational activity of f(T) is provided by

$$S = \frac{1}{16\pi G}\int d^4x\, e[T + f(T) + L_m] \quad (2)$$

This, with relation to the metric tensor $g_{\mu\upsilon}$, can be modified to give the gravitational field equation for *f*(*T*) gravity as

$$\left[e^{-1}\partial_\mu\left(eS_i^{\mu\upsilon}\right) - h_i^\lambda T_{\mu\upsilon}^\rho S_\rho^{\mu\upsilon}\right]f_T + S_i^{\mu\upsilon}\partial_\mu(T)f_{TT} + \frac{1}{4}h_i^\upsilon f = \frac{1}{2}k^2h_i^\rho T_\rho^\mu \quad (3)$$

Where $k^2 = 8\pi G, f_T = \frac{df}{dt}, f_{TT} = \frac{d^2f}{dt^2}, S_i^\mu = h_i^\rho S_\rho^{\mu\upsilon}$

The energy momentum tensor for HDE $T_{\mu\upsilon}$ is of the form

$$T_{\mu\upsilon} = (\rho_\wedge + p_\wedge)u_\mu u_\upsilon + g_{\mu\upsilon}p_\wedge \; and \; (\mu,\upsilon = 1,2,3,4) \quad (4)$$

Where $\rho_\wedge$ is the energy density and $p_\wedge$ is the pressure of the fluids. Where $u^\mu = (0,0,0,1)$ is the four-velocity vector in co-moving coordinates which satisfying $u^\mu u_\mu = 1$

$$T_\upsilon^\mu = diag(-\rho_\wedge, p_\wedge, p_\wedge, p_\wedge) \quad (5)$$

For the space-time (1), the torsion scalar is obtained as

$$T = -2\left(\frac{\dot{A}\dot{B}}{AB} + \frac{\dot{B}\dot{C}}{BC} + \frac{\dot{A}\dot{C}}{AC}\right) \quad (6)$$

We obtained the field equations for (3), using (5) in (1) as

$$f - 4\left(\frac{\dot{A}\dot{B}}{AB} + \frac{\dot{B}\dot{C}}{BC} + \frac{\dot{A}\dot{C}}{AC} - \frac{m^2}{2A^2}\right)f_T = 16\pi\rho_\wedge \quad (7)$$

$$2\left(\frac{\dot{A}\dot{B}}{AB} + 2\frac{\dot{B}\dot{C}}{BC} + \frac{\dot{A}\dot{C}}{AC} + \frac{\ddot{B}}{B} + \frac{\ddot{C}}{C}\right)f_T - 4\left(\frac{\dot{B}}{B} + \frac{\dot{C}}{C}\right)\left[\left(\frac{\ddot{A}}{A} - \frac{\dot{A}^2}{A^2}\right)\left(\frac{\dot{B}}{B} + \frac{\dot{C}}{C}\right) + \left(\frac{\ddot{B}}{B} - \frac{\dot{B}^2}{B^2}\right)\left(\frac{\dot{A}}{A} + \frac{\dot{C}}{C}\right) + \left(\frac{\ddot{C}}{C} - \frac{\dot{C}^2}{C^2}\right)\left(\frac{\dot{A}}{A} + \frac{\dot{B}}{B}\right)\right]f_{TT} - f = -16\pi p_\wedge \quad (8)$$

$$2\left(\frac{\dot{A}\dot{B}}{AB} + \frac{\dot{B}\dot{C}}{BC} + 2\frac{\dot{A}\dot{C}}{AC} + \frac{\ddot{A}}{A} + \frac{\ddot{C}}{C}\right)f_T - 4\left(\frac{\dot{A}}{A} + \frac{\dot{C}}{C}\right)\left[\left(\frac{\ddot{A}}{A} - \frac{\dot{A}^2}{A^2}\right)\left(\frac{\dot{B}}{B} + \frac{\dot{C}}{C}\right) + \left(\frac{\ddot{B}}{B} - \frac{\dot{B}^2}{B^2}\right)\left(\frac{\dot{A}}{A} + \frac{\dot{C}}{C}\right) + \left(\frac{\ddot{C}}{C} - \frac{\dot{C}^2}{C^2}\right)\left(\frac{\dot{A}}{A} + \frac{\dot{B}}{B}\right)\right]f_{TT} - f = -16\pi p_\wedge \quad (9)$$

$$2\left(2\frac{\dot{A}\dot{B}}{AB} + \frac{\dot{B}\dot{C}}{BC} + \frac{\dot{A}\dot{C}}{AC} + \frac{\ddot{A}}{A} + \frac{\ddot{B}}{CB}\right)f_T - 4\left(\frac{\dot{A}}{A} + \frac{\dot{B}}{B}\right)\left[\left(\frac{\ddot{A}}{A} - \frac{\dot{A}^2}{A^2}\right)\left(\frac{\dot{B}}{B} + \frac{\dot{C}}{C}\right) + \left(\frac{\ddot{B}}{B} - \frac{\dot{B}^2}{B^2}\right)\left(\frac{\dot{A}}{A} + \frac{\dot{C}}{C}\right) + \left(\frac{\ddot{C}}{C} - \frac{\dot{C}^2}{C^2}\right)\left(\frac{\dot{A}}{A} + \frac{\dot{B}}{B}\right)\right]f_{TT} - f = -16\pi p_\wedge \quad (10)$$

Here, differentiation with respect to cosmic time t is indicated by the dot (.).

**3. Construction of Cosmological model**

Let's now find the physical attributes that will be helpful in both the physical description of the solution and the solving of the field equations.

The Bianchi type-III space-time's average scale factor is

$$a(t) = (ABCe^{-mx})^{1/3} \quad (11)$$

The metric's spatial volume is

$$V = a(t) = ABCe^{-mx} \quad (12)$$

Directional Hubble parameter are

$$H_1 = \frac{\dot{A}}{A}, H_1 = \frac{\dot{B}}{B}, H_1 = \frac{\dot{C}}{C} \quad (13)$$

The mean Hubble parameter

$$H = \frac{\dot{a}}{a} = \frac{1}{3}\frac{\dot{V}}{V} = \frac{1}{3}\left(\frac{\dot{A}}{A} + \frac{\dot{B}}{B} + \frac{\dot{C}}{C}\right) \quad (14)$$

The scalar expansion

$$\theta = \frac{1}{3}\left(\frac{\dot{A}}{A} + \frac{\dot{B}}{B} + \frac{\dot{C}}{C}\right) \quad (15)$$

The shear scalar

$$\sigma^2 = \frac{3}{2}A_mH^2 \quad (16)$$

The mean anisotropy parameter is defined as

$$A_m = \frac{1}{3}\sum_{i=1}^{3}\left(\frac{H_i}{H} - 1\right) \quad (17)$$

In order to build a new cosmological model, we take into consideration the power law of the universe's volumetric expansion as

$$A = t^n \quad (18)$$

Let $$A = B \;\&\; C = \frac{A}{K} \quad (19)$$

Using (18) & (19) in (11), we get

$$A = aK^{1/3}e^{mx/3}, B = aK^{1/3}e^{mx/3}, C = aK^{-2/3}e^{mx/3}, \quad (20)$$

From (6) we have obtained the Torsion scalar as

$$T = -\frac{6n^2}{t^2} \quad (21)$$

Now, from (7), (8) and (21) which gives,

$$\rho_\Lambda = \frac{3n^2}{2\pi t^2} - \frac{m^2}{8\pi t^{2n}K^{2/3}e^{2mx/3}} \quad (22)$$

$$p_\Lambda = -\frac{(12n^2-2n)}{8\pi t^2} \quad (23)$$

**4. Some Physical parameters**

We have to determine the average Hubble Parameters (*H*), deceleration parameter (*q)* anisotropy parameter (*Am),* scalar expansion (*θ)* and shear scalar (*σ)* respectively as

$$H_1 = H_2 = H_3 = \frac{n}{t} \quad (24)$$

$$H = \frac{n}{t} \quad (25)$$

$$q = \frac{1-n}{n} \quad (26)$$

$$Am = \frac{1}{3}\left(\frac{3n-n}{n}\right)^2 \quad (27)$$

$$\theta = \frac{3n}{t} \quad (28)$$

$$\sigma = \frac{\sqrt{2}n}{t} \quad (29)$$

We have seen from equations (25), (28) and (29) that for high amounts of time, the physical values of H, θ, and σ approach zero and diverge at the start of the period. We have observed that starting with equation (27) the anisotropy parameter Am = constant

**Conclusion**

In the present work, we have used spatially homogeneous and anisotropic Bianchi type-III space-time to examine the Holographic dark energy cosmological model in f(T) theory of gravity. Each and every cosmic physical parameter, including the anisotropy parameter Am, the scalar expansion θ, the shear scalar σ, and the Hubble parameter H, is derived. We deduce that the physical parameters H, θ, and σ diverge at the beginning era and approach zero for high values of time from equations (25), (28) and (29). We can see that the cosmos is expanding faster than before from equations (25) and (26) because they demonstrate that the Hubble parameter is positive throughout the evolution and the deceleration parameter is negative. Therefore, we can conclude that dark energy is responsible for the universe's expansion. We have noted from (27), that the anisotropic parameter Am = constant. Furthermore, the isotropy condition σθ = constant, which we obtain from equations (28) and (29), suggests that the model is anisotropic throughout the evolution of the the universe.

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# Evaluating Plagiarism Detection Tools and Policies: Enhancing Academic Integrity in the Digital Age

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**Abstract**

In the digital age, the prevalence of plagiarism in academic settings has become a significant concern. This paper evaluates various plagiarism detection tools and policies aimed at enhancing academic integrity. Plagiarism detection tools, such as Turnitin, Grammarly, Copyscape, and Unicheck, are assessed based on their accuracy, usability, and cost-effectiveness. These tools help identify instances of plagiarism by scanning documents and comparing them against extensive databases of academic papers, websites, and books. The effectiveness of these tools is critical in minimizing both undetected plagiarism and false positives. This ensures that students or researchers understand the importance of original work and the consequences of academic dishonesty, ultimately enhancing the quality of education and research.

**Keywords:** Academic Integrity, Plagiarism, Plagiarism Tools

## Introduction

Academic integrity is a cornerstone of educational institutions, ensuring the originality and credibility of scholarly work. With the proliferation of digital resources, maintaining this integrity has become more challenging. Plagiarism, or the act of using someone else's work as your own without proper credit, is a significant problem in academia. With the rise of digital technology, it has become easier to access information, but also easier to copy it without proper citation. This paper evaluates the effectiveness of various plagiarism detection tools and examines the policies that support their use, aiming to enhance academic integrity in the digital age.

## Objectives

1. Institution has to promote the culture of academic honesty in research
2. Importance of technology for improving academic integrity
3. To assess the accuracy of plagiarism detection tools
4. Analyse the cost-effectiveness of plagiarism detection tools
5. Evaluate the usability of plagiarism detection tools
6. Review the Institutional policies on plagiarism

By achieving these objectives, educational institutions can better address the challenges of plagiarism in the digital age, ensuring a fair and honest academic environment.

## Plagiarism Detection Tools

Plagiarism detection tools are software programs designed to identify instances of plagiarism in written work. They scan documents and compare the text against a vast database of sources, including academic papers, websites, and books.

1. Turnitin: One of the most widely used tools, it provides detailed similarity reports and integrates.
2. Grammarly: Known for its grammar checking, Grammarly also includes plagiarism detection features.
3. Copyscape: Often used for web content, it checks the duplicate content online.
4. Unicheck: Focuses on educational institutions, providing detailed plagiarism reports.

Evaluating the Effectiveness of Plagiarism Detection Tools are very important factor in academic research. Some important factors are providing the easiness to use of these tools.

Accuracy: The ability of the tool to correctly identify plagiarized content. Higher detection rates

mean fewer instances of undetected plagiarism. Occurrences where the tool incorrectly flags content as plagiarized. Tools need to minimize these to avoid unnecessary penalties for researchers and students in academic research.

Usability: The interface should be user-friendly, allowing students and educators to upload and check documents easily. The Tools that integrate seamlessly with learning management systems (LMS) make it easier for educators to use them regularly for research.

Cost: Some tools require a subscription, which can be expensive for institutions or individual users. It is important to consider if the tool's features justify the cost.

**Policies**

Education and Training: Regular sessions of workshop and tutorials has to conduct to educate students and staff about plagiarism and how to avoid it. Institutions should provide clear, accessible guidelines on what constitutes plagiarism and the consequences of committing it.

Consequences and Enforcement: There should be having a consistent approach to dealing with plagiarism ensures fairness. Also providing the support for students who struggle with academic writing can help reduce plagiarism.

**The Role of Technology in Academic Integrity**

In the any kind of research the institution has to encourage the researchers or students for digital submissions. It helps to check the credibility of the research. There are some tools which allows to tracking the document versions, which helps to understand the development of a student's work. These tools track the contributions of group projects it ensures that all members are contributing fairly.

**Conclusion**

In the digital age plagiarism detection tools and policies play a crucial role in maintaining academic integrity. It enhances academic integrity, ensuring that scholarly work remains original and credible. By selecting effective tools and implementing strong policies, educational institutions can minimize plagiarism and promote honest academic practices.

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# Applications of Fuzzy Mathematics: Solving Real-Life Problems with Uncertainty and Ambiguity

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**Abstract:**
Fuzzy mathematics offers a versatile approach to solving real-life problems characterized by uncertainty and ambiguity. This paper explores the applications of fuzzy mathematics in various do- mains, including engineering, finance, and decision-making. Through case studies and examples, we demonstrate how fuzzy logic provides flexible solutions that better capture the complexities of the real world, offering valuable insights and improvements over traditional methods.

**Keywords:** Matrix, Fuzzy, Finance

**Introduction:**

In many real-life situations, decision-making processes are often confronted with uncertainty and ambiguity. Traditional mathematical methods, relying on crisp, binary logic, may not ade- quately capture the vagueness inherent in such problems. Fuzzy mathematics, introduced by Lotfi Zadeh in the 1960s [**?** ], provides an alternative framework that embraces uncertainty and allows for more nuanced reasoning. By representing variables as fuzzy sets with degrees of membership, fuzzy mathematics offers a flexible approach to modeling and analyzing complex systems.

**Foundations of Fuzzy Mathematics**

Fuzzy mathematics is built upon the theory of fuzzy sets, which extends classical set theory to handle imprecise or uncertain information. Unlike crisp sets, where membership is binary, fuzzy sets allow for degrees of membership, enabling a gradual transition between membership and non-membership. This flexibility makes fuzzy mathematics well-suited for modeling real-world phenomena, where boundaries may be vague and distinctionsmay be blurred.

**Applications in Engineering**

One of the primary applications of fuzzy mathematics is in engineering, where it is used to model and control complex systems. Fuzzy logic controllers have been successfully applied in various fields, including automotive systems, industrial processes, and robotics. Unlike traditional control methods, which may struggle to cope with nonlinearities and uncertainties, fuzzy logic controllers can effectively handle imprecise inputs and vague specifications, leading to more robust and adaptable control systems.

**Applications in Finance**

In finance, fuzzy mathematics has found applications in portfolio optimization, risk management, and decision support systems. Traditional financial models often rely on strict assumptions about market behavior and asset returns, which may not hold in practice. Fuzzy logic provides a more flexible approach to modeling financial data, allowing for the incorporation of qualitative factors and expert knowledge into the decision-making process. This can lead to more resilient investment strategies that are better able to adapt to changing market conditions and unexpected events.

**Case Studies**

To illustrate the effectiveness of fuzzy mathematics in solving real-life problems, we present two case studies: fuzzy control of a inverted pendulum and fuzzy portfolio optimization.

**Fuzzy Control of an Inverted Pendulum**

The inverted pendulum is a classic control problem that involves stabilizing an upright pendulum mounted on a cart. Traditional control methods, such as PID controllers, may struggle to maintain stability in the presence of external disturbances and nonlinear dynamics. Fuzzy logic controllers offer a more robust solution by capturing

the imprecision and uncertainty inherent in the system. By incorporating linguistic variables and fuzzy rules, these controllers can effectively stabilize the pendulum under varying conditions, demonstrating the applicability of fuzzy mathematics in control engineering.

**Fuzzy Portfolio Optimization**

Portfolio optimization is a fundamental problem in finance, where the goal is to construct an investment portfolio that maximizes returns while minimizing risk. Traditional mean-variance optimization techniques may lead to suboptimal results when market conditions are uncertain. Fuzzy portfolio optimization allows investors to incorporate subjective judgments and qualitative criteria into the optimization process, resulting in more resilient portfolios. By considering the uncertainty and ambiguity inherent in financial markets, fuzzy mathematics enables investors to make more informed decisions and achieve better risk-adjusted returns.

**Conclusion:**

Fuzzy mathematics offers a versatile framework for addressing real-life problems character- ized by uncertainty and ambiguity. By embracing imprecision and allowing for flexible reasoning, fuzzy logic provides solutions that better capture the complexities of the real world. Through appli- cations in engineering, finance, and decision-making, fuzzy mathematics continues to demonstrate its effectiveness in solving challenging problems where traditional methods fall short. As technol- ogy advances and our understanding of fuzzy mathematics deepens, we can expect its applications to grow and evolve, offering valuable insights and improvements across a wide range of domains.

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# Management in Marketing Strategies Enhancing the Modern Era

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**Abstract:**
In view of this paper, the Role of computerized promoting assume crucial job in business for development in light of the fact that it shaves less time and less sum do publicizing through world. And furthermore, if any progressions happened in product we need to change effectively and it make more mindfulness instead of conventional marketing. n the previous hardly any years, the web and web-based business exercises have gotten one of thefastest developing advancements that assuming a huge job in the day-by-day life of individual. Today,E-showcasing is one of the most rising advances in IT and E-Commerce segment. E-marketingis likewise alluded to as Internet showcasing (IM), web-based promoting or web-advertising, implies usingthe web to market and sell products and ventures. E-Marketing assists with discovering the rightaudience to whom products and enterprises are to be given by the business associations. It consistsof all procedures and exercises with the motivations behind pulling in, discovering, winning and retainingcustomers. The extent of E-Marketing is regarded to be wide in scope it doesn't just utilize topromote showcasing over the web yet in addition helps in advertising also through email andwireless media. Here we investigated to discover the chances and difficulties of Internetmarketing in India and significance of Digital advertising procedures in the serious world.

**Keywords-** E-marketing, products, India

**Introduction:**

The intensity of computer sales allows geophysical barriers to disappear, making ev ery buyer and organization on earth potential customers and service providers. It is known for its ability to enable businesses to mediate and form exchanges anywhere, anytime. Promotion of computer industry in India is an explosive vocation today. In a rapidly growing country, this is considered a very important development for a career in digital advertising. The development of the computer presentation model has an extraordinarily rich impact on advertising and promotion. A comprehensive overview of the digital marketing industry in India cannot be complete without a brief overview of the past metrics of computer advertising. Computer presentation is rapidly developing in India and also globally. While all other industries are struggling with a development rate of 5-10 percent, the industry promoting digital technology has grown explosively and reached a 30 percent development rate a year ago, and the predicted development for 2016 is 40 percent, and the most important part. that is the evolution. interest will not expire in subsequent years. Due to the gradual increase in the number of internet users, the internet business industry is also booming. Organizations are moving to advance their financial plan from a traditional introduction to a computerized advertising strategy. After independence, the Indian advertising industry has evolved from an expected minor industry to a full-fledged mega industry and is now the second largest in Asia after China. The computer marketing industry in India has spread to almost all business segments. Some online marketing applications include tracking purchases and requests, online banking, payment plans, and content management. Despite the fact that radio is far behind television in terms of revenue, but is growing at the same rate (10 percent), film advertising is likely to grow by 20 percent or more. . It is the financial part that is most trying to promote in India as RBI's moderate approach can create an ideal business for the region. Digital advertising in India topped 2016-17. 1 billion dollars in the financial year and is expected to grow at an average of 14 percent annually. Television and print media contribute enormously, while developed media accounts for

about 12 percent of total advertising, but is expected to grow to 24 percent by 2020. The explanation behind such a huge development is the shift from man-made mechanized central seeding to the benefits of better expertise, unwavering quality and precise focus. The growth is widespread, especially when one admires the increasing penetration of mobile phones; aid up to 800 million is expected over the next half decade. Robotics and artificial intelligence (man-made consciousness) would make things much better for businesses.

1. **Innovations in marketing and management**

Somewhere in the range of 1971 and 1972, The ARPANET is utilized to organize a deal between understudies at the StanfordArtificial Intelligence Laboratory and the Massachusetts Institute of Technology, the earliestexample of gadgets or advanced commerce.1979: Michael Aldrich exhibits the principal internet shopping system.1981: Thomson Holidays UK is first business-to-business web based shopping framework to be installed.1996: India MART B2B commercial center built up in India.2007: Flipkart was set up in India. Each E-promoting or business undertakings use majorlydigital implies for their showcasing purposes.In 2011, the advanced promoting insights uncovered that publicizing by means of the cell phone and tabletswas 200% lower than that of the accompanying years.During this year, the total assets was $2 billion. The development was in a mathematical movement as itrose to $6 billion of every 2012. The serious development requests for greater improvement in the careerworks and experts are being added to the field.From 2013 to March 2015, the speculation all out increment was 1.5 billion dollars over thepreceding years. There has been an amazing development up till this present moment.The report by the International Journal of Advanced Research Foundation uncovered thatsummarized that India is getting the chance to see the brilliant time of the Internet area between 2013 to2018 with staggering development openings and common development selection for E-Commerce, InternetAdvertising, Social Media, Search, Online Content, and Services relating computerized advertising.

**Objectives**

1. To understand the planning process off digital marketing strategy in the organization.

2.To explain the difference between Traditional marketing and Digital marketing.

3.Anlyze the importance and reasons for the development of Digital marketing in India.

**Analysis**

Stages Of Planning Digital Marketing In The Company

Chance, Strategy and Action. He suggests that any business that wants to implement a successful digital marketing strategy must build its plans looking at the opportunity, the strategy

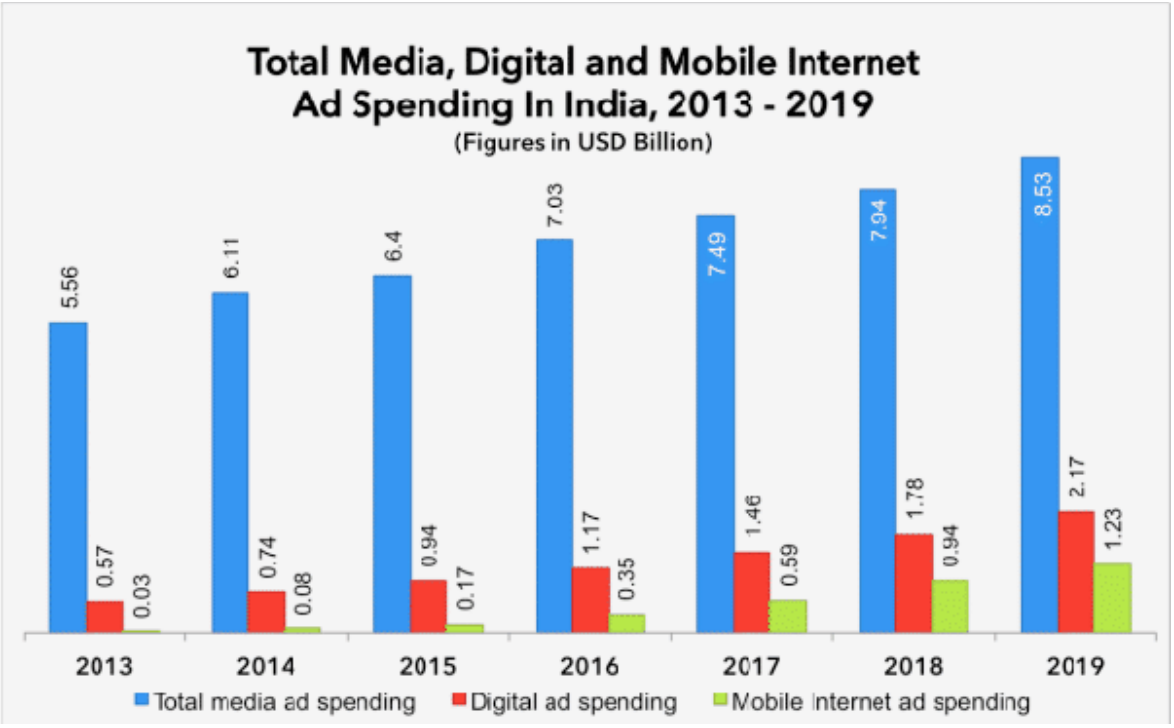
They can set smart goals by mapping the company's current benchmarks and competitors and key performance indicators (KPIs). It is important that the research used for KPI metrics is modified according to the type of company, its goals and the decision vision. Companies can filter offers and deals by monitoring their own performance and influencer reach. This means they have power because they can study the influence and brand connections of their fellow advertisers. Summarizing the purchase project, they can also notice gaps and developments for the future, promoting openings that meet goals or suggest new goals and additional benefits.

To develop an organized high-level methodology, the organization must review the computerized recommendation (that you give to the buyers) and deliver it using high-level clients who focus on strategies. Thus, they must characterize online incentives (OVP), which means that the organization clearly communicates to customers online what they offer, such as brand placement. Also, the organization should (re)select target presentations and personas and characterize digital targeting approaches. Once this is done, it is important to check the selection of online advertising options. The marketing mix includes the 4Ps - product, price, promotion and place. Some researchers have added three more components to the usual promotion of process, place and physical appearance, making it the seventh point of promotion.

The third and final stage requires the company to create a financial plan and management framework, which must be quantitative touch points, such as audience at each advanced stage. In addition, marketers must provide a financial plan and execution framework that includes the organization's paid, owned, and earned media. The process and the final stage of the agreement also require the company to establish a quantifiable substance, such as the creation of oral, visual or composite online media. Once a computerized distribution plan is established, a planned arrangement of detailed correspondences should be encoded throughout the internal tasks of the organization, such as a Gantt chart. This ensures that all the steps used correspond and complement each other in the following stages of the digital marketing system.

The use of special instruments has changed significantly over the past year. No one ever thought that was a sustainable arrangement on

the Internet. The image below shows the knowledge of digital advertising. The belief was that online data is virtual data full of lies. No one could set up an online ad not to discuss buying things, furniture or clothes. The story has really changed. Everything from presentation to bidding should be possible online. This is because of the trust that has been restored in online correspondence in India. This has really helped the advertising business. The rebellion begins with correspondence. The easy-to-use suite is currently available, so there are about 600 million online users in India, which ultimately makes for an interesting business opportunity for the emerging population. Furthermore, the improvement of computerized advertising in India has clearly transformed marketing from anonymity to personalization.




**Reasons To Show The Importance Digital Marketing Over Traditional Marketing**

**Results and discussions**

Computerized Marketing and promoting is impacting people groups to purchase and sell on the web and online business is getting an ever increasing number of deals. With a howdy development through Digital promoting in business organizations have starter spending increasingly more in Digital advertising as they are improving ROI in Digital medium contrast with conventional, another significant advantages are generally the cost and return are quantifiable which is absurd in Traditional Marketing. Appeal of Managing Companies action over Online advertising and improve organization perceivability has opened another entryway or opportunity. Request are higher at that point supply so Peoples have one new profession stream as Digital Marketer which is adaptable and giving high vocation development. Computerized Marketing is a fast profession development in India as well as all through the world. Organizations are getting increasingly more needy over web to create quicker income for their business.

Contentmarketing can be quickly portrayed as "conveying the substance that your crowd is looking for in theplaces that they are scanning for it". It is discovered that substance advertising is exceptionally present in digitalmarketing and turns out to be profoundly effective when substance showcasing is included. This is expected tocontent showcasing making your image more pertinent to the objective purchasers, just as morevisible to the objective consumer.Marketers likewise discover email a compelling methodology with regards to advanced advertising as it is anotherway to construct a drawn out relationship with the shopper. Recorded underneath are a few viewpoints that needto be considered to have a compelling advanced media crusade and angles that help make aneffective email framework.

**Conclusion:**

In view of this paper, the Role of computerized promoting assume crucial job in business for development in light of the fact that itshaves less time and less sum do publicizing

through world. And furthermore, if any progressions happened inproduct we need to change effectively and it make more mindfulness instead of conventional marketing.So it have significant influence in item mindfulness (i.e particularly in New item introducing).In thisdigital advertising we need to utilize such a large number of types instruments .so we parcel of decisions in computerized marketing.Marketers need to begin catching client goal information with the goal that promoting and experience canbecome logically applicable to singular purchasers, maybe just because. As a marketer,we can anticipate that advertising should be less about a speedy sell and more about structure a long-termrelationship. Buyers need genuineness in their acquisition of items and expect some level ofpersonalization in mass created also in upscale things.

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# FRW Cosmological Model in Linear *f*(*T*) Gravity Using Hybrid Expansion Law

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**Abstract:**

In the current work, we have studied spatially homogenous and isotropic flat Friedman-Robertson-Walker (FRW) cosmological model filled with perfect fluid within the context of $f(T)$ gravity, in particular - linear model of $f(T)$ gravity, viz. $f(T)=T$. To obtain the exact solution of the field equations, we have taken into consideration the hybrid expansion law of scale factor $a=\eta t^{n}e^{\xi t}$. We examined a few of the model's physical parameters, including energy density, pressure, equation of state (EoS) parameter, and squared sound velocity. Additionally, some of the model's kinematical properties have been discussed.

**Keywords:** $f(T)$ gravity, FRW metric, Hybrid expansion law, Perfect Fluid, Cosmology.

**Introduction:**

The current universe is expanding faster than it was before, according to observational evidence from the type Ia supernovae (SNeIa) surveys, the cosmic microwave background (CMB) anisotropy spectrum, and large-scale structure (LSS) [1-4]. Two broad categories can be used to group the explanations for this behavior that has been seen. One is to suppose that in the context of Einstein's General Relativity (GR), this observable behavior requires the explanation of an exotic component with negative pressure known as dark energy (DE). Modifying GR theory is another way to explain the current acceleration of cosmic expansion.

Modified gravity theories that are well-known include $f(R)$ gravity, $f(R,T)$ gravity, $f(T)$ gravity, etc. In modified $f(R)$ gravity, one replaces the Ricci scalar $R$ in the Einstein-Hilbert action by an arbitrary function of $R$. Recently Shaikh [5] examined the physical viability of $f(R)$ gravity models using observational constraints. Odintsov et al. [6] have investigated that a power-law $f(R)$ gravity model with early dark energy can describe both early-time and late-time acceleration of the Universe. Patil et al. [7] constructed power law and exponential law cosmological models in the framework of $f(R)$ gravity. Wankhade et al. [8] have worked on interacting two fluid dark energy Bianchi type-I cosmological model in the same gravity. Same authors Wankhade et al. [9], using an interacting dark matter and Renyi holographic dark energy model (RHDE) in f(R) gravity, they worked on a homogeneous and anisotropic LRS Bianchi type-I universe model. The outcome was that the deceleration parameter (DP) showed a signature flipping for a universe that was decelerating in the past and accelerating at the present epoch. Chirde and Shekh have investigated interaction between barotropic fluid and dark energy with zero-mass scalar field for the spatially homogeneous and isotropic flat FRW universe in the framework of $f(R)$ gravity [10]. In $f(R,T)$ gravity, the gravitational action includes an arbitrary function of the Ricci scalar $R$ and trace of the stress energy momentum tensor $T$. Patil et al. [11] have discussed the energy conditions and physical behavior of the universe, and analyzed the Statefinder diagnostic to test the validity of the model in the framework of $f(R,T)$ gravity. Yadav et al. [12], Chirde and Shekh [13], Shaikh and Wankhade [14], Pawar et al. [15], Sharif and Zubair [16], Sahoo et al. [17], Dagwal et al. [18], and Ahmed and Pradhan [19] have worked on different aspects of $f(R,T)$ gravity.

Among the various modifications of Einstein's theory, another one way to look at the theory beyond the Einstein equation is the

Teleparallel Gravity (TG) which uses the Weitzenbock connection in place of the Levi–Civita connection and so it has no curvature but has torsion which is responsible for the acceleration of the Universe. In recent past, a number of authors, Bhoyar et al. [20], Shekh and Chirde [21], Bamba et al. [22], Cai et al. [23], Rezazadeh et al. [24], Godonou et al. [25], Bhatti et al. [26], Zubair and Waheed [27], Myrzakulov [28], Sharif and Rani [29], Dagwal and Pawar [30], Pradhan et al. [31], Mandal and Sahoo [32], Shaikh et al. [33] have investigated $f(T)$ gravity in so many different aspects. Yadav et al. [12], Kumar [34], Shaikh and Wankhade [14], Akarsu et al. [35], Dubey et al. [36], Bhoyar et al. [37], Azizur Rahman and Ansari [38] have used hybrid expansion law of scale factor to get the exact solution of field equations in different theories of gravitation, which motivated us to use the hybrid expansion law in this work also.

## $f(T)$ Gravity Formalism:

Here, we provide a detailed derivation of the field equations for the f(T) gravity along with a brief description of it. Moving forward, we will define the Greek and Latin superscripts and subscripts as referring to the space-time coordinates and the tetrad field, respectively. The line element for a general space-time metric can be defined as

$$ds^2 = g_{\mu\nu}dx^\mu dx^\nu \tag{1}$$

This line element can be converted to tetrads - the Minkowski's description of the transformation, as follows

$$ds^2 = g_{\mu\nu}dx^\mu dx^\nu = \eta_{ij}\theta^i\theta^j \tag{2}$$

$$dx^\mu = e_i^\mu\theta^i\ ,\ \theta^i = e_\mu^i dx^\mu \tag{3}$$

where $\eta_{ij}$ is a metric on Minkowski space-time and $\eta_{ij} = diag[1,-1,-1,-1]$ and $e_i^\mu e_\nu^i = \delta_\nu^\mu$ or $e_i^\mu e_\mu^j = \delta_i^j$. The root of the metric determinant is given by $\sqrt{-g} = \det\left[e_\mu^i\right] = e$. For a manifold in which the Riemann tensor part without the torsion terms is null (contribution of the Levi-Civita connection) and only the non-zero torsion terms exist, the Weitzenbocks connection components are defined as

$$\Gamma_{\mu\nu}^\alpha = e_i^\alpha\partial_\nu e_\mu^i = -e_\mu^i\partial_\nu e_i^\alpha \tag{4}$$

This has a zero curvature but nonzero torsion. Through the connection, we can define various components of the torsion tensors as

$$T_{\mu\nu}^\alpha = \Gamma_{\mu\nu}^\alpha - \Gamma_{\nu\mu}^\alpha = e_i^\alpha\left(\partial_\mu e_\nu^i - \partial_\mu e_\mu^i\right) \tag{5}$$

The difference between the Levi-Civita and Weitzenbock connections is a space-time tensor and is known as con-torsion tensor:

$$K_\alpha^{\mu\nu} = \left(-\frac{1}{2}\right)\left(T^{\mu\nu}{}_\alpha + T^{\nu\mu}{}_\alpha - T_\alpha^{\mu\nu}\right) \tag{6}$$

For facilitating the description of the Lagrangian and the equation of motion, we can define another tensor $S_\alpha^{\mu\nu}$ from the components of the torsion and con-torsion tensors as

$$S_\alpha^{\mu\nu} = \left(\frac{1}{2}\right)\left(K^{\mu\nu}{}_\alpha + \delta_\alpha^\mu T^{\beta\nu}{}_\beta - \delta_\alpha^\nu T_\beta^{\beta\mu}\right) \tag{7}$$

The torsion scalar $T$ is

$$T = T_{\mu\nu}^\alpha S_\alpha^{\mu\nu} \tag{8}$$

Now we define action by generalizing the Tele-parallel Theory i.e. $f(T)$ theory as

$$S = \int\left[T + f(T) + L_{matter}\right]e\ d^4x \tag{9}$$

Here $f(T)$ denotes an algebraic function of the torsion scalar $T$. Making the functional variation of the action in equation (9) with respect to the tetrads, we get the following equations of motion

$$S_\mu^{\nu\rho}\partial_\rho T f_{TT} + \left[e^{-1}e_\mu^i\partial_\rho\left(ee_i^\alpha S_\alpha^{\nu\rho}\right) + T^\alpha{}_{\lambda\mu}S_\alpha^{\nu\lambda}\right]\left(f_T\right) + \frac{1}{4}\delta_\mu^\nu\left(f\right) = 4\pi T_\mu^\nu \tag{10}$$

where $T_\mu^\nu$ is the energy momentum tensor and $f_T = df(T)/dT$. The field equation (11) is written in terms of tetrads and their partial derivatives and appears very different from Einstein's equation. But by setting $f(T) = a_0 = \text{constant}$, this is dynamically equivalent to the GR.

**Metric, components of field equations and Kinematical parameters:**

In our work, we consider the spatially homogeneous and isotropic Friedman-Robertson-Walker (FRW) line element of the form

$$ds^2 = dt^2 - a^2(t)\left[\frac{dr^2}{1-kr^2} + r^2\left(d\theta^2 + \sin^2\theta\, d\phi^2\right)\right], \tag{11}$$

where $a(t)$ is the scale factor, $\theta$ and $\phi$ are the usual azimuthal and polar angels of the spherical co-ordinate system, the curvature constant $k$ represents closed, flat and open models of the universe for $k=+1$, $k=0$ and $k=-1$ respectively. In view of above universe in this work, we deliberate on the flat universe, so take $k=0$ with infinite radius.

The energy momentum tensor for perfect fluid is taken as

$$T_\mu^\nu = (p+\rho)u^\nu u_\mu - pg_\mu^\nu \tag{12}$$

with commoving coordinates $u^\nu = (0,0,0,1)$ and $u^\nu u_\nu = 1$,

where $u^\nu$ is the four-velocity vector of the fluid, $p$ and $\rho$ are pressure and energy density of the fluid respectively, and are functions of time $t$. The universe is filled with perfect fluid which leads to

$$\omega = p/\rho, \tag{13}$$

where $\omega$ is equation of state (EoS) parameter.

The corresponding Torsion scalar is obtained as

$$T = -6H^2 \tag{14}$$

where $H = \frac{\dot{a}}{a}$ is the Hubble parameter and overhead dot (.) represents derivative with respect to time $t$.

From the equation of motion (10), Friedman equation for stress energy tensors (12) can be written as

$$\frac{1}{4}(f+T) + (1+f_T)\left(\frac{\ddot{a}}{a} + 2\frac{\dot{a}^2}{a^2}\right) + \left(\frac{\dot{a}}{a}\right)\dot{T}f_{TT} = -4\pi p \tag{15}$$

$$\frac{1}{4}(f+T) + 3(1+f_T)\left(\frac{\dot{a}^2}{a^2}\right) = 4\pi\rho \tag{16}$$

We are having two differential equations with five unknowns as $T, f, a, p$ and $\rho$.

For the FRW cosmological model, we now define a few kinematical quantities that are crucial for cosmological observations.

The relation between average scale factor and spatial volume is given by

$$V = a^3 \tag{17}$$

The deceleration parameter (DP), denoted by $q$, indicates whether or not the cosmos exhibits accelerating volumetric expansion, is another significant dimensionless kinematic quantity and is given by

$$q = -1 + \frac{d}{dt}\left(\frac{1}{H}\right) \tag{18}$$

The universe exhibits accelerating volumetric expansion, decelerating volumetric expansion, and constant-rate expansion for $-1 \le q < 0$, $q > 0$ and $q = 0$ respectively.

In the directions of the *x*, *y*, and *z* axes, respectively, the directional Hubble parameters are $H_1 = H_2 = H_3 = \frac{\dot{a}}{a}$.

The universe's volumetric expansion rate is expressed by the mean Hubble parameter,

$$H = \frac{1}{3}(H_1 + H_2 + H_3) = \frac{\dot{a}}{a} \tag{19}$$

For discussing whether or not the universe approach isotropy, the mean anisotropy parameter is defined as

$$\Delta_m = \frac{1}{3}\sum_{i=1}^{3}\left(\frac{H_i - H}{H}\right)^2 \tag{20}$$

The expansion scalar $(\theta)$ and shear scalar $(\sigma^2)$ are respectively defined as

$$\theta = 3\frac{\dot{a}}{a} = 3H \tag{21}$$

$$\sigma^2 = \frac{3}{2}H^2\Delta_m \tag{22}$$

**Solution of field equations:**

The exact solutions of the field equations in equations (15) and (16) can be obtained by solving the system of non-linear differential equations and for that one can assume an arbitrary mathematical hypothesis about a state that corresponds to some physical situation. As previously noted, we have employed the hybrid expansion law of scale factor to solve the field equations. The power-law and exponential law cosmologies are limited to explaining the evolution of the universe during specific epochs due to the constancy of deceleration parameter (DP) and also not exhibit the universe's transition from deceleration to acceleration. Kumar [34] and Akarsu et al. [35] used the following type of scale factor to explain such a transition:

$$a = \eta t^n e^{\xi t}, \tag{23}$$

where $\eta > 0$, $n \geq 0$ and $\xi \geq 0$ are constants.

This form of scale factor in equation (23) is called as hybrid expansion law, and for $n = 0$, it leads to exponential-law cosmology whereas for $\xi = 0$, the power-law cosmology.

Using equation (19) along with above equation (23), the mean Hubble parameter is obtained as

$$H = \left(\xi + \frac{n}{t}\right). \tag{24}$$

Also, we take into consideration, the linear model of $f(T)$ gravity, viz. $f(T) = T$, where $T$ is the torsion scalar [20, 39].

The model's isotropic pressure is obtained by using equation (15) as

$$p = -\frac{3}{4\pi}\left(\xi + \frac{n}{t}\right)^2 + \frac{n}{2\pi t^2}. \tag{25}$$

The model's energy density is determined by using equation (16) as

$$\rho = \frac{3}{4\pi}\left(\xi + \frac{n}{t}\right)^2. \tag{26}$$

From above equation (26), it is clear that the energy density of the derived model is always positive. Also, it can be observed that the energy density is a function of time and gets decreasing as universe expands. At initial when universe starts to expand $(t = 0)$, the energy density of the model $\rho \to \infty$ and with the increase of time, i.e. with the expansion of the universe, it approaches to a small positive value.

The equation of state parameter (EoS), using equations (25) and (26), is obtained as

$$\omega = -1 + \frac{n}{2\pi t^2}. \tag{27}$$

The observational results derived from SNe-Ia data and a combination of SNe-Ia data with - CMB anisotropy and Galaxy clustering statistics, yielded some constraints on the equation of state parameter (EoS), which are $-1.66 < \omega < -0.62$ and $-1.33 < \omega < -0.79$, respectively. In the derived model, from equation (27), it can be observed that the EoS parameter is time dependent, and for proper choice of constant $n = 0.06$, the EoS parameter ranges from $-0.99 < \omega < -0.76$, which is in complete agreement with the above observational data. Hence the derived model represents quintessence region $(\omega > -1)$ and letter on settles to a ΛCDM model $(\omega = -1)$.

The squared velocity of sound, to discuss either model is stable or unstable, is obtained as

$$\upsilon^2 = -1 + \frac{2}{3t}\left(\xi + \frac{n}{t}\right)^{-1}. \tag{28}$$

It is required that the velocity of sound should be less than the velocity of light, i.e. within the range $0 < \vartheta_s^2$. For proper choice of constants: $n = 0.06$ and $\xi = 0.48$, from above equation (28), it is observed that the stability factor for the present model is positive in the initial stage i.e. $\vartheta_s^2 > 0$ and with the increase of time, it takes

negative value i.e. $\vartheta_s^2 < 0$. Hence the derived model is stable at initial stage and with the expansion of universe, as time increases, the model is unstable.

**Kinematical parameters:**

The spatial volume, using equations (17) and (23) is determined as

$$V = \eta^3 t^{3n} e^{3\xi t}. \tag{29}$$

From above equation (29), it can be observed that spatial volume increases with the increase of time, and $V \to \infty$ as $t \to \infty$. Hence the universe is expanding.

Now using equations (21) and (24), the scalar expansion is obtained as

$$\theta = 3\left(\xi + \frac{n}{t}\right). \tag{30}$$

From above equation (30), it can be seen that the expansion scalar is clearly a decreasing function of time. The rate of expansion diminishes with increasing time. Therefore, as time passes, the cosmos continues to expand, although at a slower rate.

The means isotropy parameter $\Delta_m$ and shear scalar $\sigma^2$ are found to be zero.

The deceleration parameter, using equations (18) and (24), is found to be

$$q = -1 + \frac{n}{t^2}\left(\xi + \frac{n}{t}\right)^{-2}. \tag{31}$$

From above equation (31), it is observed that the deceleration parameter is also time dependent. For proper choice of constants: $n = 0.06$ and $\xi = 0.48$, it exhibits decelerating volumetric expansion to accelerating volumetric expansion.

**Conclusions:**

Within the framework of $f(T)$ gravity, we have examined a spatially homogenous and isotropic flat Friedman Robertson Walker (FRW) cosmological model with perfect fluid by using a linear model $f(T) = T$. We used the hybrid expansion law of scale factor to solve the field equations and got the following results:

- The energy density of the derived model is time dependent, always positive and decreases as universe expands.
- From EoS parameter, it is observed that the model represents quintessence region $(\omega > -1)$ and letter on settles to a ΛCDM model $(\omega = -1)$ [40, 41].
- The spatial volume increases with the increase of time and hence the universe is expanding.
- The expansion scalar is decreasing function of time and as time increases, the cosmos continues to expand, although at a slower rate.
- The deceleration parameter exhibits decelerating volumetric expansion to accelerating volumetric expansion. [43].
- The stability factor is positive in the initial stage and with the increase of time, it takes negative value. Hence the derived model is stable at early stage and with the expansion of the universe, as time increases, the model is unstable.

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# Management in Digitalization in India: Futurescope and Development

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**Abstract:**

Advanced Marketing is the term utilized for the focused on, quantifiable, and intuitive advertising of items or administrations utilizing computerized innovations to arrive at the watchers, transform them into clients, and hold them. What's more, when we state advanced promoting, at that point note that the eventual fate of computerized showcasing in India and the extent of computerized advertising in future will get more brilliant in the coming years. A cell phone has become the essential requirement for everybody. As indicated by a study (by Internet and Mobile Association of India (IAMAI)), India will have around 500 million web clients by June 2018. This will make a captivating business occasion to offer administrations and items to a developing populace of well informed web clients. The business is molding out to get one of its sort markets, as the International Journal of Advanced Research Foundation is guaranteeing 2013 to 2018 as the brilliant period of computerized promoting in India. The nation is clearly up for an advanced uprising and truth be told, the financing is now enormous. About $1.5 billion ventures were set apart in the limited capacity to focus 2013 to 2015 towards Indian organizations. Advanced Marketing and publicizing is impacting people groups to purchase and sell on the web and internet business is getting an ever increasing number of deals.

**Keywords:** Advanced marketing, management, business, innovations

**Introduction:**

India, a densely populated country with a population of 1,339,180,127 (as of July 2017), is the second most populous country on the planet. There are enough open doors that are made every moment for individuals. To build a spa, everyone needs to promote their products and management through the web. Unlike the traditional introduction, these are important advantages that make this advertising method more effective and moderate. According to an overview (Internet and Mobile Association of India (IAMAI)), India has around 500 million internet customers as of June 2018. This makes it an exciting business opportunity to provide management skills and products to an evolving, technical Internet customer. In short, how is enhanced advertising not quite the same as regular advertising.

Involved organizations publicizing their objects or management in print media, radio and television advertisements, business cards, billboards and various corners where the Internet or online media were not used for advertising. Conventional sales promotion methods have limited the reach of customers and the purchasing behavior of customers.

Web-based media has grown to be the most common result of the Internet because people all over the world want to broadcast and share their extraordinary minutes, problems, thoughts and suggestions with others. In addition, they want to find out about some places worth visiting, other art projects, plans or some other dialect. Online media allows you to deliver your crucial content to the right audience when it suits you. This proliferation of online media has excited business people around the world with the possibility of small online organizations. You can open a store on Amazon, eBay or through other usual steps like Shopify or Etsy. However, the main test is to find customers. There are a variety of ways to list items on Google, Bing, or another online directory. Be that as it may, another company with solid competitors will have to put in a lot of effort to achieve a high position in the indexed quotations.

**Objectives:**

1. To know the eventual fate of advanced promoting will be splendid in India,
2. To analyze the Scope of Digital Marketing,
3. To talk about the Mobile Marketing,
4. To specify the Video Marketing

**Rule of Social Media Marketing**

Long range informal communication sites are an extraordinary answer for this test. The essential method here is to share connecting with posts and the correct substance made for the ideal crowd. At that point the crowd helps by sharing the substance further, which thus arrives at further.

Henceforth there is another choice of publicizing the item, administrations, or thoughts on the person to person communication sites where there is less level of rivalry.

**Reasons why eventual fate of advanced showcasing is brilliant**

**Drastic changes in conventional advertising**

The past customary arrangement of showcasing was restricted to house to house and mouth exposure. Beforehand the advertisers were utilizing actual labor to advance their items. Global Journal of Applied Research 2019; 5(2): 87-93 ~ 88 ~ International Journal of Applied Research And satisfying the necessities of the clients is the most noteworthy need of each business. So the pattern of computerized promoting required off a couple of years back. Individuals and the advertisers are truly going gaga over this advanced promoting pattern. How was the advertising for land prior? It was generally through print media or flags. Be that as it may, presently, all the land monsters lean toward the computerized stage to showcase their merry homes to their clients. On the off chance that we take a gander at the above screen capture of Hiranandani's Facebook page, at that point it is unmistakably obvious that the land goliath is focusing on individuals with continuous pictures. In the event that individuals can see the specific photos of the item, they would expect to get it. Along these lines, we as a whole can unmistakably observe the distinction of how the conventional promoting has seen an uncommon change. Also, it has been taken over totally by advanced advertising.

**Government's "Digital India" initiative backs up**

To change the whole environment of public administrations using data innovation, the Government of India has dispatched the Digital India program with the vision to change India into a carefully enabled society and information economy. The public authority has likewise concocted the application for Employment programs. Everything is going advanced nowadays. Along these lines, on the off chance that we talk about, advanced showcasing vocation in India, at that point you are at the opportune spot. Quit bantering over the decisions and become acquainted with what benefits it holds. The public authority's e-commercial center is additionally observing an extensive ascent in its e-commercial center logical charts. The changes occur at each spot. Individuals in India are getting to the innovation gradually and it will require some investment to get to know it.

**Reaching worldwide business sectors**

Furthermore, this is the truth. The scope of these web-based media stages is gigantic to such an extent that you can interface with nearly everybody now. So the sky is the limit with web-based media. As such, there's a ton occurring in India's advanced advertising space. Numerous individuals are discussing it and looking for it too.

**Institutions concocting Digital Marketing courses**

Numerous organizations are these days presenting degree courses in computerized advertising that has a down to earth approach. The scholarly courses are private and online both. Mudra Institute of Communication is India's highest school to learn correspondence. Additionally, it offers courses in marking and promoting. Indeed, even numerous computerized advertising offices presently have their own foundation where they show advanced promoting to the planned understudies. It is as basic, when there is request, there has to a legitimate inventory. The interest for advanced promoting is on the ascent and the individuals who know are concocting thoughts to prepare the understudies.

**Small towns getting carefully prepared**

Presently as the extent of computerized showcasing is expanding, the towns and urban areas are likewise getting profoundly associated with advanced mediums. Many new businesses are getting dispatched in little urban areas and they are contacting the worldwide crowd through web-based media. On the off chance that we take an illustration of online entryway Scoop Whoop, it was begun by Sattvik Mishra and 5 others in August 2013 in Delhi. Yet, the manner in which they were composing their substance and posting it via web-based media made them begins for the time being. Everybody in the nation is a devotee of substance that this online interface is creating.

**Affordable**

Contrasting it and other showcasing stages, computerized advertising is quite possibly the most reasonable media to advance the item. Gone are the days when one was burning through thousands and lakhs n getting the promotion imprinted in the paper? With computerized media, it has gotten so natural. On the off chance that you are a land organization, you can advance your new venture via web-based media by arriving at a great many individuals all at once. Making an advertisement on Facebook scarcely costs around Rs.40 every day, which isn't anything. Normal expense per click is Rs.0.52 to Rs.2.3. Spending lakhs of rupees on a solitary promotion and spending just Rs.40 every day can give great outcomes. Numerous enterprises and new businesses, all are intensely putting resources into the computerized showcasing exercises. They are searching for individuals who can devise and actualize advanced advertising procedures that suit their requirements.

**Growth of internet users**

The above chart obviously says everything. It has been anticipated that the number web clients are to get multiplied by 2022. This is on the grounds that, the rate in which the nation is filling as far as

everything, individuals will be vigorously reliant on the web in the coming years.

All the incomes will be multiplied by 2020 in the field of computerized showcasing. Thusly, to place yourself in the driving seat, all the Indian business must be well-more terrible with computerized showcasing to speak to the nation in the worldwide commercial center. Businesses as well as the up-and-comers who are searching for a profession opportunity in this field can secures lakhs of positions in practically all the urban areas. Advanced Marketing will stay as the most impressive method of showcasing later on. Be that as it may, as the elements of computerized showcasing is changing each day, an advanced advertiser must be deft, alarm, and shrewd and adjust to most recent changes.

**Mobile Marketing**

Google, the greatest web crawler, has moved its concentration to versatile first file, and each advanced organization India has no alternative except for to pay attention. Insights for the US as of now show that 72% of all US computerized advertisement spending by 2019 will be for versatile publicizing. That is not exactly a year away, and Indian advertisers are completely mindful of the capability of promoting straightforwardly to an individual client. Advertising Land has obviously expressed in any event, for disconnected buys, 90% of customers, possessing a Smartphone, will go to the online medium to arrive at a choice. This is the intensity of computerized advertising those organizations and showcasing experts should use later on to remain in the retribution. Computerized showcasing diagram uncovers that Social media has been assuming a supporting part to promoting. Throughout the long term, it has been seen that 92% of web-based media clients are from the cell phones. This empowers the size of advanced promoting enterprises.

**Digital Marketing and Advertising**

Computerized Marketing and promoting is impacting people groups to purchase and sell on the web and online business is getting an ever-increasing number of deals. With a howdy development through Digital promoting in business organizations have starter spending increasingly more in Digital advertising as they are improving ROI in Digital medium contrast with conventional, another significant advantage is generally the cost and return are quantifiable which is absurd in Traditional Marketing. Appeal of Managing Companies action over Online advertising and improve organization perceivability has opened another entryway or opportunity. Request are higher at that point supply so Peoples have one new profession stream as Digital Marketer which is adaptable and giving high vocation development. Computerized

**Conclusion:**

Marketing is a fast profession development in India as well as all through the world. Organizations are getting increasingly more needy over web to create quicker income for their business. As utilization of web is a lot of it is clear sign that the computerized promoting administrations will keep on encountering gigantic development and changes. Organizations in India need to grasp the advanced changes and receive the moving developments to remain serious and oblige an enormous number of web clients.

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# Librarian's Involvement In Scholarly Communication Beyond Traditional Library Roles : A Systematic Literature Search

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**Introduction:**

Librarians are increasingly recognized as valuable research partners in academic and professional settings. Their roles extend beyond traditional library services to actively contributing to various stages of the research process. Librarians teach researchers how to effectively locate, evaluate, and use information. This includes training on database searching, citation management, and critical appraisal of sources. Some librarians specialize in research design and can provide guidance on methodologies, data collection, and analysis techniques. They often collaborate with researchers to refine research questions and design robust studies. Librarians play a crucial role in conducting systematic reviews and meta-analyses. They help develop comprehensive search strategies, identify relevant databases, and manage large volumes of references. Librarians assist in managing research data, including data organization, storage, and sharing. They advise on data management plans and best practices for data preservation and access. Librarians support researchers in identifying funding opportunities and crafting grant proposals. They provide insights into funding databases and help researchers meet funding agency requirements. Librarians help researchers navigate the complex landscape of scholarly publishing, including open access, copyright, and author rights. They offer guidance on selecting appropriate journals and maximizing research impact.

Librarians assist in measuring and enhancing the impact of research through citation analysis, altmetrics, and other tools. They help researchers track their publications' reach and influence. With expertise in digital tools and technologies, librarians support digital humanities projects, data visualization, and the use of multimedia in research. Librarians facilitate interdisciplinary research by connecting researchers from different fields and providing access to diverse resources and knowledge bases. Librarians offer guidance on ethical and legal issues related to research, such as plagiarism, intellectual property, and research integrity. By leveraging their expertise, librarians enhance the quality and efficiency of research, making them indispensable partners in the research process.

**Objectives of the Study:**

The objective of this study is to analyze the roles played by librarians in research activities beyond providing traditional library services

**Methodology:**

An extensive literature search was conducted to find research articles on the involvement of librarians in research activities, scholarly communication, and addressing plagiarism. Keywords such as "involvement of librarians in research," "plagiarism," "other than library publications," "scholarly communication," "beyond librarianship," "multiple roles," and "research partners" were used in the search. The selected articles underwent a literature review using both primary and secondary resources.

**Findings**

The Literature searched on the involvement of librarians in research is as following. It involves the participation of librarians in research support activities such as data management, prevservation; Scholarly communication such as open access resources, open educational resources, publications; plagiarism prevention, software use, copyright guidelines, etc. The studies undertaken are as follows;

**Research:**

In 2019, Dalbehera conducted a survey to analyze research data management methods and services provided by six libraries at Odisha Technical University. The survey received 545 responses from 650 research scholars. It aimed to examine how these libraries manage and organize research data to facilitate reuse and sharing. The findings indicate that the libraries provide RDM support through services such as data analysis, visualization, mining, GIS, and geospatial analysis, in addition to general library services.

A research project funded by ACRL Impact used a mixed-methods approach to explore the perspectives of librarians on the impact of academic libraries. The study involved a literature review, focus group interviews with library administrators, and interviews with provosts. The research found

differences in attitudes between librarians and administrators regarding the perceived usefulness of research impact. Additionally, the study found that academic libraries contribute to enhancing students' academic success, managing research data, and influencing decisions related to funding and student retention (Cheng & Hoffman, 2020).

A study analyzed articles from the Library and Information Science and Research Administration fields published between 2012 and 2017. The goal was to compare the involvement of librarians and research administrators in each other's activities as portrayed in the literature. The findings indicated that RA articles often mentioned librarians and libraries in discussions on research support, undergraduate research programs, research data management, and scholarly communications. After analyzing the articles, five major topics emerged in both bodies of literature: research funding, research impact, research methodologies, research infrastructure, and the use of research (Bradley, 2018).

A survey of 95 librarians, researchers, students, educators, and managers revealed that assisting researchers benefits librarians by providing more research time, strengthening their role, demonstrating the library's value, and enhancing the institution's reputation. To promote research, librarians use strategies such as improving discoverability, using social media, and assisting with consultations, workshops, and integration with faculty. Respondents suggested that publishers could contribute by organizing workshops, providing collateral and guides, and sharing promotional tips with researchers. (AIP Publishing, 2020)

In 2014, Pinfield conducted a study on the roles and relationships of librarians in managing research data. The study used qualitative methods and data from 26 interviews with library practitioners. The findings revealed that libraries play a significant role in managing research data, with some uncertainty in their relationships with other stakeholders. RDM programs focus on policies, guidelines, technology, storage, security, compliance, preservation, and sharing, with libraries closely involved. The study also identified various factors influencing ongoing RDM developments and constructed a model to capture the main aspects of an institutional RDM program.

The study outlines the responsibilities of a data librarian in managing research data and e-research in New Zealand. It used qualitative case research and semi-structured interviews to examine the data librarian's role. The findings contribute to a better understanding of the data librarian's role and can be used to improve professional practice and develop relevant education and training programs (Ojhaji, Chawner & Yoong, 2019).

Bunker & Bhut in 2020 conducted a survey was to understand the opinions of researchers and educators at Parul University concerning research data management and sharing. The survey aimed to discover how researchers store their data for future use and identify initiatives librarians can undertake to support and improve research data management. 88 out of 100 respondents completed the survey. The findings indicate that most respondents agree to share research data for browsing and reusing. Furthermore, researchers express their interest in the library's participation in organizing and preserving research data. However, researchers and faculty members have concerns about protecting intellectual property rights when sharing data publicly.

In a research study, the role of health sciences librarians in conducting research was explored. The findings revealed that 79% of health sciences librarians read research articles every month, 58% apply research studies to their work, and 44% conduct research themselves. Hospital librarians demonstrated less engagement in research activities compared to their academic librarian counterparts. The study emphasized the importance of research benefits and the potential for practitioners to use research results to improve their services. The authors recommended further research to support and expand upon their findings. (Lessick, 2016)


Figure 1: Involvement of Libraians in Resaerch Activities

**Scholarly Communication**

A survey was sent to 4,643 librarians and archivists at 91 academic institutions in the United States, and 603 responses were collected. The survey explored the mediums used for research dissemination, teaching responsibilities, and types of publications valued for tenure evaluation. It also looked into the channels employed by respondents to share their research and best practices within the field. (Sugimoto, 2014)

In 2017, Fitzgibbons, Kloda, & Miller-Nesbitt conducted a study on librarian participation in journal clubs. They interviewed 20 librarians involved in 18 different journals. The study found that librarians benefited from participating in journal clubs by developing knowledge and professional skills, acquiring research skills, and enjoying social interaction. It also showed that journal clubs had group impacts, such as preserving learning time and promoting a "research culture." Additionally, participating in journal clubs had positive effects on library users, leading to the introduction of user-centric initiatives and improved librarian capabilities.

A SurveyMonkey survey was conducted with 689 faculty members from the Virginia Community College System, resulting in 338 responses. The survey aimed to understand librarians' support for Open Educational Resources (OER) and their involvement in OER roles. Statistical analysis using SPSS software revealed that librarians were actively engaged in traditional roles and were involved in mentoring and policy development for OER. Faculty members expressed support for the advocacy role played by librarians in OER. (Braddlee, & VanScoy, 2019)

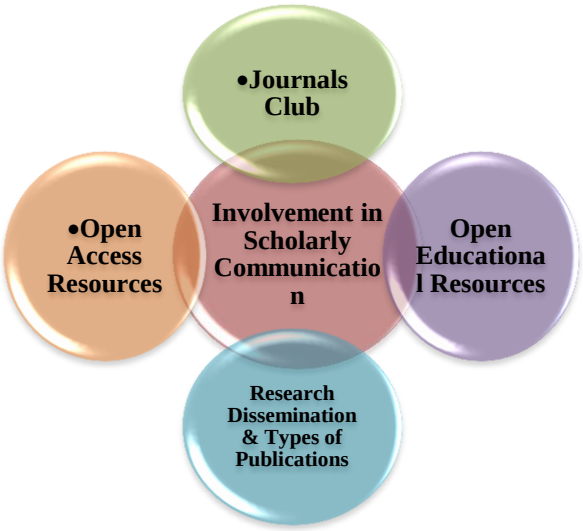


Figure 2: Involvement of Libraians in Scholarly Communication

**Plagiarsim**

The writer discusses instances of plagiarism in Indian Ph.D. theses, covering various forms of plagiarism and providing real-life examples. It also outlines guidelines for proper research paper publication and explores the role of librarians in preventing plagiarism. (More, 2008)

The study aims to understand why university scholars in Pakistan engage in the unethical use of literature and what measures are being taken to prevent plagiarism in higher

education institutions. Interviews were conducted with nine university library heads in Pakistan, who oversee anti-plagiarism software services like Turnitin. The study found that factors such as a lack of understanding of plagiarism, inadequate information literacy skills, socio-cultural influences, and insufficient policies contribute to unethical research behavior among graduate scholars. The participants expressed hope that university libraries can combat plagiarism by providing anti-plagiarism software and guidance for researchers. (Mansoor, Ameen & Arshad, 2022)

An exploratory survey was conducted to identify the roles of librarians in guiding students to avoid plagiarism. Over 90% assist students with citing sources, while over 70% instruct students about plagiarism. Additionally, 75% of librarians collaborate with other departments, attend workshops, work with instructors to redesign assignments, and help faculty track instances of student plagiarism (Gibson & Chester-Fangman, 2011).

In 2020, a study was conducted to examine the role of librarians in preventing plagiarism in NIRF-ranked engineering institutions. 200 librarians were surveyed, with 110 valid responses. The study found that 81% of respondents found plagiarism awareness programs highly effective. 89% of institutions had plagiarism policies, and 38% used plagiarism detection software. Various methods were used to raise awareness, and a high percentage of librarians delivered lectures and conducted meetings on plagiarism prevention (Jilani & Ahmad, 2021).

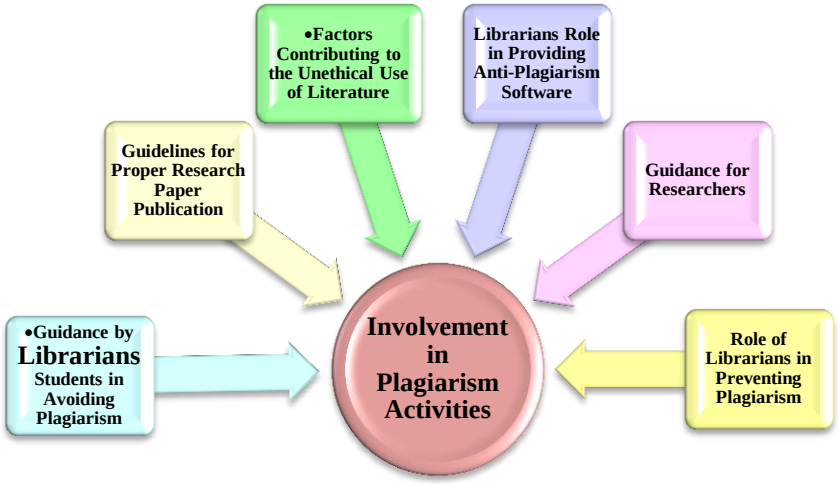


Figure 3 : Involvement of Libraians in Plagiarism Activities

**Conclusion:**

The literature review above shows that librarians are broadening their roles beyond traditional library services to provide significant support to researchers. They are actively involved in activities to prevent plagiarism and participate in scholarly communication by offering guidance in the publication process. Librarians now take on diverse roles, including co-researchers, data organizers, scholarly communicators, copyright advisors, plagiarism managers, data analysts, data miners, research promoters, infrastructure managers, policy makers, research funding finders, research publication supporters, research project detectors, open access resources guides, open educational resources supporters, journal club members, plagiarism detectors, plagiarism software managers, and plagiarism preventers and guiders. Librarians offer a wide range of services and support beyond what is typically expected from library professionals.

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# A Review on Transition from pristine copper sulphide to copper sulphide-reduced graphene oxide (CuS-rGO) nanocomposite in electrode materials

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**Abstract:**

In this review, we provide an overview of the improvement in electrode materials of dye sensitized solar cells (DSSCs), quantum dot sensitized solar cells (QDSSCs) and supercapacitors (SCs) when replacing pristine CuS nanomaterials by its nanocomposites, copper sulphide-reduced graphene oxide (CuS-rGO). An in-situ preparation of the nanocomposite in which sulphur precursor solution is added to the solution containing copper precursor solution and graphene oxide solution is discussed. The role of rGO in improving the photovoltaic performance and charge storing capacity of CuS is investigated. This study is mainly dedicated towards modern synthesis techniques of CuS-rGO nanocomposites and their vast array of applications, and finally, illustration of the future prospect of the wonderful nanocomposite materials.

**Keywords:** *Copper sulphide; Reduced graphene oxide (rGO); dye sensitized solar cells (DSSCs); quantum dot sensitized solar cells (QDSSCs) and supercapacitors (SCs)*

## Introduction:

Nanotechnology made researchers relook into diverse field of research and new developments have been reported in both theoretical research and experimental research. Nanotechnology opens up into many potential renewable energy technologies because of advancement of research in the field of energy conversion in nanomaterials and because the research in the field of renewable energy technology is a responsibility of scientific community with a hope of improving the health of the already deteriorating environment as a result of over-consumption of energy obtained from fossil fuel [1].

There is an improvement in the field of harvesting of solar energy production and new understanding in the field of energy storage. Recent developments in the technique of synthesis of nanomaterials have paved way in the production of finely tuned properties of the nanomaterials. Copper chalcogenides nanomaterials are p-type semiconducting materials with vast applications in the field of solar cells, optical filters, photosensors electrode material in energy-storage devices, and superionic materials.

Copper sulphide (CuS) of any desired stoichiometric phases such as CuS (covellite), $Cu_2S$ (chalcocite), $Cu_{1.75}S$ (anilite), $Cu_{1.96}S$ (djurleite) and $Cu_{1.8}S$ (digenite) have been prepared by many researchers. The structure and morphology of synthesized nanomaterials were greatly influenced by the mode of preparation and because the properties of a material can be controlled by the size and morphology of the materials, it is highly desired that a researcher should know the various techniques of synthesis of a nanomaterial for possible device applications. Different methods of synthesis of copper sulphide have been reported by researchers. In addition to the use of capping agents in controlling the size and properties of nanomaterials, recently the researchers have explored upon new approach of growing one nanomaterial in another nanomaterial substrate to improve the desired properties of the nanomaterials.

In this newly adopted approach the use of pristine graphene (PG), graphene oxide (GO) and reduced graphene oxide (rGO) as a substrate for growth of nanomaterials are widely studied by researchers. One of the objectives of an experimental research is provide an improved result over the existing results. Hence, our aim in this review is to report on the recent developments in the improvement in the synthesis of CuS nanomaterial from 2010 onwards with a special reference to their applications in photovoltaics such as dye sensitized solar cells (DSSCs)/quantum dot sensitized solar cells (QDSSCs) and supercapacitors (SCs).

The various methods of synthesis of CuS will be discussed in this review and how the researchers have improved the properties of CuS for optoelectronic applications from 2010 onwards. CuS-rGO nanocomposites show better photocatalytic properties as compared to pristine CuS [2-5], wonderful catalytic effect in wet hydrogen peroxide catalytic oxidation (WHPCO) processes [6], dopamine biosensors [7], non-enzymatic glucose sensing [8].The size and shape of nanomaterials control their properties and hence their performance in any applications. This is the reason why all synthesized particles have been characterized by the researchers using various

techniques. Crystallite size of synthesized nanoparticles has been calculated using Debye-Scherrer's formula with the data available from X-ray diffraction measurements. Further the optical band gap of the nanoparticles is related to its size as theoretically derived by Louis Bru [9] and the UV-vis spectra of nanoparticles provide information on the direct and indirect energy band gap as calculated from Tauc's plot of the UV-Vis spectra. The structure and morphology of agglomerated nanoparticles were characterized by using transmission electron microscope (TEM), scanning electron microscope (SEM) and their improved version such as high resolution TEM (HRTEM) and field emission SEM (FESEM). The surface roughness of nanosheets and nanofilms is determined using atomic force microscopy (AFM). Once the phase and phase purity, size, structure and morphology of a synthesized material have been studied, the researchers explored the possibility of various applications of the synthesized material and the performance of a material in specific applications are measured using different tools and technique. In this review, we are looking toward the improvement in the applications of CuS nanomaterials in the field of optoelectronic devices and SCs.

The optoelectronic applications of semiconducting nanomaterials include their uses as photoanodes and counter electrodes in DSSCs and QDSSCs. The photovoltaic performance of a solar cell is reported in terms of four parameters measured from J-V characteristics. The four parameters commonly reported on the photovoltaic performance of a solar cell are short circuit current density ($J_{sc}$), open circuit voltage ($V_{oc}$), fill factor (FF) and photoconversion efficiency (PCE). Besides the research on efficient harvesting of solar energy in DSSCs and QDSSCs, the mechanism of storing electric charge electrochemically has dominated the research in the form of supercapacitors (SCs). Supercapacitors are devices that can store electric charge electrochemically with low charging-discharging time.

The charge storage mechanisms in SCs are strongly controlled by the properties of electrode materials and it is a two steps process [10] Firstly, the separation and accumulation of ions at the electrolyte/electrode contact that is characteristic of porous carbonaceous materials and titled to electrochemical double-layer capacitors. The second one is the redox reactions from electroactive species that are accompanied by using conductive polymers, metal oxides/hydroxides, or metal sulfides as electrode materials and so-called pseudo-capacitors. Based upon the charge storage mechanisms, SCs are classified into two main types: electric double layer capacitor (EDLC) and pseudocapacitor. A hybrid type of EDLC and pseudocapacitor was also introduced [11]. In this review, we provide an overview of the recent works of researchers on improving the electrode material using CuS nanomaterials and CuS-rGO nanocomposites. An enhancement in specific capacitance of CuS is observed when its structure and morphology is modified using GO and rGO as substrate for growth of CuS.

**Methodology:**

This paper focuses on the recent improvements in the photovoltaic properties and charge storing properties of copper sulphide nanomaterials. The synthesis techniques of CuS-rGO composites adopted by various researchers were investigated from relevant research publications related to the morphology, crystallinity structure. In the present study we identified the commonly adopted technique of synthesis of copper sulphide-reduced graphene oxide nanocomposites (CuS-rGO and $Cu_2S$-rGO). To carry out this study we have to extract accurate information from trusted and relevant research articles which are available in different databases such as ScienceDirect, Springer and ResearchGate, Archives, AIP.org, etc. Permission to reproduce the related graphs and diagrams were duly sought from the publishers or authors of the articles.

**Results And Discussion**

**Synthesis techniques of CuS-rGO nanocomposites**

Several techniques were reported in the synthesis of CuS/rGO nanocomposites, such as hydrothermal [12-19], solvothermal [20-22], sonochemical [23-25], laser assisted method [26], biomolecule-assisted method [44] and microwave assisted method [4]. In this section we are interested in the synthesis techniques of CuS-rGO nanocomposite. So our search for research articles includes the use of keywords. We analyze the objectives of the research works and if it related to fabrication of DSSCs and QDSSCs, the paper is critically reviewed and the key information from the research works is extracted and stored in tabular formed. A comparative study of the synthesis techniques is undertaken and reported. CuS-rGO nanocomposites are widely prepared by hydrothermal method. In this method, graphene oxide solution is prepared in water-butanol solution. Copper precursors solutions such as copper sulphate, copper chloride, copper nitrate solution and sulfur precursors solution such as sulphur powder, thiourea were prepared separately.

Graphene oxide solution was added first to copper precursor solution with constant stirring then sulphur precursor solution of higher molarity is added to the homogeneous mixture of copper precursor solution and graphene oxide solution. The mixture is stirred vigorously for certain duration of time and transferred to Teflon-lined stainless steel

autoclave and hydrothermally treated at certain temperature. The effect of concentrations of copper precursor solution, sulphur precursor solution and graphene oxide solution on the physicochemical properties such as shape, size and crystallinity of the CuS-rGO nanocomposite is investigated. Further the effect of autoclave temperature on the photovoltaic properties and supercapacitor properties of is also studied. A summary of the hydrothermal method of synthesis of CuS-rGO using different copper and sulphur precursors is given in Table 1.The presence of rGO directly modifies the morphology of CuS because rGO nanosheets restrict the growth and aggregation of CuS nanoclusters [14]. With the increase in the quantity of graphene oxide added to the solution of the precursors, agglomeration of CuS nanoparticles is prevented [17]. The ability of rGO sheets to control growth and aggregation of CuS nanoparticles is because the rGO nanosheets act as conductive, elastically strong and electrochemically active substrate. The other methods of production of CuS on rGO also confirmed the role of rGO nanosheets in controlling the size of CuS nanoparticles.

**Table 1.** The Role of rGO nanosheets in controlling the morphology of CuS nanoparticles as synthesized by hydrothermal method

| Copper precursor (conc) | Sulphur precursor (conc) | GO (g) | Shape | Grain Size (nm) | Autoclave Temp. ( °C) | Time (h) | Ref. |
|---|---|---|---|---|---|---|---|
| Copper acetate (1mmol) | Thiourea (5mmol) | 50 | Highly agglomerated CuS in rGO sheet | | 200 | 24 | [17] |
| Copper acetate (1mmol) | Thiourea (5mmol) | 100 | No agglomeration | | | | [17] |
| Copper acetate (1mmol) | Thiourea (3mmol) | 50 | Spherical nanoparticles wrapped in rGO sheets | 29 | 180 | 12 | [18] |
| Copper acetate | Thiourea | 30 | Wrinkled sheets | 32.9 | 180 | 24 | [12] |
| Copper nitrate (1mmol) | Thiourea (2.5 mmol) | 20 | Nanoplates with flower-like CuS structures | | 150 | 24 | [16] |
| Copper nitrate (1mmol) | Thiourea (2.5 mmol) | 40 | | | | | [16] |
| Copper nitrate (1mmol) | Thiourea (2.5 mmol) | 150 | | | | | [16] |
| | | | Crumpled RGO sheets loosely packed together | | | | [13] |
| nitrate trihydrate (Cu(NO3)2·3H2O , | thiourea | 46 | nanowires wrapped by rGO nanosheets | | 145 | 6 | [14] |
| $CuCl_2$ (1mmol) | Thiourea (2mmol) | 50 | Wrinkled sheets | 17 | 120 | 12 | [15] |
| $CuCl_2$ (1mmol) | Thiourea (2mmol) | 50 | Pentagon, hexagon and near-sphere supported on rGO nanosheets | 20-30 | 60 | 24 | [21] |

The morphology of CuS-rGO nanocomposites are studied using FESEM. The shape of the nanoparticles in their agglomeration is observed. The ability of rGO in preventing agglomeration of the CuS aggregation is clearly seen in Figure 1.

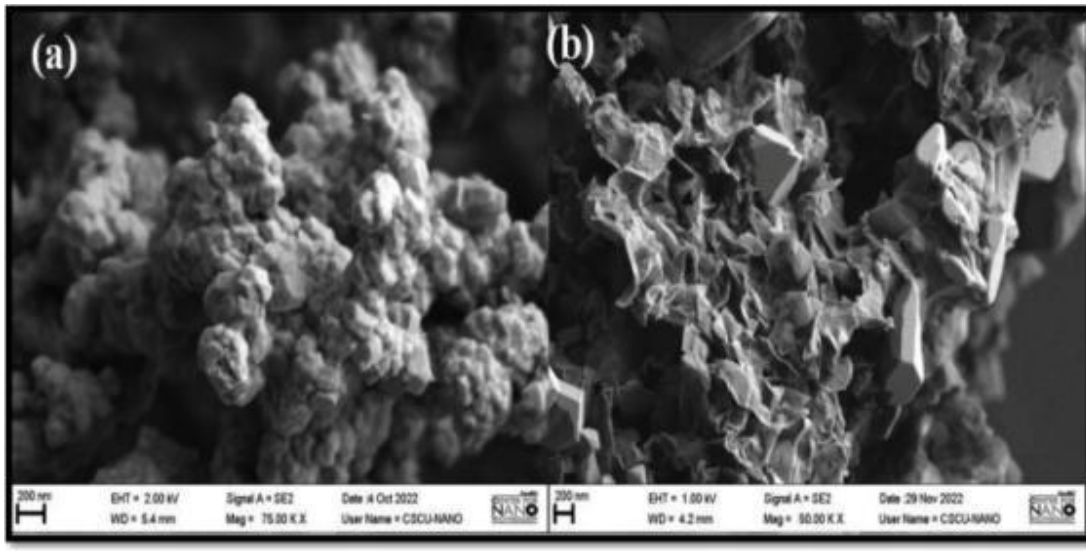


**Figure 2.** FESEM images of (a) CuS which shows hexagonal structure and (b) CuS-rGO which shows wrinkled sheets, reproduced from ref. [12]

**Applications of CuS-rGO in DSSCs and QDSSCs.**

DSSC was primarily introduced by O'Reagan and Gratzel in 1991 [27]. A typical DSSC consists of a photoanode made of wide band gap (WBG) semiconducting material grown on transparent substrate commonly known as transparent conducting oxide (TCO), a dye or sensitizer which is attached to the WBG semiconducting material, an electrolyte which is the source of electrons to the photoionized dye and a counter electrode which reintroduce the electron from external circuit to the oxidized electrolyte as shown in Figure 2.

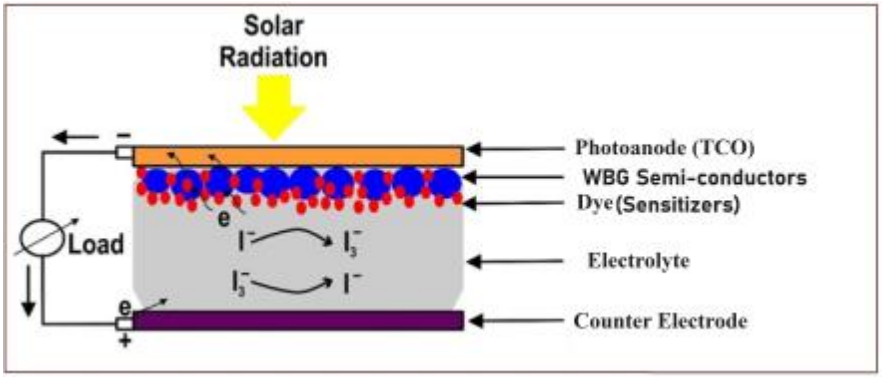


**Figure 2.** Construction of a dye sensitized solar cell (DSSC).

The efficiency of a DSSC depends on the performance of each component: the light harvesting ability of photoanode, the photovoltaic effect in the semiconducting material and the ability of the counter electrode or cathode to inject electrons from external circuit to the electrolyte. The commonly used WBG materials are metal oxides and pristine chalcogenides like PbS [28], NiS [29]. Recently CuS nanoparticles of different morphology have been introduced as photoanode and counter electrode. But CuS has a comparatively low conductivity, and huge volume variation amid charge/discharge process this become a difficulty to the promising application for photovoltaic [18]. This property of pristine CuS limits the efficiency of a solar cell. Many researchers have investigated on how to improve the conductivity of CuS and also how to improve volume retention after few cycles of operation or charge/discharge process. From available literature, researcher have reported that one way of improving photovoltaic performance of CuS as photoanode or as counter electrode material is by means of preparation of CuS such as controlling the microtopography of CuS surface by SILAR method [30], treatment of CuS surface with hydrohalic acids [31]. Recently the researcher explored on the use of nanocomposites to improve photovoltaic performance of DSSCs and QDSSCs. In this section we reported on the enhancement of photovoltaic performance of a DSSC by replacing pristine CuS photoanode with CuS-rGO nanocomposites. This is illustrated in the Table 2

**Table 2.** Enhancement in photovoltaic performance of CuS when modified to CuS-Graphene and CuS-rGO nanocomposites

| Counter electrodes | Sensitizers | Electrolyte | $J_{sc}$ ($mA/cm^2$) | $V_{oc}$ (V) | FF (%) | PCE (%) | Ref |
|---|---|---|---|---|---|---|---|
| CuS | N719 dye | Iodide/triiodide | 11.1 | 0.64 | 56.1 | 4.27 | [18] |
| CuS/rGO composites on FTO | N719 dye | Iodide/triiodide | 16.0 | 0.71 | 70.1 | 7.81 | [18] |
| CuS/Graphene on glass substrate | N719 dye | Iodide/triiodide | 10.33 | 0.708 | 66 | 4.83 | [32] |
| $Cu_2S$ | CdS/CdSe-QD-assembled TiO2 | Polysulfide electrolyte | 18.19 | 0.569 | 38.1 | 3.94 | [33] |
| $Cu_2S$-rGO | CdS/CdSe-QD-assembled TiO2 | Polysulfide electrolyte | 24.9 | 0.503 | 42.1 | 5.24 | [33] |
| CuS/rGO composites on FTO | CdS-QD-assembled TiO2 | Polysulfide electrolyte | 8.67 | 0.571 | 47.5 | 2.36 | [34], [17] |
| $Cu_2S$ | CdS/CdSe-QD-assembled $TiO_2$ | Polysulfide electrolyte | 16.2 | 0.56 | 41.4 | 3.77 | [35] |
| $Cu_2S$-rGO | CdS/CdSe-QD-assembled $TiO_2$ | Polysulfide electrolyte | 17.2 | 0.56 | 44 | 4.26 | [35] |
| $Cu_2S$ | CdS/CdSe-QD-assembled $TiO_2$ | Polysulfide electrolyte | 15.7 | 0.48 | 42 | 3.16 | [36] |
| $Cu_2S$-rGO | CdS/CdSe-QD-assembled TiO2 | Polysulfide electrolyte | 17.1 | 0.58 | 48 | 4.76 | [36] |

Duy *et al.* reported that CuS-rGO nanocomposites serve as a better counter electrode as compare to both the Pt counter electrode and the rGO [37].

### 3.3 Transition from pristine CuS to CuS-rGO nanocomposites for electrode materials of SCs

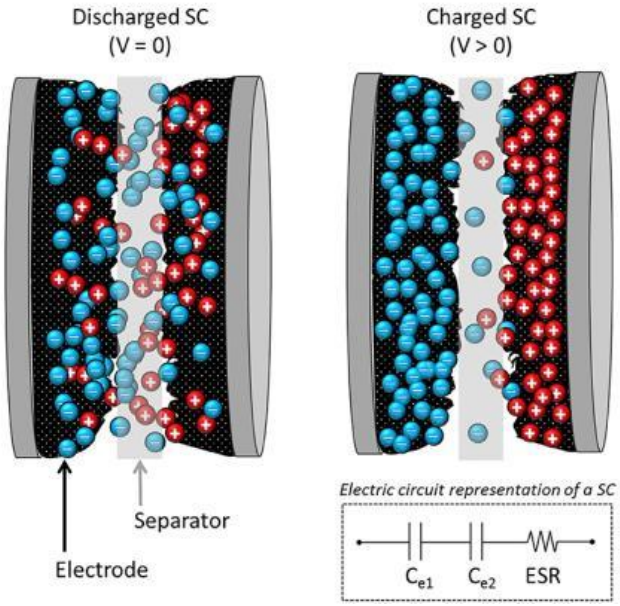


**Figure 3.** Representative diagram of supercapacitor, reproduced from ref. [43]

Electrical energy conversion from renewable sources such solar energy is irregular depending on relative orientation of the earth and the sun, hence in order to have a regular and

accessible electrical energy at any time, intermediate energy storage devices are required. The energy storage devices should be more efficient than the storage batteries. The urgent need for efficient energy storage devices has resulted in a widespread and concerted research effort into electrochemical capacitors, also called supercapacitors. A supercapacitor consists of two parallel electrodes separated by a non-conductive material impregnated with an electrolyte as shown in Figure 3. The electrochemical energy storage (EES) devices play a very important part of providing uninterrupted electric power. The oldest form of EES is the storage batteries. Batteries have high power storage density but they have low life cycle and high charging time. Supercapacitors are another form of EES device. The two categories of: electrochemical double-layer capacitors (EDLCs) and pseudocapacitors differ in their charge-storage mechanisms. In EDLCs, the charge-storage mechanism is based charge–discharge process (electrosorption) in an electric double layer on porous electrodes [38], whereas in pseudocapacitors, electrical charge storage is achieved as a combination of the simultaneous "double layer" and faradaic reactions, by combining the working mechanism of capacitors and electrochemical batteries. These devices, consisting of transitional metal oxide active materials, were prepared by depositing thin films on metallic substrates [39]. Supercapacitor or ultracapacitor, as an energy storage device, possesses higher specific capacitance compared with conventional capacitor, more excellent cyclic stability and higher power density contrasted with batteries [21]. Metal chalcogenides show promising properties to be used as electrode materials of supercapacitors (pseudocapacitors) with CuS nanomaterials being in the forefront for many researchers as it is low cost, abundant, environment friendly and high theoretical capacity [23,40,41].However, pristine CuS nanomaterials have prominent limitations because of its inferior conductivity and poor cyclic stability like other chalcogenides. Researchers explored on improving the conductivity of pristine CuS by using graphene sheets and its derivatives. The CuS-rGO nanocomposites not only improve the conductivity of the electrode materials but the specific capacitance and cyclic stability are enhanced as shown in Table 3.

**Table 3.** Summary of improvement in specific capacitance and cycling stability performance of CuS as a result of formation CuS- rGO nanocomposites

| Electrolyte | Specific capacitance (in $Fg^{-1}$ ) | Cycling stability | Power density ($W\ kg^{-1}$) | Energy density $Wh\ kg^{-1}$ | Ref. |
|---|---|---|---|---|---|
| 2 M KOH | 3058 at 1 $Ag^{-1}$ current density | 60.3% after 1000 cycles at 10 $Ag^{-1}$ current density | nd* | nd* | [19] |
| 6 M KOH | 587.5 at 1 $Ag^{-1}$ current density | 94% after 2000 cycles at 10 $Ag^{-1}$ current density | 1426 | 43 | [3] |
| 6 M KOH | 2317.8 at 1 $Ag^{-1}$ current density | 96.2% after 1200 cycles at a current density of 1 $Ag^{-1}$ | nd* | nd* | [22] |
| 3 M KOH | 1604 $Fg^{-1}$ at 2 $Ag^{-1}$ current density | 98.5% after 5000 cycles at 2 $Ag^{-1}$. | 315 | 21 | [15] |
| 1 M $LiClO_4$ | 1132.9 at 0.007$Ag^{-1}$ | 87% at 6000 cycles at 2.5 $Ag^{-1}$ | 1400 | 44 | [42] |
| 2 M KOH | 368.3 at 1 A $g^{-1}$ | 88.4at 1000 cycles at 3 $Ag^{-1}$ | nd* | nd* | [2] |
| 6 M KOH | 906 $Fg^{-1}$ at 1 A $g^{-1}$, | 89% after 5000 cycles at 5 $Ag^{-1}$ | 2500 | 105.6 | [21] |

* not discussed

**Conclusion:**

The research in the field of photovoltaic applications of nanomaterials has reported improved PCE in the last decade and it is time that the research findings of a scientific community in research and development (R&D) stage are communicated to the industrial community for large scale production. But it seems from the reports as highlighted in this Review that more study is to be carried out by researchers to decide on the best technique on preparation of copper sulphide nanomaterials and fabrication of a device keeping in mind the cost of synthesis, the time-scale involved and sustainability of the whole process. The mechanisms of energy storage in supercapacitors need to be probed further to increase the energy storage capacity of SCs at par with that of batteries so that these low cost, environmental friendly SCs can replace the LIBs. One of the drawbacks of SCs is the low energy storage density which limits their used as standalone devices. To improve the energy density, the choice of electrolyte-electrode system must be finely selected from all the available electrolyte and electrodes materials. The use of

graphene and its derivatives in the synthesis of CuS has improved the specific capacitance, cyclic stability of SCs but the energy storage density is too low as compared to that of batteries hence more research is needed to compile the best electrolyte to be used with CuS-rGO electrode so as to improve the energy storage capacity. With so much concern of the various environmental issues arising out of the uncontrolled use of energy from fossil fuels, the research on photovoltaic devices and energy storage devices should speed up now. This is a call to the research community; photovoltaic technology must overtake petroleum technology in order to have a zero carbon emission.

**Conflict Of Interest**

There is no conflict of interest to declare.

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# Relevance of Cluster Based Routing Protocol for avoidance of Congestion in Network using AI and Deep Learning Algorithms

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**Abstract:**

Communication between the wireless nodes requires minimum response delay and congestion. It also requires the communication to be energy efficient. In our proposed system, we have introduced a protocol that helps in communication between nodes resulting in energy efficient and congestion avoidance. The cluster-based routing protocol uses artificial intelligence technique for cluster head calculation.

Network congestion in data networking and queueing theory is the reduced quality of service that occurs when a network node or link is carrying more data than it can handle. Typical effects include queueing delay, loss of packets or the blocks the new connections. A consequence of congestion is that an incremental increase in load leads either only to a small increase or even a decrease in network performance.

**Keywords**: *HEED, CH- Cluster Head, clustering, Sensor, WSN, LEACH.*

**Introduction:**

A wireless network is a flexible data communications system, which uses wireless media such as radio frequency technology to transmit and receive data over the air, minimizing the need for wired connections.

Network protocols retransmit to compensate for packet loss due to congestion can increase congestion, even after the initial load has been reduced to a level that would not normally have induced network congestion. Such networks exhibit two stable states under the same level of load. The stable state with low throughput is known as congestive collapse.

Networks use congestion control and congestion avoidance techniques to try to avoid collapse.

**Clustering in WSN**

Clustering is the process of grouping data with similar attributes. The process of clustering is used in WSN technology to group the nodes that are transmitting the data. It becomes difficult for every single node to transfer the data directly to the Base Station. So the nodes are clustered into groups using different attributes of the nodes like Energy, priority, distance etc. Once the nodes are clustered CH can be selected and the data transmission process can be carried out effectively. This section presents how clustering is effectively utilized in WSN applications.

**Principles of Clustering**

Cauterization represents a promising solution for "self-organizing" networks with a large number of nodes. This technique aims to bring together the nodes of the network in virtual groups called "clusters" [1]. The grouping of surrounding nodes in the same cluster follows certain rules. Each cluster has a leader or leader named the cluster head or cluster head (CH). The role of the latter is to manage the activities of group, such as data routing, aggregation, coordination and synchronization between member nodes. These are ordinary nodes and can switch between active state or asleep state, depending on the events to be detected, in order to prolong the life of their drums. Thus, after having accomplished their task (detection of an event, transmission of their own data to the CH to which they are associated, routing of node data adjacent nodes, etc), the active nodes transit in the state of sleep. The CHs are then responsible for the structure of the higher hierarchical level by relaying these data to the base station.

- **Cluster topology**

In this part, the principle of building clusters, the maintenance of these clusters, the advantages and disadvantages of these techniques.

- **Construction**

These last may vary depending on the chosen metric of the cluster-heads, the size of the clusters, the deployment of sensors (random or deterministic), etc. The process of building a Self-organized topology in clusters is illustrated in figure (1). After the discovery phase surrounding Figure (1.b), the network begins to organize itself into groups of nodes Figure (1.d). All CHs can construct an inter cluster routing virtual backbone Figure (1.c). Chronologically, phases c and d can take place at the same time.

- Like most routing algorithms, each node discovers its surrounding from using the "HELLO" messages that he broadcasts to

surrounding. This way he can calculate its metric Figure (1.b).

- If the CHs are not designated in advance, the sensor node determines whether it is the leader of the cluster or not depending on the discovery metric of its surrounding Figure(1.c)
- After being elected as a CH, the latter broadcasts its status to its surrounding to form a cluster; it invites the nodes of the surrounding to join it Figure (1.d).
- Any change in status must be notified by a message broadcast to all adjacent nodes.

Depending on the strategy adopted, the formation of clusters can be characterized by the size and type clusters (homogeneous, heterogeneous, covering or not, active or passive, etc.) [2]. The clusters are said to cover if a node can belong to several clusters at the same time. In this case, these nodes act as gateways in the network Figure (2). The opposite case of non-overlapping clusters where a node is associated with only one group as in Figure (1). It is also important to consider the number of hops that separate a member node and the CH to which it is attached and which can be single-hop, as it can be multiple-hop.

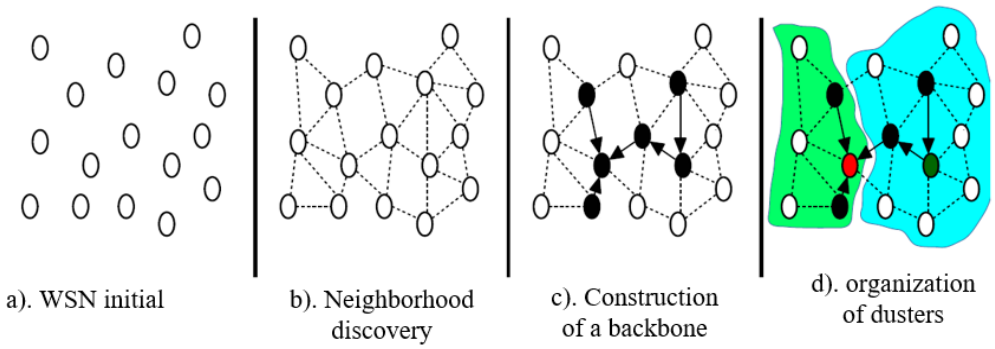


Figure 1: Steps for organizing a topology in clusters

**Review of Literature and Development in the subject**

Authors Yalcin Sadi and Sinem Coleri Ergen [3] introduced the joint optimization of control and communication systems incorporating their efficient abstractions practically used in real-world scenarios. They introduced an exact solution method based on the analysis of the optimality conditions and smart enumeration techniques. Then, they proposed two polynomial-time heuristic algorithms based on intelligent search space reduction and smart searching techniques. Extensive simulations demonstrated that the proposed algorithms perform very close to optimal and much better than previous algorithms at much smaller run time for various scenarios.

Rosana Lachowski et. al [4] implemented and evaluated distributed algorithms for constructing routing trees in WSNs. After identifying the drawbacks and advantages of these algorithms, they proposed a new algorithm for constructing spanning trees in WSNs. The performance of the proposed algorithm and the quality of the constructed tree were evaluated in different network scenarios. The results showed that the proposed algorithm was a more efficient solution. Furthermore, the algorithm provided multiple routes to the sensor nodes to be used as mechanisms for fault tolerance and load balancing.

In another paper proposed by Juan Cota-Ruiz et. al [5], their method was capable of estimating the distance between two non-neighboring sensors in multi-hop wireless sensor networks. Our method employs a global table search of sensor edges and recursive functions to find all possible paths between a source sensor and a destination sensor with the minimum number of hops. Their algorithm was then analyzed and compared with classical and novel approaches, and the results indicated that the proposed approach outperforms the other methods in distance estimate accuracy when used in random and uniform placement of nodes for large-scale wireless networks.

Wireless Sensor Systems (WSNs) are utilized to gather the information and to propel them to the base station and this domain is also used to design and analyse routing problems in the network. Besides, the corresponding vitality in the sensor systems is a crucial challenge to keep away from loss of packets or packet drop, quick power consumption and compelling to degradation in node performance while increasing the delay in packet delivery across the network. In order to have an effective routing decision, there is an outrageous need to check the usage of power of the nodes by maximizing the overall performance of the network using the improved machine learning techniques.[6]

**Methodology to be adopted**

For the selection of cluster head, we can adopt HEED (Hybrid Energy-Efficient Distribution Clustering) algorithm. HEED is a hierarchical, distributed, clustering scheme. It allows single hop communication within each cluster and allows multi-hop communication between Chs and base station. CH selection depends on residual energy

and intracluster communication cost. Residual energy is used to set the initial set of cluster heads. Intra cluster communication cost is used for deciding to join a cluster or not. This cost value is based on node's proximity or node's degree to the neighbor. Each sensor node estimates $CH_{prob}$ value for becoming a CH as follows :

$CH_{prob} = C_{prob} * E_{residual} / E_{max}$

This probability value should not be beyond the threshold value $P_{min}$; $P_{min}$ is inversely proportional to $E_{max}$. This algorithm consists of constant number of iterations. Every node goes through this iteration until it finds a CH that it will be the node with least communication cost. At the end of iteration every node doubles the $CH_{prob}$ value. Iteration will be terminated if $CH_{prob}$ value reaches 1.Two types of CH status that a sensor node announces to its neighbors; i) Node becomes a tentative CH with CH prob less than 1; ii) Node becomes permanently becomes a CH if its $CH_{prob}$ reaches 1. At the end final CHs are considered as CHs, and tentative CH becomes regular nodes. In this, if two nodes are within the transmission range of each other, then the probability of selecting CH will be small. But in HEED, synchronization is required and energy consumption is significant if CHs are far away. It also requires knowledge of entire network to determine the intra cluster communication cost; in practical it is very difficult to calculate the cost. So it is very difficult to obtain the network lifetime bounds to ensure predictability.

Block Diagram:

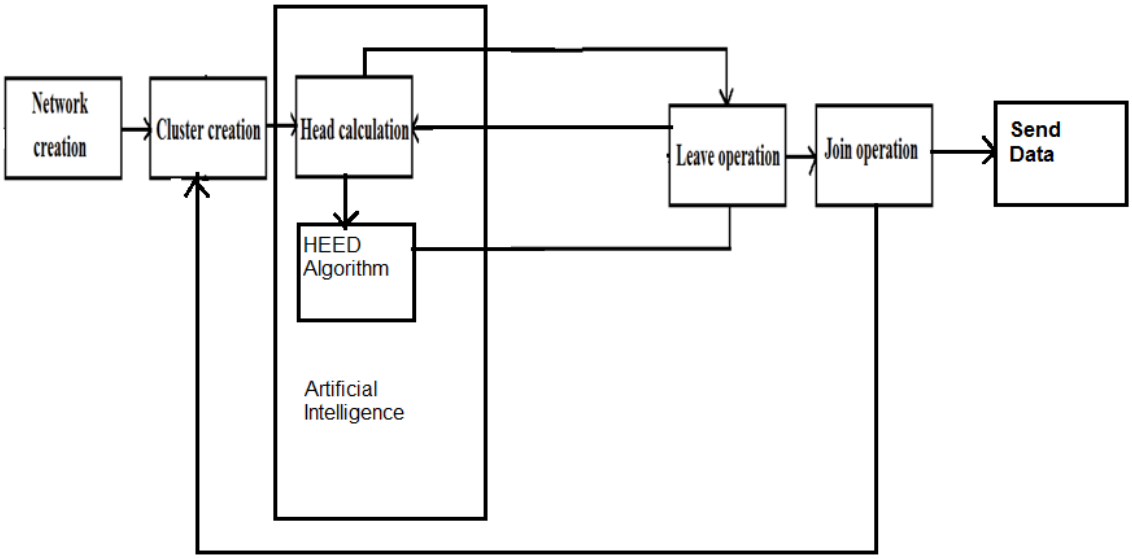


Fig.2 Architecture

**Network Creation**

Creating network for connectivity. Basically in general Wi-Fi network if there are n number of nodes in network which are actively participated in message transfer or communication. Then if any node say node no 1 want to communicate with node no 16 then for this communication or message transfer; firstly node must connect with its neighbor nodes and so on; up to the destination node 16. Out of that it will choose shortest path to reach up to destination and then it will send message packets. This process is happen in various wireless networks. But due to some disadvantages this system is fail to acquire reliability and\proper flow control in energy efficient way. So all this disadvantages are overcome in MEMAC system.

**Cluster Creation:**

Clusters which are dynamically formed contain all nodes in sensor network. In MEMAC system, for eg. when node no. 1 wants to communicate with node no. 16, then node 1 firstly communicate with its own cluster head (here ch1). After that ch1 communicate with CH2 which is cluster head of node no. 16 and then finally ch2 transfer message which is come from node no 1 to destination node (i.e. node no 16). In this way in MEMAC system three-way communication is happen. So, it is faster and energy efficient system.

**Head Calculator:**

Clusters Head created with respect to cluster quantity. In this phase CH broadcast the calculated schedule to the other node within cluster. The schedule contains those nodes which have data to send only. The current schedule do not consider nodes that want to leave or join the cluster. If the number of request message is greater than number of join or leave messages, then frame length is increased otherwise decreased.

**Leave / Join operation:**

In case of request or leave phase the contention period should be long enough to enable all Sensor node. In MEMAC protocol handles the channel access through the following

are the phases request\leave\join phase, schedule calculation and distribution phase and data transfer phase. In case of request or leave phase the contention period should be long enough to enable all sensor nodes that have data to transmit contain for the channel in order to acquire the access to send its request to CH as well as those nodes which are

expected to leave or join the cluster should the CH by sending message of leave or join.

**Importance and Conclusion**

Mobility increases the probability of collision and hence retransmissions are required which leads to high energy consumption. By introducing our protocol, the energy efficiency is increasing leading to lower response delay.

Unwanted congestion in the network is avoided leading to minimum response delay. When there is less congestion in the network, then it becomes to efficiently transfer data from sender to receiver with minimum energy utilization.

Wireless sensor network performance energy is perhaps the most essential measurement in a WSN. In fact, any limited resource needs to be considered in a restricted setting. The lifetime of the network, however, is remarkable since it constitutes the upper limit of the usefulness of this network, as a measure of power consumption. In terms of availability and security in wireless sensors networks, service life is also regarded as an essential element. Maximizing the network's lifetime means lowering nodes' energy usage. Existing energy conservation techniques major and key factor, requiring more research into the energy efficiency of platforms and communication protocols. The proposed Cross layer LEACH algorithm optimizes the energy of the network and increases the performance of the system.

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# Photocatalytic Degradation Studies Of Congo Red And Methyl Orange Dyes Employing $TiO_2$ –ZnO (1:2) Composite Hollow Spheres

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**Abstract:**
Colloid carbon spheres were used as templates in a hydrothermal technique to create $TiO_2$- ZnO(1:2) composite structures. The structural characterization of as-prepared composite was achieved by XRD, FE-SEM, EDS, and UV-Vis. The photocatalytic studies were evaluated by the decolorization of Congo Red and Methyl Orange dyes under UV irradiation. The results of photocatalytic activity are mainly attributed to the rate of photo generated charge carriers. Finally the efficiency of degradation of phtocatalytic activity is brought into focus. The results will be presented.

**Keywords:** *Hollow Spheres, Hydrothermal synthesis, Carbon sphere, Photocatalytic degradation, Congo Red, Methyl Orange*

## Introduction:

From many scientists it is evident that, the metal oxides like $SnO_2$,$TiO_2$, CuO and ZnO are used as photocatalysts for degradation of water consists organic pollutants, usage of solar energy,and production of hydrogen etc.[1-4]. These Metal/Composite Metal Oxides are acted as efficient photo- catalysts have high physical and chemical stability, low cost and nontoxicity[5,6].Various methods have been utilized to synthesize composite structures of metal , metal oxides and their composites including hydrothermal crystallization, sol-gel, and chemical precipitation[7-10]etc. In these, hydrothermal processes starting fromaqueous solutions are the most commonly used for producing metal oxide composite structures[11].

Since the Titanium di-Oxide have the high photosensitivity, not having toxic nature, large band gap energy, and low cost widely used as phtocatalyst. Zinc Oxide is also suitable to this due to their similar band gap energy[12]. It is very much interest to synthesize $TiO_2$ and ZnO in various structures, all of them the hollow spherical structures have low density, high surface area and permeability[13]. According to Sun et al.,8 , produce the hollow micro spheres by using carbonaceous polysaccharide microspheres as template prepared from saccharide solution[14].

Now it is reported that , by using carbon spheres as sacrificial template, synthesize $TiO_2$, ZnO hollow structures and the composite hollow structure $TiO_2$-ZnO in the ratio of 1:2. Finally studied the photocatalytic behavior in the organic dyes of Congo Red and Methyl Orange.

## Experimental:

### Synthesizing carbon spheres:

In this analysis, the hydrothermal method was utilized to create the colloidal carbon spheres. They dissolved eight grams of glucose in sixty milliliters of deionized water, which was subjected to magnetic stirring for sixty minutes. After that, the solution was added to an autoclave until about ¾th of the capacity was filled. The autoclave was placed in a hot air oven and heated to 180 degrees Celsius for twelve hours. Following the hydrothermal process, the sample was sonicated . The resulting precipitate was centrifuged three times using methanol-deionized water, then dried for twelve hours at a temperature of 80 degrees Celsius in a hot air oven.

### Preparing TiO2-ZnO (1:2) Hollow Spheres

To create the hollow spheres TiO2, ZnO, TiO2-ZnO(1:2), carbon sphere templates were used. In 150ml of Methanol, dissolved 0.25 grams carbon spheres, along with 45mM titanium tetra isopropoxide 90 mM zinc nitrate and ultrasonicate for 3 hours. Then, Magnetic stirring was applied for 12 hours at room temperature. To obtain clear product used DI

water and methanol for centrifuge three times. Placed the sample in hot air oven by four hours at 80 degree Celsius for drying process. Finally calcinate the product by using muffle furnace at 500 degree Celsius with the heating rate of 4 degree Celsius per minute.

**Characterization:**

By using Pan alytical xpert3 powder diffractometer under Cu Kα radiation with a wavelength of 0.15406 nm, at an operating voltage of 45 kV to obtain crystalline structures of the hollow metal spheres. The morphologies, sample sizes, and composition % of the samples are all seen by Zeiss Ultra 55field emission scanning electron microscope integrated with EDX. The absorbance peaks of prepared instances obtained by UV-Vis NIR spectrometer of Agilent Technologies.

**Photocatalytic Activity Measurement**

A 40 milligrams of the sample TiO2- ZnO(1:2) and dye of Methyl Orange (MO), which is at the concentration of 10 milligrams per litre in the 40 ml of DI water was magnetically stirred continuously and irradiated by a UV- lamp of 54 watts. Up to 270 minutes, for every 30 min time interval, analyzed the photocatalytic degradation of the solution, which reach adsorption/desorption equilibrium by using UV-Vis spectrometer.

**Results and Discussion**

**XRD:**

XRD pattern of the produced samples is presented in Fig. 1.Determining the size of the crystalline sample is the Debye-Schererformula[15] is $D = 0.9\ \lambda / \beta\cos\theta$, where the matching Bragg's diffraction angle is represented by μ, β is the whole breadth of the peak at 50% of the highest intensity, D is the size of the crystallite, and the wavelength of the XRD peak at 0.154 nm.

Figure 1(a) dispersed diffraction pattern makes it evident how amorphous carbon spheres develop[16]. The diffraction patterns of hollow spheres $TiO_2$ and ZnO are shown in Figs. 1b and 1c, respectively, and $TiO_2$ - ZnO composite oxide at 1:2 ratio is shown in Fig. 1d. Using Scherer's formula calculated the average diameters of the $TiO_2$, ZnO, and $TiO_2$-ZnO(1:2) hollow spheres and the values are 30.65 nm, 19.36 nm and 3.04 nm respectively. From this it can be seen that $TiO_2$-ZnO(1:2) have smaller crystallite size than $TiO_2$ and ZnO.

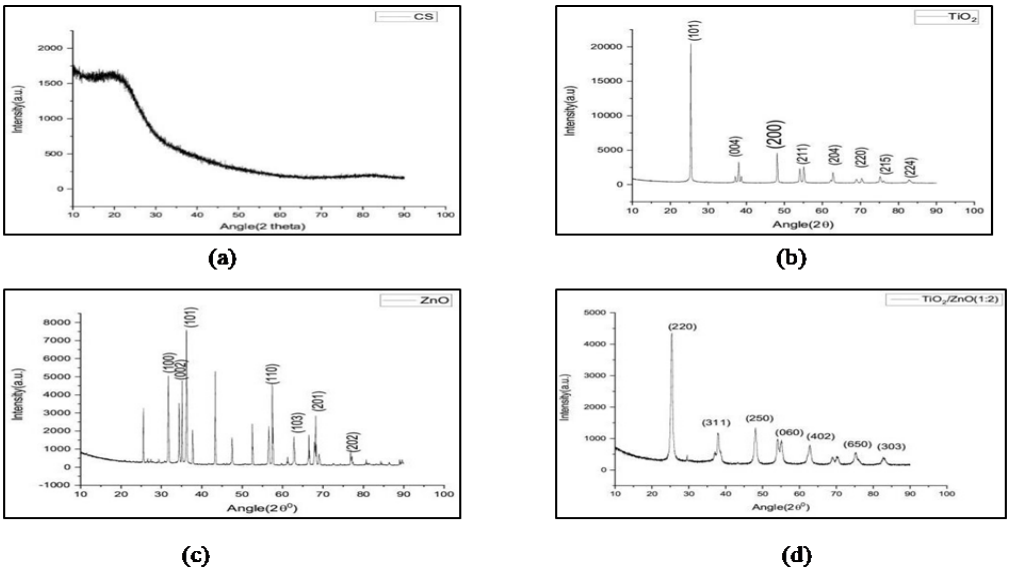


**Figure 1(a)-(d).** XRD peaks of the (a)Carbonaceousspheres,(b) $TiO_2$ hollow spheres (c) ZnO hollow spheres (d) TiO2-ZnO(1:2) hollow spheres

**SEM**

The acquired samples' SEM images are displayed in Figure 2:(a) to (d).

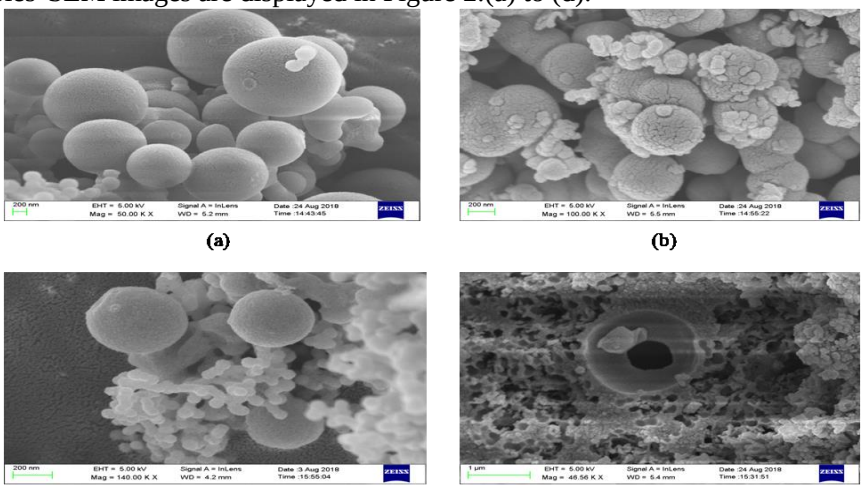

**Figure 2 (a)-(d).**SEM images of (a) Carbonaceous spheres, (b) $TiO_2$ hollow spheres, (c) ZnO hollow spheres (d) $TiO_2$-ZnO(1:2) hollow spheres

The SEM image of Fig. 2(a) shows carbon sphere's shape is spherical, having diameter in the range of 600 nm to 1700 nm. From Fig. 2(b) to 2(d) shows the SEM image of the $TiO_2$, ZnO and $TiO_2$ - ZnO (1:2) hollow spheres and the average diameters are in the range 480nm,444nm and 1860 nm respectively.

**EDS**

The EDS of obtained samples was shown below

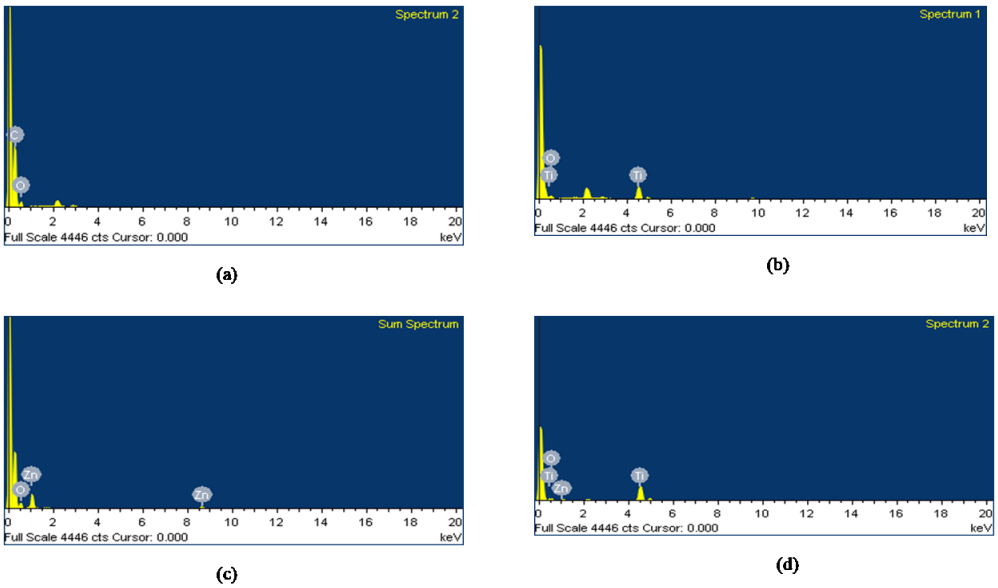


**Figure 3 (a)-(d).** EDS images of (a) carbon spheres, (b) $TiO_2$hollow spheres, (c) ZnO hollow spheresand(d)$TiO_2$ -ZnO(1:2)hollow spheres

The chemical composition was examined from the EDS spectra, TiO2-ZnO(1:2) hollow spheres displayed 35.08% and 3.09% atomic yield of Ti and Zn elements respectively and Oxygen is about 33.53%. Whereas, in case of TiO2 and ZnO hollow spheres , peaks of Ti and Zn elements are with atomic percent 19.39% and 53.15%, respectively, and the respective oxygen percentages are 80.61% and 46.85% which assures the prepared hollow spheres. Results also show that titanium ions are more readily absorbed by zinc ions during the hydrothermal process on carbon spherical surfaces. The ions of Titanium and Zinc oxidized to form $TiO_2$ and ZnO respectively. During calcinations, in order for the carbon sphere to escape, it oxidized into gas. Ultimately, the composite hollow spheres of $TiO_2$-ZnO(1:2) were formed[17]

**UV-Vis**

Below are the acquired samples UV-Vis spectra.

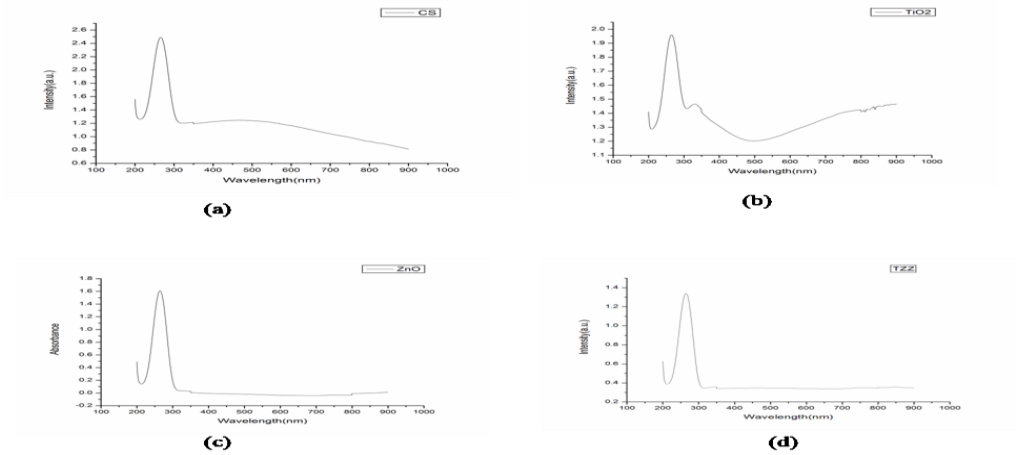


**Figure 4 (a)-(d)**. UV-Vis images of (a) carbon spheres, (b) $TiO_2$hollow spheres, (c) ZnO hollow spheresand(d)$TiO_2$ -ZnO(1:2)hollow spheres

The absorption edge wavelengths of carbon spheres, the investigations shown in Figure 4(a), (b), (c), and (d) figure out where $TiO_2$-ZnO(1:2), $TiO_2$, and ZnO hollow spheres are found, which are approximately 264 nm to 265 nm respectively[18]

Based on XRD analysis from Figure.1, the crystallite size is low for $TiO_2$-ZnO (1:2) hollow spheres among others. Dye degradation was used to assess the photocatalytic activity of $TiO_2$ - ZnO (1:2) hollow spheres. After t minutes of reaction, the Congo Red(CR) and Methyl Orange(MO) dyes break down by the aforementioned catalyst in the process of preparing a UV lamp of 54 W while combining 40 millilitres of each dye at a 10 mg/L concentration with 40 milligrams of the composite oxide to test the dyes in various aqueous solutions.

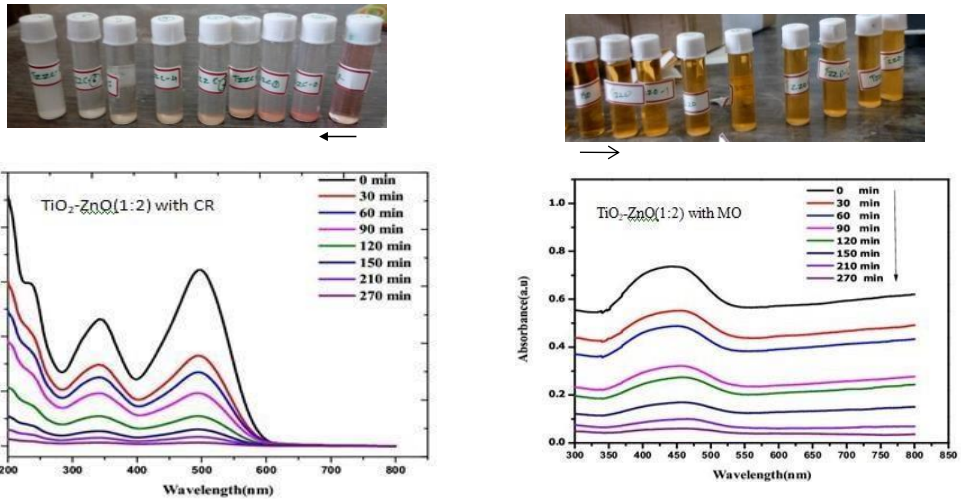


**Figure 5 (a)&(b).** UV-Vis studies of (a) Congo Red+ $TiO_2$-ZnO metallic hollow spheres(a), and(b)Methyl Orange+ $TiO_2$-ZnO metallic hollow spheres

The dye's UV-Vis spectra with catalyst $TiO_2$-ZnO(1:2) are displayed in Figure.5 (a) and (b) following 0, 30, 60, 90, 120, 150, 210, and 270 minutes of dark adsorption/desorption. For the two mentioned dyes, photocatalytic degradation reaches its highest level after 270 minutes. Using the dyes Congo Red (CR) and Methyl Orange (MO), Figure.6 (a) and (b) shows the degradation efficiency versus Time of TiO2-ZnO(1:2). These values shown in the below table 1

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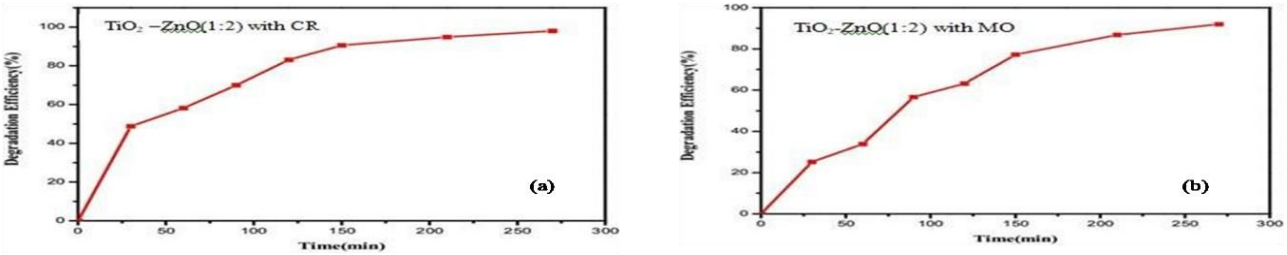


**Figure 6 (a)&(b).** Degradation Efficiency versus Time of $TiO_2$-ZnO (1:2) metallic hollowsphere combined with dyes of (a) Congo Red(CR) and (b) Methyl Orange(MO)

**Table 1.** The photocatalytic degradation efficiency versus Time of $TiO_2$-ZnO(1:2) hollow spheres in Congo Red(CR) & Methyl Orange(MO) dyes

| Time (min) | Degradation Efficiency(%) | |
|---|---|---|
| | Congo Red | Methyl Orange |
| 0 | 0 | 0 |
| 30 | 48.78 | 25.185 |
| 60 | 58.17 | 33.86 |
| 90 | 70 | 56.60 |
| 120 | 83.07 | 63.19 |
| 150 | 90.61 | 77.25 |
| 210 | 94.83 | 86.77 |
| 270 | 98.07 | 91.96 |

As observed from above, it was concluded that$TiO_2$-ZnO (1:2) hollow sphere exhibited high photo catalytic activity in CR than MO due to their heterogeneous structure[19,20].

**Conclusions:**

After preparing carbon spheres used as sacrificial template and synthesized the hollow spherical structures of $TiO_2$,ZnO and $TiO_2$-ZnO (1:2) successfully. On observing the XRD pattern, it is evident that the composite hollow sphere have lower crystalline size when compare with individuals which gives the structure of composite hollow sphere is heterogeneous. The compositions of the samples is obtained by Energy Dispersive X-ray Spectroscopy and also the absorbance of the wavelengths by the hollow spheres observed through UV-Vis spectrometer. The study of photo catalytic degradation of two dyes viz CR and MO gives that $TiO_2$-ZnO (1:2) catalyst is worked faster in degradation at CR than MO.

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# Contribution of Social Infrastructure in Rural Development of Maharashtra

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**Abstract:**

Rural development is a multifaceted process encompassing various dimensions, including economic, social, and infrastructural aspects. In the context of Maharashtra, a state characterized by a diverse rural landscape and significant disparities in development outcomes, the contribution of social infrastructure to rural development is of paramount importance. This review research paper aims to analyze the role and impact of social infrastructure in facilitating rural development in Maharashtra, shedding light on the challenges, opportunities, and policy implications.The study begins by providing an overview of rural development in Maharashtra, highlighting key socio-economic indicators and development challenges faced by rural communities. It then delves into the concept of social infrastructure, encompassing facilities and services such as education, healthcare, sanitation, transportation, and communication, which play a crucial role in enhancing the quality of life and well-being of rural residents.

Furthermore, the paper examines the state of social infrastructure in rural Maharashtra, considering factors such as accessibility, affordability, and quality of services. It analyzes the disparities in access to social infrastructure across different regions and communities within the state, identifying marginalized groups that are particularly vulnerable to inadequate infrastructure provision.

Moreover, the study explores the linkages between social infrastructure and various dimensions of rural development, including poverty alleviation, human capital development, gender equality, and social inclusion. It discusses how investments in social infrastructure can contribute to improved livelihoods, enhanced productivity, and overall socio-economic development in rural areas.

Additionally, the paper reviews existing policies, programs, and initiatives aimed at strengthening social infrastructure in rural Maharashtra. It evaluates the effectiveness of government interventions and identifies potential areas for improvement, such as decentralized governance mechanisms, community participation, and innovative financing models.

Overall, this review contributes to the understanding of rural development in Maharashtra by highlighting the crucial role of social infrastructure in fostering inclusive and sustainable growth. It underscores the need for holistic approaches to rural development that prioritize investments in social infrastructure alongside economic and environmental interventions.

**Keywords:** Rural development, Social infrastructure, Maharashtra, Education, Healthcare, Sanitation, Transportation, Communication.

## Introduction:

Rural development stands as a cornerstone for fostering inclusive growth and sustainable progress in any region, playing a pivotal role in the socio-economic fabric of a nation. In the context of Maharashtra, India's third-largest state by area and second-most populous, rural development initiatives hold significant importance due to the substantial portion of the population residing in rural areas. The state's rural landscape is characterized by diverse geographical features, ranging from the fertile plains of western Maharashtra to the hilly terrains of the Western Ghats and the arid regions of Vidarbha and Marathwada. Amidst this diversity, the contribution of social infrastructure in rural development emerges as a critical aspect warranting thorough investigation and analysis.

Social infrastructure encompasses a wide array of essential services and facilities that contribute to the overall well-being and quality of life of rural communities. These include but are not limited to healthcare facilities, educational institutions, sanitation facilities, drinking water supply systems, transportation networks, and community centers. The provision of adequate social infrastructure in rural areas not only addresses the basic needs of the population but also serves as a catalyst for socio-economic development, empowerment, and poverty alleviation.

The importance of social infrastructure in rural development is underscored by its potential to bridge existing gaps in access to essential services and resources between urban and rural areas. In

Maharashtra, where disparities between rural and urban regions persist despite rapid urbanization and economic growth, enhancing social infrastructure in rural areas is imperative to ensure equitable development and inclusive growth across the state. Furthermore, the COVID-19 pandemic has accentuated the significance of robust social infrastructure, particularly in rural areas, for effective healthcare delivery, education, and livelihood support.

Against this backdrop, this review research paper seeks to explore and evaluate the contribution of social infrastructure in the rural development of Maharashtra. By examining existing literature, policy documents, and empirical studies, the paper aims to elucidate the various dimensions of social infrastructure and its impact on rural development outcomes in the state. Furthermore, it endeavors to identify key challenges, opportunities, and best practices in the provision and management of social infrastructure in rural Maharashtra, offering insights for policymakers, practitioners, and stakeholders involved in rural development initiatives.

This paper sets out to shed light on the critical role of social infrastructure in fostering rural development in Maharashtra, with the ultimate goal of informing evidence-based policies and interventions aimed at improving the well-being and livelihoods of rural communities across the state.

**Background of the study**

Rural development has long been a critical focus area for policymakers and development practitioners in India, particularly in states like Maharashtra, which exhibit significant rural-urban disparities. The state of Maharashtra, with its diverse geography, rich cultural heritage, and economic significance, presents a unique context for studying the contribution of social infrastructure to rural development.

Historically, rural areas in Maharashtra have faced numerous challenges, including inadequate access to basic amenities, limited educational opportunities, poor healthcare facilities, and insufficient infrastructure for social services. These challenges have hindered the socio-economic progress of rural communities and perpetuated cycles of poverty and deprivation.

Against this backdrop, the role of social infrastructure in rural development becomes increasingly salient. Social infrastructure encompasses a wide range of services and facilities that are essential for enhancing the well-being and quality of life of rural residents. This includes educational institutions, healthcare facilities, sanitation infrastructure, community centers, and other amenities that promote social cohesion, human capital development, and inclusive growth.

The significance of social infrastructure in rural development is underscored by its potential to address key developmental objectives, such as poverty alleviation, health promotion, and human resource development. Access to quality education, for instance, not only empowers individuals with knowledge and skills but also enhances their employability and income-earning potential, thereby contributing to poverty reduction and economic empowerment.

Similarly, adequate healthcare infrastructure plays a crucial role in improving health outcomes, reducing mortality rates, and enhancing the overall well-being of rural populations. Access to clean water and sanitation facilities is essential for preventing waterborne diseases and ensuring public health and hygiene.

Furthermore, social infrastructure serves as a catalyst for community development and social inclusion by providing spaces for collective engagement, cultural expression, and social interaction. Community centers, religious institutions, and recreational facilities foster a sense of belonging and solidarity among rural residents, strengthening social capital and resilience.

Despite the recognized importance of social infrastructure, rural areas in Maharashtra continue to face disparities in access to these essential services. Factors such as geographical remoteness, inadequate funding, governance challenges, and socio-cultural barriers contribute to the uneven distribution and quality of social infrastructure in rural communities.

Against this backdrop, understanding the contribution of social infrastructure to rural development in Maharashtra is crucial for informing policy interventions, resource allocation, and development strategies aimed at addressing the multifaceted challenges facing rural areas. By enhancing the availability, accessibility, and quality of social infrastructure, policymakers can foster inclusive and sustainable rural development, thereby unlocking the full potential of Maharashtra's rural economy and society.

**Justification**

The justification for conducting a review research paper titled "Contribution of Social Infrastructure in Rural Development of Maharashtra" is multi-faceted and grounded in the pressing need to understand and address the challenges faced by rural communities in Maharashtra. Below are the key justifications for undertaking this study:

1. **Critical Importance of Rural Development:** Rural areas constitute a significant portion of Maharashtra's population and economy. However, these regions often lag behind in terms of socio-economic development compared to urban areas. Therefore, there is a compelling need to explore the factors contributing to rural development, with a specific focus on social infrastructure.

2. **Impact of Social Infrastructure:** Social infrastructure, including healthcare, education, sanitation, and transportation, plays a pivotal role in enhancing the quality of life and fostering socio-economic progress in rural communities. Understanding the contribution of social infrastructure to rural development can inform policy interventions and resource allocation strategies aimed at addressing rural disparities.
3. **Policy Relevance:** The findings of this research can inform the design and implementation of government policies, programs, and initiatives aimed at promoting rural development in Maharashtra. By identifying the strengths and weaknesses of existing social infrastructure systems, policymakers can formulate targeted interventions to address gaps and enhance service delivery in rural areas.
4. **Empirical Knowledge Gap:** While there is existing literature on rural development and social infrastructure, there may be a lack of comprehensive studies specifically focusing on Maharashtra. This research aims to fill this gap by providing a detailed analysis of the contribution of social infrastructure to rural development in the context of Maharashtra, thereby contributing to the empirical knowledge base.
5. **Community Empowerment:** Understanding the role of social infrastructure in rural development can empower local communities, stakeholders, and practitioners to actively participate in the planning and implementation of development initiatives. By involving communities in decision-making processes, there is a greater likelihood of identifying context-specific solutions that address local needs and priorities.
6. **Academic Contribution:** This research contributes to the academic discourse on rural development, social infrastructure, and regional disparities. By synthesizing existing literature, analyzing empirical data, and offering insights into the nuances of rural development in Maharashtra, this study adds to the body of knowledge in the fields of development studies, sociology, geography, and public policy.

   The review research paper titled "Contribution of Social Infrastructure in Rural Development of Maharashtra" is justified by its potential to inform policy, address empirical knowledge gaps, empower communities, and contribute to academic scholarship in the domain of rural development.

**Objectives of the Study:**

1. To assess the existing social infrastructure in rural areas of Maharashtra, including healthcare facilities, educational institutions, transportation networks, and community resources.
2. To examine the role of social infrastructure in facilitating access to essential services and amenities for rural communities in Maharashtra.
3. To identify the strengths and weaknesses of social infrastructure in rural Maharashtra, considering factors such as availability, accessibility, affordability, and quality of services.
4. To explore the impact of social infrastructure on various dimensions of rural development, including economic growth, social cohesion, human capital development, and environmental sustainability.
5. To investigate the relationship between social infrastructure development and key indicators of rural well-being, such as poverty alleviation, health outcomes, educational attainment, and employment opportunities.

**Literature Review**

Social infrastructure plays a crucial role in facilitating rural development by providing essential services and amenities to rural populations. In the context of Maharashtra, a state with diverse socio-economic and geographic characteristics, the contribution of social infrastructure to rural development has been a subject of scholarly inquiry and policy debate. This literature review aims to synthesize existing research and insights on the role of social infrastructure in fostering rural development in Maharashtra.

**Role of Social Infrastructure in Rural Development:**

The concept of social infrastructure encompasses a wide range of facilities and services, including education, healthcare, water supply, sanitation, transportation, and communication. These elements form the backbone of rural communities, enabling access to basic needs, promoting human development, and enhancing overall quality of life. Numerous studies have underscored the importance of robust social infrastructure in driving economic growth, reducing poverty, and narrowing socio-economic disparities in rural areas (Bose, 2018; Raut & Mishra, 2019).

**Education Infrastructure*:***

Access to quality education is a fundamental determinant of rural development, empowering individuals with knowledge and skills to participate in economic activities and contribute to societal progress. Research in Maharashtra has highlighted disparities in educational infrastructure across rural regions, with uneven distribution of schools, inadequate facilities, and challenges in teacher recruitment and retention (Thorat & Sahoo, 2017; Sharma & Sisodia, 2020). Improving access to education through the expansion of school infrastructure, provision of scholarships, and

implementation of innovative pedagogical practices has been emphasized as critical for enhancing rural development outcomes.

**Healthcare Infrastructure:**

Adequate healthcare infrastructure is essential for promoting rural well-being and productivity by addressing health needs, preventing diseases, and ensuring timely medical treatment. Studies in Maharashtra have identified gaps in healthcare infrastructure, including insufficient healthcare facilities, shortage of medical personnel, and limited access to essential healthcare services in rural areas (Waghmare & Shinde, 2018; Ghosh & Kumar, 2021). Strengthening healthcare infrastructure through the establishment of primary health centers, upgrading facilities, and enhancing outreach programs has been recommended to improve rural health outcomes and contribute to overall development.

**Water Supply and Sanitation Infrastructure:**

Access to safe drinking water and sanitation facilities is crucial for maintaining public health, hygiene, and environmental sustainability in rural communities. Research in Maharashtra has highlighted challenges related to inadequate water supply, poor sanitation infrastructure, and prevalence of waterborne diseases in rural areas (Patil & Chavan, 2019; Khade & Patil, 2020). Promoting investments in water supply schemes, constructing sanitation facilities, and implementing community-based hygiene promotion initiatives are seen as key strategies for enhancing rural development and improving living conditions.

**Transportation and Communication Infrastructure:**

Efficient transportation and communication networks are essential for connecting rural areas to markets, employment opportunities, and essential services, thereby facilitating economic growth and social development. Studies in Maharashtra have identified deficiencies in transportation infrastructure, including inadequate road connectivity, limited access to public transport, and challenges in last-mile connectivity (Kale & Mane, 2018; Kamble & Sawant, 2020). Enhancing rural road networks, upgrading transportation facilities, and expanding access to telecommunications and internet connectivity have been proposed as measures to enhance rural connectivity and promote inclusive development.

Social infrastructure plays a pivotal role in driving rural development in Maharashtra by providing essential services and amenities that contribute to human well-being, economic productivity, and social cohesion. However, challenges persist in ensuring equitable access to education, healthcare, water supply, sanitation, transportation, and communication infrastructure across rural regions. Addressing these challenges requires concerted efforts from policymakers, local authorities, community organizations, and other stakeholders to prioritize investments, implement effective policies, and promote inclusive development strategies that empower rural communities and enhance their quality of life.

**Material and Methodology**

**Research Design:**

This review research paper adopts a qualitative research design to explore the contribution of social infrastructure in rural development of Maharashtra. Qualitative research allows for an in-depth understanding of the subject matter by examining the perspectives, experiences, and narratives of various stakeholders involved in rural development initiatives. By synthesizing existing literature and analyzing secondary data, this study aims to provide comprehensive insights into the role of social infrastructure in fostering rural development in Maharashtra.

**Data Collection Methods:**

The data collection process primarily relies on secondary sources, including academic journals, government reports, policy documents, and other relevant publications. Secondary data sources offer a wealth of information on various aspects of rural development, including the establishment and functioning of social infrastructure such as schools, healthcare facilities, community centers, and transportation networks. The secondary data will be collected from reputable sources such as the Maharashtra government's official website, academic databases (e.g., PubMed, JSTOR), and relevant non-governmental organizations (NGOs).

**Inclusion and Exclusion Criteria:**

1. **Inclusion Criteria:**

- Secondary data sources relevant to the topic of social infrastructure and rural development in Maharashtra will be included in the review.
- Publications and reports published within the past two decades (2000-2022) will be considered to ensure the relevance and currency of the information.
- Data sources that provide insights into the role of social infrastructure in addressing key developmental challenges faced by rural communities in Maharashtra will be included.

2. **Exclusion Criteria:**

- Secondary data sources that are outdated or lack relevance to the research topic will be excluded from the review.
- Publications that focus solely on urban infrastructure or rural development in regions outside Maharashtra will not be included in the analysis.
- Data sources that do not provide sufficient detail or empirical evidence to support their findings will be excluded from the review.

**Ethical Consideration:**

1. **Data Privacy and Confidentiality:**

As the study relies on secondary data sources, ethical considerations primarily revolve around ensuring the privacy and confidentiality of individuals mentioned in the literature. Any personal or sensitive information obtained from secondary sources will be handled with confidentiality and used only for research purposes.

2. **Attribution and Citation:**

Proper attribution and citation will be ensured for all secondary data sources used in the review. Academic integrity will be maintained by acknowledging the contributions of previous researchers and authors whose work forms the basis of this review paper.

3. **Conflict of Interest:**

The researchers conducting the review will declare any potential conflicts of interest that may influence the interpretation or presentation of the data. Transparency will be maintained throughout the research process to uphold the credibility and integrity of the findings.

This material and methodology outline provides a structured approach for conducting the review research paper on the contribution of social infrastructure in rural development of Maharashtra. By adhering to ethical considerations and employing rigorous data collection methods, the study aims to contribute valuable insights to the existing literature on rural development and social infrastructure.

**Results and Discussion**

The examination of the contribution of social infrastructure in rural development of Maharashtra yielded several significant findings and insights. The results are presented and discussed below:

1. **Access to Education Facilities:**

The study revealed that the availability and accessibility of education facilities in rural Maharashtra significantly impact the overall development of the region. Areas with well-established schools, colleges, and vocational training centers tended to exhibit higher rates of literacy, educational attainment, and skill development among the rural population. Furthermore, the presence of quality educational institutions was associated with enhanced economic opportunities and social mobility, contributing to the overall socio-economic development of rural communities.

2. **Healthcare Services Provision:**

The analysis indicated that the provision of healthcare services plays a crucial role in promoting the health and well-being of rural residents in Maharashtra. Areas with adequate healthcare infrastructure, including primary health centers, hospitals, and medical clinics, experienced improved health outcomes, reduced morbidity rates, and increased life expectancy. Access to healthcare services also contributed to poverty alleviation by reducing medical expenses and productivity losses due to illness, thereby enhancing the overall quality of life in rural areas.

3. **Infrastructure Development and Connectivity:**

Infrastructure development, particularly in terms of transportation and communication networks, emerged as a key determinant of rural development in Maharashtra. The presence of well-maintained roads, bridges, and public transportation systems facilitated connectivity between rural communities and urban centers, promoting economic integration, market access, and trade opportunities. Additionally, access to reliable communication infrastructure, such as mobile networks and internet connectivity, facilitated information dissemination, e-governance initiatives, and access to online education and healthcare services, thereby fostering socio-economic development and empowerment in rural areas.

4. **Social Empowerment and Community Development:**

The study highlighted the importance of social infrastructure in fostering social empowerment and community development in rural Maharashtra. Social infrastructure, including community centers, public libraries, and cultural institutions, provided platforms for social interaction, civic engagement, and cultural exchange, promoting social cohesion, identity formation, and collective action among rural residents. Moreover, the presence of social infrastructure contributed to the preservation of indigenous knowledge, cultural heritage, and traditional practices, enriching the social fabric of rural communities and promoting sustainable development.

5. **Challenges and Policy Implications:**

Despite the significant contribution of social infrastructure to rural development, the study identified several challenges and areas for policy intervention. These include disparities in infrastructure provision across different regions, inadequate funding and resource allocation, institutional capacity constraints, and governance issues. Addressing these challenges requires targeted policy interventions aimed at enhancing infrastructure investment, improving service delivery mechanisms, strengthening institutional frameworks, and promoting participatory approaches to rural development planning and implementation.

Overall, the findings underscore the critical role of social infrastructure in promoting rural development and advancing the socio-economic well-being of rural communities in Maharashtra. By addressing the identified challenges and leveraging the potential of social infrastructure, policymakers can foster inclusive and sustainable development that benefits all segments of the rural population.

**Limitations of the study**

While the review research paper on the "Contribution of Social Infrastructure in Rural Development of Maharashtra" provides valuable insights into the role of social infrastructure in rural development, it is important to acknowledge several limitations that may impact the interpretation and generalizability of the findings:

1. **Limited Scope:** The study may have a limited scope in terms of geographical coverage, focusing solely on the rural areas of Maharashtra. This may restrict the applicability of the findings to other regions or states with different socio-economic contexts.
2. **Data Availability:** The availability of comprehensive and up-to-date data on social infrastructure in rural Maharashtra may pose a challenge. Limited access to reliable data sources or incomplete datasets could constrain the depth of the analysis and the accuracy of the conclusions drawn.
3. **Methodological Constraints:** The research paper may face methodological constraints, such as the use of secondary data sources or survey instruments with inherent limitations. Methodological issues related to sampling, measurement, and data analysis could affect the validity and reliability of the study findings.
4. **Contextual Factors:** The study may not fully account for contextual factors that influence the relationship between social infrastructure and rural development in Maharashtra. Socio-cultural dynamics, political factors, and historical legacies may shape the implementation and impact of social infrastructure projects in rural areas.
5. **Temporal Considerations:** The analysis may be based on data collected at a specific point in time, which may not capture long-term trends or changes in social infrastructure and rural development over time. Temporal considerations could affect the relevance and timeliness of the study findings.
6. **External Validity:** The findings of the study may have limited external validity beyond the specific context of rural Maharashtra. Extrapolating the results to other regions or countries with different socio-economic conditions may not be appropriate without considering contextual variations.
7. **Bias and Subjectivity:** The research paper may be subject to bias or subjectivity in the selection of variables, interpretation of results, and presentation of conclusions. Researchers' personal perspectives or institutional affiliations could influence the analysis and findings.

Despite these limitations, the study provides valuable insights into the contribution of social infrastructure to rural development in Maharashtra. Future research efforts could address these limitations by employing robust methodologies, incorporating multi-disciplinary perspectives, and considering a broader range of contextual factors to enhance the validity and generalizability of the findings.

**Future Scope**

The review research paper on the contribution of social infrastructure in rural development of Maharashtra provides valuable insights into the significance of social infrastructure for enhancing the socio-economic well-being of rural communities in the state. While the current study sheds light on the existing state of social infrastructure and its impact on rural development, there are several avenues for future research and exploration in this field.

1. **Quantitative Analysis:** Future studies can employ quantitative research methodologies to analyze the quantitative impact of different forms of social infrastructure on various aspects of rural development, such as education, healthcare, sanitation, and access to basic amenities. Statistical techniques like regression analysis and econometric modeling can be utilized to assess the causal relationship between social infrastructure investments and rural development outcomes.
2. **Case Studies:** Conducting in-depth case studies of specific villages or regions within Maharashtra can provide a more nuanced understanding of how different types of social infrastructure interventions contribute to rural development. By examining success stories and best practices, policymakers and practitioners can derive valuable lessons for replicating effective strategies in other rural areas.
3. **Community Participation and Governance:** Future research can explore the role of community participation and local governance structures in the planning, implementation, and maintenance of social infrastructure projects. Understanding the dynamics of community involvement and decision-making processes can inform more participatory and bottom-up approaches to rural development.

4. **Technological Innovations:** With the rapid advancement of technology, there is a need to explore how digital innovations and ICT (Information and Communication Technology) solutions can be leveraged to enhance the delivery and accessibility of social infrastructure services in rural areas. Studies on the adoption of e-governance platforms, mobile health applications, and online education initiatives can offer insights into their potential impact on rural development outcomes.
5. **Sustainability and Resilience:** Investigating the long-term sustainability and resilience of social infrastructure investments in the face of climate change, natural disasters, and socio-economic shocks is essential. Future research can examine strategies for building resilience into social infrastructure projects and ensuring their continued effectiveness in the face of evolving challenges.
6. **Policy Implications:** Finally, future studies can explore the policy implications of findings related to the contribution of social infrastructure to rural development in Maharashtra. This includes assessing the effectiveness of existing policies, identifying gaps and areas for improvement, and recommending policy interventions to enhance the quality and accessibility of social infrastructure services in rural areas.

   The study of the contribution of social infrastructure in rural development of Maharashtra opens up several avenues for future research, ranging from quantitative analysis and case studies to exploring the role of technology, community participation, and governance structures. By addressing these research gaps, scholars can contribute to a deeper understanding of the dynamics of rural development and inform evidence-based policy decisions aimed at improving the lives of rural communities in Maharashtra.

**Conclusion:**

This review research paper has explored the significant contribution of social infrastructure to rural development in the state of Maharashtra. Through an extensive examination of existing literature and empirical evidence, it has been elucidated that social infrastructure plays a pivotal role in enhancing the quality of life, promoting economic growth, and fostering sustainable development in rural areas.

The review has underscored the multifaceted nature of social infrastructure, encompassing various dimensions such as education, healthcare, sanitation, transportation, and community facilities. It has been demonstrated that investments in social infrastructure not only address basic human needs but also serve as catalysts for broader development outcomes, including poverty reduction, social inclusion, and gender equality.

Furthermore, the paper has highlighted the interconnectedness between social infrastructure and other sectors of rural development, emphasizing the synergistic effects that arise from integrated planning and investment strategies. For instance, improved access to education and healthcare facilities can enhance human capital formation, leading to increased productivity, higher incomes, and overall economic development.

Moreover, the review has examined the specific context of rural Maharashtra, considering the unique challenges and opportunities present in the state. It has discussed various initiatives and interventions aimed at strengthening social infrastructure in rural areas, including government programs, community-driven projects, and public-private partnerships.

Additionally, the paper has identified key factors that influence the effectiveness of social infrastructure investments, including governance structures, financing mechanisms, stakeholder engagement, and capacity-building efforts. It has emphasized the importance of participatory approaches and bottom-up decision-making processes in ensuring the sustainability and relevance of social infrastructure initiatives.

Overall, this review underscores the crucial role of social infrastructure in promoting rural development and improving the well-being of rural communities in Maharashtra. By prioritizing investments in education, healthcare, sanitation, and other essential services, policymakers can create an enabling environment for inclusive growth and poverty alleviation.

This paper calls for continued efforts to strengthen social infrastructure in rural Maharashtra, recognizing it as a cornerstone of sustainable development and a pathway to building resilient and prosperous communities.

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# "The Role of Industry-Academia Collaboration in Bridging Skill Gaps for Management Graduates"

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**Abstract:**

Collaboration between academia and industry contributes greatly to better positions in accreditation bodies, growth and job opportunities, research and development, etc. A productive interface between industry and academia is crucial in today's information economy. Due to the dynamic nature of industry and academia, there is an obligation to develop concepts and theories along the same lines to keep up with the changing environment. There is relatively little collaboration between industry and academia and less research on general paradigms. Collaboration frameworks (Perkmann, Tartari et al., 2012) were developed in response to changes in the work environments of various companies (Cunningham and Link, 2014). Industries have always viewed universities as potential sources of new ideas and knowledge, seeking to expand their knowledge base and improve their ability to provide solutions to society's complex problems (Perkmann, Neely et al., 2011). According to Perkmann, Neely et al. (2011), more and more organizations are collaborating with higher education institutions to achieve their competence and innovation goals. Academics and decision-makers are now more than ever interested in the impact of university studies on business innovation. Universities have the opportunity to engage in mutually beneficial collaborations with businesses that increase educational opportunities and value. This can be achieved by creating better resources for higher and continuing education, encouraging the exchange of innovative ideas and technology transfer, and developing an environment conducive to continuous learning.

**Keywords**: Skill gap, management graduates, University, employability, skills development, higher education

## Introduction:

Science and industry are important pillars of our economy. The research explored the role of industry-university collaboration in improving educational opportunities and outcomes in the digital Industry 4.0, using the characteristics of research and development, patenting and development, and artificially mediated curriculum development. Intelligence New research is published every year on the importance and outcomes of university-industry collaboration (UIC). In the current social and economic situation, colleges (universities) and industry are under various pressures. This is especially true for the technology sector and especially for the information and communication technology (ICT) sector. The development of technology is rapidly changing and disrupting modern business environments, which in turn affects companies, product life cycles, and services and creates a constant need for new and better skills. The financial burden, financial needs and competitiveness in the research field make collaboration with industry an important and valuable way for higher education institutions.The final goal of a business school is to develop a candidate in sync with the knowledge, skills and abilities (KSA) necessary to face the realities and volatility of the industry. They also need to develop communication tools such as case studies, develop channels of collaboration with industry, publish research and be qualified to address industry trends. Students can use their skills to get ahead. Technology transfer and commercialization can also take place on an industrial scale. Industry can provide business schools with more virtual or hands-on experiences to improve students' problem-solving, decision-making, core and soft skills, as well as traditional internship programs. Academia is innovative, while industry is tasked with commercializing innovation. Collaboration between companies and universities around the world is necessary, and there is no commonly used paradigm, although it has long been discussed by both sides. Business schools and management

institutes used to operate in isolation from industry, but recently the two have become closer. Both entities will quickly benefit from this synergy. Industrial processes have become more complex, and the constantly changing business environment with the introduction of Industry 5.0 has required a more collaborative response. In addition to a solid structure, the need for the class is a skilful interface between industry and academia. This is necessary to update the curriculum as per the industry requirements with an emphasis on new technology in the workplace which will help the students to become industry-ready in time. This increases their job opportunities.

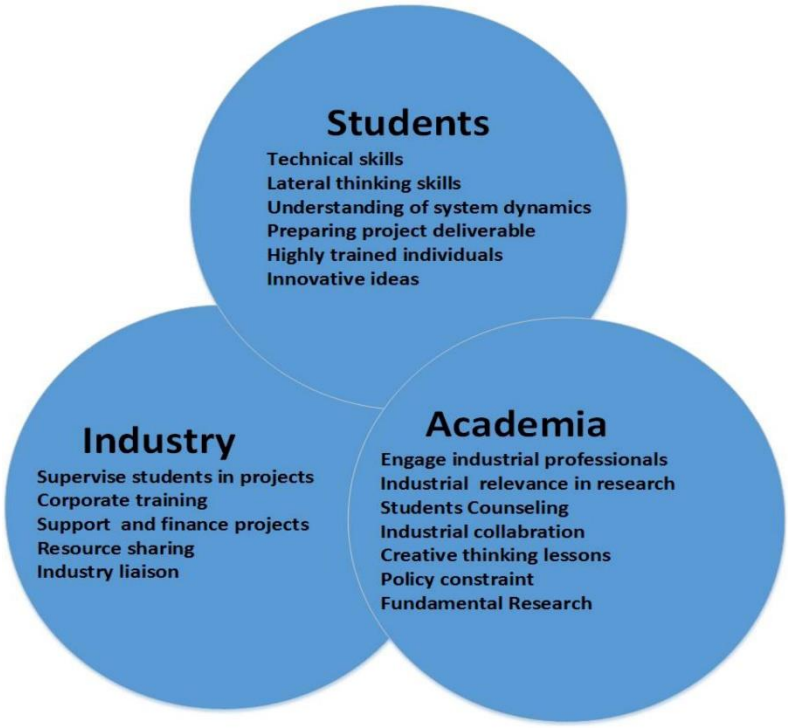


Fig -1 Strengthening the Bridge Between Academic and the Industry

**Research Methodology**

Universities and industry are two important pillars of the economy. It is the role of universities to develop skills to meet the demands of industry. In today's globalized world, economies are increasingly interconnected, leading to cross-border research and development. India, which aims to become a global innovation power, needs to focus on collaborative knowledge creation and information exchange between industry and universities. Research collaboration is essential, but other means must also be created to promote closer collaboration between universities and industry at all stages of technological development. Although challenges lie ahead, the government must establish a coherent policy to enable collaboration between academia and industry to flourish and support technological leadership.

Given the important role of employers, this study considers industry-university collaboration as a mediating variable and examines how it mediates the relationship between university quality management and student employment.

This research is conducted using secondary content sources and research observations. For the research paper, information was collected from secondary sources such as research papers, articles and websites that raised awareness of the problem and helped interpret solutions to it. Secondary data helped to understand the differences and shortcomings of previous studies and what additional material needed to be collected.

The purpose of this study is to shed light on the best practices that universities must adopt to succeed in UICs. In particular, research should examine the challenges faced by universities in implementing these practices and provide solutions to them. By identifying and addressing these challenges, this study aims to provide valuable information to universities and help them create successful UIC centres. The objectives of this research are as follows:

- To investigate the cooperation of the Academy of Industry in the general growth of higher education, especially in B-schools.
- Explore new areas of collaboration in line with the demands of colleges in the field.

**Analysis**

By 2030, more than 250 million skilled manpower is required in manufacturing and service

segments, so there is a growing demand for higher education in India. The government has started emphasizing on competency-based assessment, and industry exposure through live projects, webinars and business activities. Opportunities such as real-time projects and internships help build a student's confidence and prepare them to enter the business world with the necessary skills and knowledge.

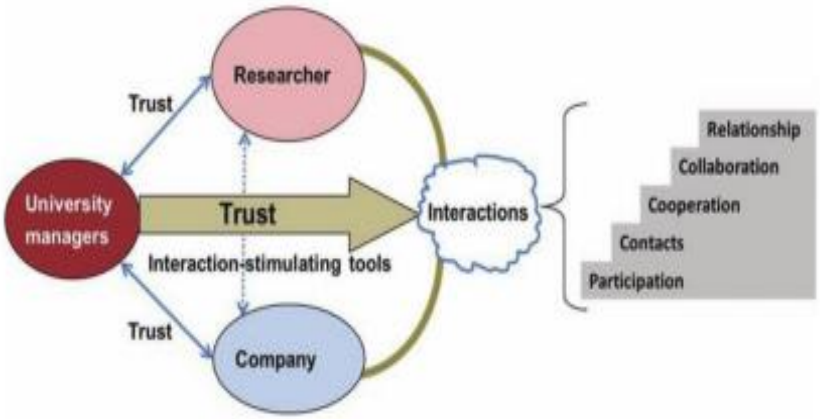


Fig- 2 A theoretical framework over university-industry interactions (from Jonsson et al. 2015)

Cooperation is beneficial both for the university and companies. Companies not only acquire talent but also play a role in nurturing it. Talent is seen as an investment for the company, not a liability. It helps to match the right job at the right time, in the right place with the right KSA. Since each student acquires unique characteristics and qualities, and the company offers a wide range of products and services, companies can save on training and development costs and skill costs in creating future managers through the links established with business universities. The interface between industry and academia has already been widely discussed. Relations between universities or research institutes and industry are strengthened by an established area of common interest. The education sector in India is developing rapidly and the rate of growth is fast. India is becoming an educational powerhouse.

The relationship between academia and industry is not a donor relationship but is collaborative and interactive, understanding and maintaining mutual coherence with each other's positions and efforts to achieve the real goal of such partnerships. Create synergy between research and results. Links between academia and industry are indeed a mechanism that requires the active participation and cooperation of all parties involved. The success of University-Industry Collaboration (UIC) is highly dependent on the adoption of common industry best practices. Such practices require strong planning skills and the ability to maintain informal relationships, both of which are necessary to ensure that the project works well. It is easier for universities to implement these practices, but there can be challenges in implementing them. According to the first objective, the challenge is to find the gap between supply and demand. Also to explain the information exchange gap. To analyze the relationship/impact between industry and higher education and the employability of students, we need to explore the importance of knowledge transfer and provide real-time solutions to existing problems. Then, the second goal is to explore new areas of collaboration according to the requirements of the department - academics. New areas of collaboration can be research and innovation as that is a key indicator for the growth of any B-school. Skill development is another area to look at where all three aspects need to be looked at, for example – upskilling, retraining and training management as per industry requirements. Further invention and the establishment of a centre of excellence would lead to universities. In summary, it can be said that the treatment of the system would lead to the growth of the educational institution and contribute to the implementation of classroom learning in the daily activities of the company.

**Discussions:**

In 2014, according to Manpower's Talent Shortage Survey, India was ranked third among the top 10 countries where employers had great difficulty filling vacancies in their organizations. This number has been estimated at around 64 per cent globally, which in itself is proof that despite management institutes looking for job-ready candidates, there is still a wide gap between the right talent. involve the person the company observes. Among the world's leading economies, India was second only to Japan, competing with the leading global economies, with approximately 81 per cent of the talent shortage. So how do you fill this gap? This argument highlights the important fact that the importance of collaboration between industry and higher education institutions for the growth of higher education institutions, especially business schools, urgently needs to be explored. (India Today, 2020).

**Conclusion:**

Industrial scholars are a new way to bridge the gap between the workload and preparation offered in academic institutions. Linkages between industry and academia are a win-win scenario. Management students should think about entrepreneurship and use the human talents available in the country to develop and promote the economy. Universities and the private sector need to establish good mutual links and communication. Such engagement should not be limited to pre-initiatives and industrial tours, but should also include other relevant areas such as curriculum, new project planning, business acumen, common R&D practices and ethical issues in industrial workplaces. Academic institutions should design the course model in such a way that the students get ample exposure to the areas required by the industry. In general, regarding the quality and competitiveness of teaching.

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# Right Plagiarism Detection Tool, its working and Advantages: An Overview

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**Abstract:**
This article provides an overview of the Right plagiarism detection tool. It outlines the tool's working mechanism, which involves comparing uploaded text against a vast database to identify potential instances of plagiarism. The article highlights the advantages of Right, including its comprehensive database, advanced algorithm, user-friendly interface, detailed reports, time-saving capabilities, and contribution to maintaining academic integrity. By understanding the functionalities and benefits of Right, users can effectively utilize the tool to ensure the originality of their work.

**Keywords:** Plagiarism detection software, Academic integrity, Copyright infringement, Originality check, Similarity index, Turnitin, Grammarly, paraphrasing tool, Citation, Referencing, Research ethics.

**Plagiarism Detection Tools:**

Plagiarism detection tools are software applications designed to identify instances of text overlap between a submitted document and existing sources. They play a crucial role in maintaining originality and ensuring academic honesty.

**Popular Plagiarism Detection Tools:**

- **Turnitin:** A widely used tool in educational institutions, Turnitin compares submitted papers against a vast database of academic papers, websites, and publications.
- **Copyscape:** Primarily used for website content, Copyscape detects duplicate content across the web.
- **Plagiarism Checker X:** Offers a free online plagiarism checker with a comprehensive database.
- **Grammarly:** While primarily known for grammar and style checking, Grammarly also includes plagiarism detection features.

**How Plagiarism Detection Tools Work:**

These tools typically operate by:

1. **Digitizing the document:** The submitted document is converted into a digital format.
2. **Creating a text fingerprint:** The tool generates a unique digital fingerprint of the document.
3. **Comparing against a database:** The fingerprint is compared against a massive database of academic papers, websites, and other sources.
4. **Identifying matches:** Any significant matches between the submitted document and existing sources are flagged as potential plagiarism.

**Plagiarism Detection Software: Free vs. Commercial:**

Plagiarism detection software has become an indispensable tool for maintaining academic and professional integrity. These tools scan documents against vast databases to identify potential instances of copied content. Let's delve into the differences between free and commercial plagiarism detection software.

**Free Plagiarism Detection Software**

While free options offer a convenient way to check for plagiarism, they often come with limitations.

**Key Characteristics:**

- **Limited Database:** Free tools typically have smaller databases compared to their commercial counterparts, which can result in missed matches.
- **Basic Features:** They often provide essential plagiarism detection functions but lack advanced features like in-depth analysis or originality reports.
- **Advertisements:** To sustain their services, free tools often display advertisements, which can be distracting.
- **Word Limits:** Many impose restrictions on the number of words you can check in a single scan.

**Popular Free Options:**

- **DupliChecker:** Offers a basic plagiarism check with a user-friendly interface.
- **Plagiarism Checker X:** Provides free checks with some limitations on word count and features.
- **SmallSEOTools:** Offers a free plagiarism checker with additional SEO tools

**Commercial Plagiarism Detection Software:**
Commercial tools invest heavily in database expansion, advanced algorithms, and customer support, making them more reliable and accurate.

**Key Characteristics:**

- **Extensive Databases:** They access vast repositories of academic papers, websites, and publications, increasing the likelihood of detecting plagiarism.
- **Advanced Features:** Commercial tools often offer in-depth analysis, originality reports, and integration with learning management systems (LMS).
- **Accuracy:** Due to their larger databases and sophisticated algorithms, they generally provide more accurate results.
- **Customer Support:** Commercial providers typically offer dedicated customer support to assist users.

**Popular Commercial Options:**

- **Turnitin:** Widely used in educational institutions, Turnitin offers comprehensive plagiarism detection and originality reports.
- **iThenticate:** A popular choice for publishers and businesses, iThenticate provides advanced features and customization options.
- **Copyscape:** Primarily focused on website content, Copyscape helps identify duplicate content online.
- **Grammarly:** While primarily a grammar and style checker, Grammarly also includes plagiarism detection features.

**Choosing the Right Tool:**
The best plagiarism detection software depends on your specific needs. Consider the following factors when making a decision:

- **Purpose:** Are you a student, teacher, researcher, or business owner?
- **Budget:** Commercial tools often require a subscription fee, while free options are available at no cost.
- **Database Size:** A larger database increases the chances of detecting plagiarism.
- **Features:** Consider the specific features you need, such as in-depth analysis, originality reports, or integration with other tools.
- **Accuracy:** Look for tools with a proven track record of accuracy.

**Advantages of Using Plagiarism Software for Academic Integrity:**
Plagiarism detection software has become an invaluable tool in maintaining academic integrity. Here are some key advantages:

**Detecting Plagiarism:**

- **Identifies Unintentional Plagiarism:** Helps students and researchers identify instances of accidental plagiarism, such as improper paraphrasing or citation errors.
- **Deterrence:** The presence of plagiarism detection software acts as a deterrent, encouraging students to produce original work.
- **Fairness:** Ensures a level playing field for all students by preventing the unfair advantage of those who plagiarize.

**Enhancing Research and Writing Skills:**

- **Improves Citation Practices:** Encourages students to learn proper citation formats and accurately attribute sources.
- **Fosters Critical Thinking:** By identifying areas of potential plagiarism, students are prompted to analyze and synthesize information more critically.
- **Develops Research Skills:** Students are motivated to conduct thorough research and develop their own arguments.

**Saving Time and Resources:**

- **Efficient Screening:** Quickly scans large volumes of text for potential plagiarism.
- **Reduces Administrative Burden:** Streamlines the process of checking for plagiarism, allowing faculty to focus on teaching and research.
- **Protects Institutional Reputation:** Helps maintain the institution's reputation for academic integrity.

**Promoting Academic Honesty:**

- **Creates a Culture of Integrity:** Reinforces the importance of original thought and intellectual honesty.
- **Educates Students:** Can be used as a teaching tool to explain the consequences of plagiarism and the importance of proper citation.

**How to Reduce Plagiarism in Academic writing?**
Plagiarism is a serious academic offense. Here are some strategies to avoid it:

**Understanding Plagiarism:**

- **Know what constitutes plagiarism:** Understand the different forms of plagiarism, including direct copying, paraphrasing without citation, and mosaic plagiarism.
- **Learn citation styles:** Familiarize yourself with the appropriate citation style (APA, MLA, Chicago, etc.) for your field.

**Effective Research and Note-Taking:**

- **Develop a strong research plan:** Clearly outline your research questions and objectives.
- **Take detailed notes:** Summarize information in your own words and record the source accurately.
- **Avoid excessive reliance on quotes:** Paraphrase information whenever possible and use quotes sparingly.

**Writing and Citation:**

1. **Paraphrase effectively:** Restate information in your own words without changing the original meaning.

2. **Use quotations judiciously:** Enclose direct quotes in quotation marks and cite the source accurately.
3. **Cite all sources:** Acknowledge all information that is not your own, including ideas, facts, and statistics.
4. **Proofread carefully:** Review your paper for any unintentional plagiarism.
5. **Additional Tips:**
6. **Use plagiarism detection tools:** Run your paper through a plagiarism checker to identify potential issues.
7. **Seek feedback:** Ask peers or instructors to review your work for clarity and originality.
8. **Develop your own voice:** Strive to develop a unique writing style and perspective.

**Conclusion:**

Right plagiarism detection tool has established itself as a valuable asset for students, researchers, and content creators. Its advanced features, combined with its user-friendly interface, make it an effective tool for identifying and preventing plagiarism. By leveraging Right, individuals can ensure the originality of their work and uphold academic standards.

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# The Influence of Artificial Intelligence on Contemporary Library Services: A Transformation

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**Abstract:**
Artificial intelligence, sometimes known as AI, is a recent advancement in the application of technology in libraries. Artificial intelligence is the computational technique that allows computers to do activities that would be deemed intelligent if performed by humans. Artificial intelligence in libraries holds the potential to create machines or computer systems that can think, act, and surpass human intelligence. This development will have a significant impact on librarianship. At present, libraries around the world use artificial intelligence extensively. Artificial intelligence has supported in-house library functions like text recognition, document analysis, and circulation, classification, indexing, and cataloguing. Artificial intelligence will likely help libraries accomplish more rather than replace librarians, despite the perception that doing so will divide librarians from users. Artificial intelligence will significantly enhance the services and operations provided by libraries, as well as increase their significance in today's rapidly evolving digital society.

**Keywords:** Artificial Intelligence, Librarian, digital society, Library

**Introduction: -**

AI improves operational efficiency, user experiences, and information services in libraries. AI can automate cataloguing and inventory management, freeing up library staff to focus on more difficult jobs and individualized patron services. Machine learning algorithms facilitate better understanding of user behaviour, enabling libraries to offer customized recommendations and optimize resource allocation. Natural language processing (NLP) empowers libraries to enhance search functionalities and provide more intuitive interfaces for accessing information. Overall, AI in libraries represents a transformative shift towards more agile, responsive, and user-centric information environments. Artificial Intelligence (AI) is increasingly becoming integral to modern libraries, offering a range of applications that enhance both operational efficiency and user engagement. One significant area of impact is in automating and optimizing library processes. AI can expedite cataloguing and categorization, making large collection management more efficient and accurate. Automation decreases human error and lets library personnel focus on higher-level jobs that need judgment and experience. Another key application of AI in libraries is in improving user services. AI technologies enable libraries to analyse large amounts of data about user preferences and behaviour. This data can be leveraged to provide personalized recommendations for books, articles, or other resources that match individual interests. For instance, recommendation systems powered by machine learning algorithms can suggest relevant materials based on users' borrowing history, preferences, and even current trends in reading or research. Natural Language Processing (NLP) is another crucial AI technology transforming libraries. NLP enables more sophisticated search capabilities, allowing users to interact with library catalogues and databases using natural language queries. This makes information retrieval faster and more intuitive, addressing the requirements of a wide range of users and skill levels. Chatbots equipped with NLP can also provide instant assistance to users, answering questions about library services, operating hours, and resource availability.

Furthermore, AI enhances accessibility in libraries by enabling the conversion of text to speech and vice versa, facilitating access to information for patrons with visual impairments or language barriers. AI-powered translation services also support multilingual communities by enabling the seamless translation of library resources into different languages. Overall, AI is reshaping libraries into more dynamic and responsive information hubs, capable of meeting the evolving needs of their patrons effectively. As libraries integrate AI technology, they will become increasingly more important in encouraging reading, education, and information access in the digital age. It is set to transform libraries into innovative and efficient institutions. AI involves a variety of technologies and methods that allow robots to mimic human intellect, learn from data, and execute

cognitive tasks. AI can change libraries in many ways.

Firstly, AI enhances operational capabilities by automating routine tasks such as cataloguing, sorting, and managing library collections. Machine learning algorithms can analyse and classify vast amounts of data, improving the accuracy and speed of tasks that once relied heavily on manual effort. This automation allows library staff to redirect their efforts towards more strategic activities like curating collections, developing programs, and engaging with patrons. Secondly, AI improves user experience through personalized services and enhanced accessibility. AI-driven recommendation systems can suggest relevant books, articles, or resources based on users' past borrowing history, preferences, and interests. Natural language processing technologies enable more intuitive search interfaces, making it easier for patrons to navigate and access information within library catalogues and databases. Additionally, AI-powered tools like speech recognition and translation services facilitate access to library resources for diverse linguistic and sensory needs, fostering inclusivity and broadening the reach of library services. Furthermore, AI supports data-driven decision-making in libraries by providing insights into usage patterns, resource availability, and community needs. Artificial intelligence-powered predictive analytics can help libraries predict demand for items and services, optimize resource allocation, and improve outreach. Libraries' use of AI technology improves operational efficiency and service delivery and reinforces their position as community hubs for lifelong learning, research, and cultural enrichment. Using AI to create dynamic, responsive, and user-centered libraries in the digital era is proactive.

Here are some specific examples of how Artificial Intelligence (AI) is being implemented in libraries:

1. **Automated Cataloguing and Metadata Management:** AI algorithms are used to analyse and categorize vast amounts of bibliographic data, automating the process of cataloguing and ensuring consistency in metadata management. This helps libraries maintain organized collections and improve search ability for users.
2. **Personalized Recommendations:** AI-driven recommendation systems analyse user preferences, borrowing history, and reading habits to suggest relevant books, articles, or resources. For example, libraries can use machine learning algorithms to offer personalized reading lists or suggest materials based on similar users' interests.
3. **Enhanced Search with NLP**: NLP technologies let libraries create more user-friendly search interfaces. Patrons may search using natural language queries, simplifying and boosting user happiness.
4. **AI-powered Virtual Assistants and Chatbots:** Instantly respond to user queries about library hours, services, or how to navigate the website or catalogue. These assistants improve user assistance and accessibility, especially after hours.
5. **Decision-Making Data Analytics:** AI and machine learning algorithms analyze use data to reveal patron behavior, resource consumption, and library usage trends. Data-driven choices help libraries grow collections, allocate resources, and improve services.
6. **Accessibility Tools:** AI technologies like optical character recognition (OCR) and text-to-speech conversion improve accessibility for users with visual impairments by converting printed materials into accessible formats. AI-driven translation services also support multilingual communities by providing translations of library resources into different languages.
7. **Predictive Analytics for Collection Management:** AI can predict demand for certain materials based on historical borrowing patterns, seasonal trends, or community events. Libraries can use these predictions to optimize their collections, ensuring they have the right resources available when patrons need them.

These examples illustrate how AI is transforming libraries by enhancing efficiency, improving user experiences, and expanding access to information and services in innovative ways.

**The convergence of libraries and artificial intelligence**

Though studies on artificial intelligence in libraries have been growing over the past few years, prior studies focused on librarians' opinions on artificial intelligence. **(Wood and Evans, 2018).** Many academics are of the opinion that artificial intelligence has the potential to significantly alter library services. **Cox (2021)** suggested that librarians should enhance their proficiency in educating consumers about the utilization of AI in library services and its ramifications for information retrieval and exploration. Other research has observed that numerous librarians express concerns about the impact of AI on library services due to various factors such as job stability, practical applications, and technical challenges. Nevertheless, the majority of librarians remain hopeful that AI will generate fresh prospects and expand the possibilities available to them **(Wood and Evans, 2018).** According to the findings of a few studies, librarians

ought to get involved with professional interest groups that are experiencing this technology. Because of the implementation of this technology in library services, engaging with these experts will result in the creation of new skills and the development of new services.

In this age of information explosion, artificial intelligence in library services will be a game-changer since it will enable access to reliable information. A useful instrument for the natural integration of readers and libraries alike. A momentum will be given to library practitioners and consumers through the implementation of AI in library services.

Through the use of the same platform, readers will be able to communicate with one another and receive access to humanized services at a lower cost. There are a few researchers, such as **Hussain (2020a, 2020b),** who have made the observation that the majority of librarians in poor countries are still uninformed of the implementation of it in their libraries. There might be a number of reasons behind this, including a lack of understanding or the substantial financial investment that is necessary to effectively incorporate AI in library services. One further reason why artificial intelligence is not being incorporated into library services is that there are not enough research activities that relate AI to librarianship. There are certain libraries that have partially incorporated artificial intelligence, such as chatbots for virtual reference that employ machine learning, which is a subtype of AI.

**Use of Artificial Intelligence in the Provision of Library and Information Services**

Libraries have always utilized computers for acquisition, cataloging, and categorization. The emergence of AI presents a new dimension for machine intelligence in library services. Information services like reference, descriptive cataloguing, technical services, collection development, subject indexing, database searching, and document delivery introduce knowledge representation and natural language processing challenges. The use of AI in many businesses, schools, hospitals, and libraries is growing, with intelligent systems replacing traditional ones. According to **Mogali (2015),** artificial intelligence (AI) involves using computer-based programs and software to execute various library activities and services. **Senthikumaran and Sreeja (2017)** define library automation as using computers to automate routine tasks including cataloging, acquiring, charging, and discharging.

**Umahi (2018)** emphasized the need of automating library collections for rapid response and simple access to information. Integrating AI into library operations will improve service delivery, but non-specialists may struggle to interpret its specific information. The goal of creating artificially intelligent computers has significant implications for librarianship and information services, including reference, descriptive, technical, collection development, subject indexing, database searching, and document delivery. The focus is on using computerized expert systems, such as Artificial Intelligence (AI), to give recommendations and decisions for library services.

**The Advantages of Artificial Intelligence in Library Service Delivery**

To Western libraries, AI "Robotics" has long been a boon. These new technologies have the potential to channel human intelligence by solving problems, making decisions, and thinking and learning on their own. More and more applications of artificial intelligence are cropping up in many industries, such as medicine, teaching, media, and commerce. Machines that scan checks, cellphones, and GPS systems are all ways that artificial intelligence is starting to seep into our everyday lives **(Nilsson, 2014).** When libraries use AI, patrons will be more likely to try new things and be open to new kinds of services. The benefits of library services are immeasurable and can be summarized as follows:

- Artificial intelligence has the ability to improve the marketing of information products and services using a range of channels, including but not limited to email, voice mail, video conferencing, machine vision, natural language processing, voice recognition, and language translations. These channels are just few of the many that are available.
- Artificial intelligence in libraries will improve new services and goals while simultaneously limiting human errors and fatigue. This will be accomplished by reducing the amount of manual daily routines that include finding information and executing reference operations, such as desk queries.
- It is possible for artificial intelligence to do many tasks at once, much like in the movie "Avatar," and it may interact with users to check out collections and obtain books. Artificial intelligence has the potential to improve operational efficiency due to its ability to manage vast volumes of data, facilitate the sharing of data, and assist research that spans several disciplines.
- A number of crimes, including theft, mutilation, fraud, and others, can be identified with the use of artificial intelligence in libraries. A forensic examination of the eye, finger, and face may also be performed with its assistance, and only those individuals who have registered can have

access to the system. As a consequence of the provision of information services that are both expedient and useful, the library is able to get financial support.

- As a result of its capacity to function for extended periods of time and generate results that can be relied upon, artificial intelligence has the potential to strengthen the institution and make it easier for individuals to engage in independent study.
- As a result of the incorporation of analytics and feedback loops into operations and services, artificial intelligence has the potential to lower the cost of delivering services, hence supporting management in improving the efficiency with which services are delivered.
- AI increases operational efficiency by facilitating more flexible and easy workflows. Since computers are faster and less prone to error than humans, artificial intelligence (AI) maximizes operational performance and benefits libraries by improving information search.

**Limitations of AI in Libraries**

Artificial intelligence in libraries offers numerous benefits, such as automating routine tasks, enhancing cataloguing accuracy, and improving user search experiences through natural language processing. However, it also presents several limitations. AI systems can struggle with understanding the nuances and context of complex or specialized queries, potentially leading to incomplete or incorrect information retrieval. Additionally, there are concerns about data privacy and the ethical use of user information, as well as the potential for bias in AI algorithms, which can perpetuate existing inequalities in information access. Moreover, the implementation and maintenance of AI technologies require significant financial investment and technical expertise, which may be challenging for libraries with limited resources. Finally, while AI can assist librarians, it cannot replace the critical human elements of personalized service, professional judgment, and the deep understanding of user needs that librarians provide.

**Conclusion**

AI can help libraries better serve clients in need, both now and in the past. Libraries in developed and underdeveloped nations are still not completely aware of this technology. While there is a large body of material on AI in libraries, it primarily focuses on specific applications. AI is a cost-effective way to improve library services. Libraries play a crucial role in driving technological innovation. Consider setting enough finances for incorporating advocacy programs for librarians can help identify difficulties with AI in library operations. Librarians can get new skills by attending AI-related training and conferences. A policy should be developed to meet both the strengths and disadvantages of AI in library services. Librarians' attitudes towards AI adoption in library operations can be improved by participation in discussion forums. Despite its status as a relatively new technology, artificial intelligence is expanding at a startling rate across a variety of industries. Very few well-known services, such as RFID, GIS technologies, chatbots, and virtual references, are connected to library operations in both developed and developing nations. Despite this, the majority of librarians are ignorant of the existence of these applications. However, however, the majority of applications, such as big data, the Internet of Things, and augmented reality, require high costs, which are out of control for libraries in both developed and developing countries. Facial recognition, chatbots, and Google maps are examples of low-cost applications that can be associated with library websites.

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# The Critical Role of Environmental Chemistry in Addressing Global Challenges

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**Abstract:**

Environmental chemistry plays a vital role in understanding and addressing pressing environmental issues facing our planet. This paper explores the fundamental principles of environmental chemistry, its diverse applications in various environmental compartments (air, water, soil), and its contribution to solving contemporary environmental challenges like climate change, pollution, and resource scarcity. Additionally, the paper examines emerging areas of research within environmental chemistry, such as green chemistry, bioremediation, and environmental forensics. Throughout the paper, the importance of environmental chemistry in formulating sustainable solutions and shaping environmental policy is emphasized.

**Keywords:** Environmental Chemistry, Air Pollution, Water Quality, Soil Contamination, Climate Change, Green Chemistry, Bioremediation, Environmental Forensics.

## Introduction:

The Earth's environment is a complex web of interconnected systems. Human activities have significantly impacted this delicate balance, leading to a myriad of environmental challenges. Environmental chemistry emerges as a critical scientific discipline in this context, providing the tools and knowledge to understand the chemical and biochemical processes occurring within the environment (Manahan, 2009).

This paper delves into the multifaceted role of environmental chemistry in addressing contemporary environmental issues. We will explore the core principles guiding environmental chemists in their investigations, delve into the applications of environmental chemistry in different environmental compartments, and showcase its contributions to tackling crucial problems.

## Foundations of Environmental Chemistry

Environmental chemistry draws upon various scientific disciplines, including chemistry, biology, geology, and physics, to understand the fate and behavior of chemicals within the environment (Boyd & Atwood, 2015). It focuses on key concepts such as:

**Chemical Transformations:**

Understanding how chemical compounds undergo reactions in the environment, such as oxidation, reduction, hydrolysis, and photolysis.

**Chemical Equilibrium:** Analyzing how chemical reactions reach a state of balance, determining the distribution of chemicals between different environmental compartments.

**Chemical Kinetics:** Investigating the rate and mechanisms of chemical reactions occurring in the environment.

**Thermodynamics:** Employing thermodynamic principles to predict the feasibility and spontaneity of chemical reactions within environmental systems.

## Applications in Environmental Compartments

**Air Pollution:** Environmental chemists analyze air pollutants, their sources, transport mechanisms, and chemical transformations in the atmosphere. This knowledge is crucial for devising strategies to control air pollution, such as designing emission control technologies and formulating air quality regulations (Finlayson-Pitts & Pitts, 2000).

**Water Quality:** Water quality is a major concern due to contamination by various pollutants such as industrial effluents, agricultural runoff, and pharmaceuticals. Environmental chemists measure and analyze water samples to identify contaminants, assess their impact on aquatic life, and develop remediation strategies like wastewater treatment and desalination technologies (Hem, 1989).

**Soil Contamination:**

Soil contamination arises from sources like industrial waste disposal, agricultural practices, and accidental spills. Environmental chemists assess soil characteristics and contaminant levels, identifying potential risks to human health and ecosystems. They develop techniques for soil remediation, such as bioremediation and soil washing (Barriuso et al., 2008).

## Environmental Chemistry and Global Challenges

**Climate Change:**

Environmental chemistry plays a vital role in understanding the global carbon cycle and the greenhouse effect. Chemists analyze greenhouse gas emissions, study their atmospheric behavior, and develop strategies for mitigation, such as carbon capture and storage technologies (Crutzen, 2002).

**Pollution Control:**

Environmental chemists utilize their expertise to develop methods for identifying and quantifying pollutants in air, water, and soil. They design pollution control technologies and assess their effectiveness in reducing environmental contamination. Additionally, they conduct environmental risk assessments to predict the potential impacts of new technologies and chemicals on the environment (Harrison, 1999).

**Resource Management:**

Environmental chemistry contributes to sustainable resource management by analyzing the chemical composition of resources like minerals, fuels, and water. Chemists develop methods for efficient resource utilization and minimize waste generation. They also explore alternative energy sources and develop technologies for cleaner energy production (Liu & He, 2013).

**Emerging Frontiers in Environmental Chemistry**

**Green Chemistry:** This field promotes the design and development of environmentally friendly chemical products and processes. Green chemists focus on minimizing waste generation, employing renewable resources, and designing safer chemicals with lower environmental toxicity (Anastas & Warner, 1998).

**Bioremediation:** Environmental chemists explore the use of microorganisms to break down or transform pollutants into less harmful substances. Bioremediation is a promising strategy for cleaning up contaminated environments like oil spills and industrial waste sites (Vidali, 2001).

**Environmental Forensics:** Environmental chemists utilize their knowledge and analytical techniques to identify the sources of environmental contamination. By analyzing the chemical composition of pollutants, they can pinpoint the responsible parties and hold them accountable, leading to better environmental protection (Murphy & Morrison, 2007).

**Environmental Nanochemistry:** This emerging field investigates the behavior and interactions of nanoparticles in the environment. Environmental nanochemists assess the potential risks associated with nanoparticles and develop strategies for their safe production and use (Hochella et al., 2019).

**Environmental Modeling:** Environmental chemists utilize computer models to simulate the behavior of chemicals in various environmental compartments. These models help predict the fate and transport of pollutants assess potential environmental impacts, and guide the development of effective mitigation strategies (Chapra, 2008).

**The Future of Environmental Chemistry**

Environmental chemistry is a rapidly evolving field continuously adapting to address pressing environmental challenges. As we face issues like climate change, resource depletion, and emerging contaminants, environmental chemists will play a critical role in developing innovative solutions. Here's what the future holds:

**Focus on Sustainability:** Environmental chemistry will continue to emphasize sustainable practices throughout chemical production, resource utilization, and waste management. The development of biodegradable materials and closed-loop production systems will be key areas of focus.

**Advancements in Analytical Techniques:** The development of increasingly sophisticated analytical tools will allow for more accurate detection and quantification of environmental contaminants at trace levels. These advancements will facilitate more effective monitoring and regulation of environmental pollution.

**Interdisciplinary Collaboration:** Environmental chemistry will increasingly collaborate with other disciplines like ecology, toxicology, and environmental engineering to achieve a holistic understanding of environmental issues and develop solutions with broader impact.

**Public Policy and Education:** Environmental chemists can play a vital role in developing sound environmental policies based on scientific evidence. Additionally, by promoting public education and awareness about environmental issues, environmental chemists can empower individuals to make sustainable choices.

**Conclusion**

Environmental chemistry is an indispensable discipline in addressing the multitude of environmental challenges facing our planet. By understanding the chemical processes within environmental compartments, its applications have led to advancements in cleaner air, safer water, and responsible waste management. As we strive for a sustainable future, environmental chemistry will continue to provide critical insights and develop innovative solutions for a healthier planet.

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# Solution of Manufacturing Problem through FLP

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**Abstract:**

Fuzzy linear programming (FLP) is a valuable optimization method designed for situations involving uncertainty and ambiguity. Unlike traditional binary models, which strictly categorize events as black or white, FLP allows for a continuum of possibilities between these extremes. This flexibility makes FLP applicable to a wider range of scenarios, reflecting the reality that most situations do not have clear-cut boundaries. In this discussion, we introduce a novel FLP-based method that utilizes a single membership function (MF) known as the modified logistics MF. This modified logistics MF is adjusted to reflect the specific characteristics of the parameters involved, based on thorough analysis. The efficacy of this MF was tested through FLP modeling, demonstrating its practical utility. The enhanced version of FLP developed here shows promising results, particularly in applications involving integrated process planning and production scheduling (IPPP). This method facilitates interaction among the analyst, decision maker and the implementer, thus promoting a collaborative approach to problem-solving. This process is referred to as FLP interaction. Moreover, the concept of fuzzy set (FS) self-assembly is introduced for addressing multi-parameter system (MPS) problems, aiming to find satisfactory solutions. By leveraging their expertise and experience, decision makers, researchers, and practitioners can use this approach to achieve optimal outcomes.

**Introduction:**

In previous research, a logistical membership function (MF) model was established to overcome the difficulties of employing linear MF to solve complex decision-making issues. It is expected that a new type of logistic MF, based on specific nonlinear (NL) resources, can be designed and tested for its ability to alter the patterns of real-world issues. This work examines such NL logistic MF patterns and their paradoxical modifications in real-world situations. The first stage in testing this MF system and its transformation is to apply it to a digital model that represents the challenge of real-world decision-making. Recently, a unique technique to fuzzy linear programming (FLP) Created using the modified logistic membership function. This modified logistic MF is first created, followed by an analytical technique to assess its adaptability to unknown factors. FLP is then used to evaluate the usefulness of this membership function using an illustrated case. When used to solve real-world industrial manufacturing challenges, the developed FLP approach appears promising. This approach accepts feedback from analysts, implementers, and decision-makers, making it an interactive fuzzy linear programming (IFLP) method. To solve the mixed product selection problem, a self-organizing fuzzy system can be created. Decision-makers, analysts, and implementers can obtain the best results by integrating their skills and experiences. Another study shows the advantages of MF employing an exponential logistic function (LF).

This work establishes a foundation for evaluating and comparing the newly constructed nonlinear membership function (NLMF) with the findings of this investigation. The newly designed membership function (MF) should be evaluated based on intellectual ability to demonstrate its efficacy in decision-making. This entails developing numerous goods with high fuzzy probability (FP) and accounting for multiple variables such as productivity, product demand, availability, and service time. Aggregate Manufacturing (APP) is essential in production systems because it connects operations and strategies, as well as playing an important role in enterprise resource planning and organizational integration. An effective APP should improve customer service while lowering production and inventory expenses. However, some cost and demand aspects cannot always be accurately calculated. To solve this, fuzzy logic is used in a variety of engineering applications to manage uncertain data, laying the groundwork for APP programming in uncertain data contexts.

Fuzzy linear programming (FLP) is used to solve APP problems when background information is available. An example shows how the model performs for different α-cut values. A researcher used a variety of performance indicators (PI) to

ensure that standard optimization strategies were used. Complex real-world intelligence techniques should be utilized to test the newly produced MF to assure its usefulness in decision-making. To test the new MF and its associated difficulties, a software platform is required that not only accepts fuzzy probabilities but also streamlines FLP to supply decision-makers with the essential data. Software like MATLAB and the Linear Programming (LP) Toolbox are ideal for resolving such FLP issues, as well as managing multiple FPs and unneeded constraints. In this study, the author employed MATLAB and the LP Toolkit to tackle real-world integrated manufacturing challenges in multi-parameter system (MPS) environments.

**Membership Function**

Previous study indicates that when solving FLP issues, the trapezoidal MF will face hurdles like as degradation. To address the damage problem, employ NL LF as a hyperbolic tangent with asymptotes at 1 and 0 [6-8]. Here, we use LF for NLMF, as indicated by,

$$f(y) = \frac{A}{1 + Be^{\beta y}} \qquad \text{..... (1)}$$

Where the FP Taking DOV into account, where signifies sharpness and A and B are scalar constants. When you approach the same thing, the difference becomes more apparent. When, Configuration (1) will be identical to that shown in Figure 1. We adopt this function because, while it is more flexible than hyperbolic tangent, MF logistic is comparable to the hyperbolic tangent function in previous studies. It is also understood that LF and trapezoidal MF are equivalent. LF is thus deemed to be an appropriate function for demonstrating the degree of irrationality. This effort can help the decision-maker and designer make decisions and implement them. LF (1) is a non-monotonic activity that can be utilized to generate fuzzy MF. This is critical because, in the current unstable context, DOV represents the acquisition of change

.

$$\frac{df}{dy} = \frac{AB\beta e^{\beta y}}{1 + Be^{\beta y}} \qquad \text{..... (2)}$$

Here A,B and y are above zero, $\frac{df}{dy} \le 0$, Here it can be seen that (1) has asymptotes in $f(y) = 0 \,\&\, f(y) = 1$ with the proper values of A & B.

$$\lim_{y \to \infty} \frac{df}{dy} = 0 \,\&\, \lim_{y \to 0} \frac{df}{dy} = 0$$ From equation (2) this can be expressed as ,

$$\lim_{y \to \infty} \frac{df}{dy} = \frac{\infty}{\infty}$$

Therefore, by using Cauchy's rule, we obtain,

$$\lim_{y \to \infty} \frac{df}{dy} = \frac{A\beta}{2(1 + Be^{\beta y})} = 0 \qquad \text{..... (3)}$$

As $y \to 0$, The scenario isn't really vague so $\beta \to 0$. From equation (2) we have,

$$\lim_{y \to \infty} \frac{df}{dy} = \lim_{y \to \infty} \frac{AB\beta}{(1 + B)^2} = 0; \quad \text{When , } \beta \to 0 \qquad \text{..... (4)}$$

In addition, LF equation (2) has a vertical tangent at $y = y_0$. Where $f(y_0) = 0.5$. To demonstrate this, define tangent as:

$$\lim_{i \to 0} \frac{f(y_0 + i) - f(y_0)}{i} = -\infty$$

$$\lim_{i\to 0}\frac{f(y_0+i)-f(y_0)}{i}=\lim_{i\to 0}\frac{\frac{A}{1+Be^{(\beta y_0+i)}}-\frac{A}{1+Be^{(\beta y_0)}}}{i} \quad \text{..... (5)}$$

$$\lim_{i\to 0}\frac{ABe^{\beta y_0}(1-e^{\beta i})}{i(1+Be^{(\beta y_0+i)})(1+Be^{\beta y_0})}=\frac{0}{0}$$

So, by using Cauchy's rule,

$$\lim_{i\to 0}\frac{f(y_0+i)-f(y_0)}{i}=\lim_{i\to 0}\frac{-\beta ABe^{\beta y_0}}{i(1+Be^{(\beta y_0+i)})(1+Be^{\beta y_0})}$$

$$\lim_{i\to 0}\frac{f(y_0+i)-f(y_0)}{i}=\lim_{i\to 0}\frac{-\beta ABe^{\beta y_0}}{(1+Be^{\beta y_0})^2} \quad \text{..... (6)}$$

To make $f(y_0)=0.5 \,\&\, f(0)=1$ by equation (1),

$$y_0=\frac{1}{\beta}\ln(2+\frac{1}{D}) \quad \text{..... (7)}$$

From this we conclude that vertical tangent is at $y=y_0$.

It may also be demonstrated that the LF has an inflection point at $y=y_0$ such as $f''(y_0)=1$.

Where $f''(y)$ is the second derivative of $f(y)$ compared to y. Furthermore, it can be demonstrated that $f''(y_0)=0$ at $y=y_0$. And $f'''(y)$ is the third derivative of $f(y)$ compared to y [10-13].

The preceding discussion of vertical, asymptotic, and rotational tangent leads to the conclusion that the recommended LF is variable [16-17]. In contrast to linear work, this sort of MF provides real-world difficulties. Based on the definition of LF features, the present MF is completely explained for FLP difficulties in the statistics below. The next section immediately identifies NLMF as the source of the FLP problem.

### 1.1 MF Logistics and S-Curve MF

Logistics MF for FLP problem is described as,

$$f(y)=\begin{cases}0; y\succ y_k\\ \frac{A}{1+e^{\beta y}}; y_k\prec y\prec y_v\\ 1; y\prec y_k\end{cases} \quad \text{..... (8)}$$

Where f(y) is the membership function value for $0\prec f(y)\prec 1$.

S-curve MF is a variant of LF with specific values of A and B. The principles will be identified by the researcher [17] represent this LF as MF in S form based on equation (8). We define the S-curve MF as follows:

$$\phi(y)=\begin{cases}1; y\prec y_b\\ 0.9; y=y_b\\ \frac{A}{1+e^{\beta y}}; y_b\prec y\prec y_c\\ 0.001; y=y_c\\ 0; y\succ y_c\end{cases} \quad \text{..... (9)}$$

**Fuzzy Mix Product Problem with output $w^*$**

There are nine alternative configurations of products created from various components, with ten marketing restrictions, including MPS and demand limits. Given the ambiguity of these criteria, utilizing DOS to optimize the benefits of FLP integration is critical.

Using the LP approach, we will be able to address the above-mentioned FLP kinds, as well as the nonlinear size solution for the constraints and objective functions that can be obtained. The results from Tables 3.1 are summarized. And it demonstrates that the values improve performance. Some earlier studies contrasted this approach as an appropriate way to represent DOS when describing OF as PF [9-14]. This advice is becoming increasingly realistic. PF has a range of 319939 to 0.999. We refer to this as 99.9% DOS. As a result, w * of 207963 has 0.1% DOS. A conceivable solution is at $\phi$ = 0.5 (i.e. 50% DOS), with a value of w * as 247000.

Table 3.1: Optimum solution with S-curve MF

| Degree of Satisfaction $\phi$ | Optimum Value $w^*$ |
|---|---|
| 0.001000 | 207963 |
| 0.022502 | 216398 |
| 0.121470 | 224527 |
| 0.142474 | 225177 |
| 0.224478 | 225592 |
| 0.283608 | 230332 |
| 0.348042 | 232317 |
| 0.414188 | 234535 |
| 0.456242 | 245439 |
| 0.510467 | 247826 |
| 0.524670 | 268147 |
| 0.542077 | 273526 |
| 0.558422 | 288537 |
| 0.778327 | 291170 |
| 0.783527 | 292077 |
| 0.838137 | 303324 |
| 0.859673 | 305543 |
| 0.914147 | 307862 |
| 0.925365 | 314989 |
| 0.935917 | 319187 |
| 0.999000 | 319939 |

**Optimum Values for various $\beta$**

Table 3.1 shows the OS with S-curve MF for DOS (θ) and Optimum Values (w*), Table 3.1 compares the variability of OV w * to DOS $\phi$ for the value of DOV. The decision-maker will benefit from seeing such variances for a variety of reasons. The optimal solution in a nonlinear setting is. Table 3.1 displays the findings for 50% of the DOS and their matching w * values. It also shows that as $\phi$ increases, w * decreases. We can conclude that as DOV and TC conversion grow, w * falls for each DOS. Table 3.1 shows the results of the IFLP analysis. This information is extremely important for the decision maker in making an informed decision on its implementation following the dissertation [15-17]. In this study, the membership value reflects DOS, while w * represents PF. We can deduce that when DOV increases, so does the individual's value. This occurrence occurs with real-world difficulties in an uncertain context.

**Distribution of output**

Table 3.1 summarizes the relationship between w * and θ. This table helps decision makers assess the value and benefits of DOS θ. Table 4.2 shows that OV is independent of both DOV and DOS. It is not possible to conclude that greater DOS values will result in higher value values. This isn't true. However, even at the greatest DOV expenses, the profit margin at 99.9% DOS is the largest. According to the diagonal values in table, the OV increases at a lower value. Then the w * value is decreased to $0.500 \le \phi \le 0.750$. Finally, the value of w* rises by these findings show that the correct resolution (DOS) does not ensure high value (OV). This suggests that a person will be content with some DOS regarding decision-making and the environment.

**Conclusion:**

The industrial use of FLP interaction was investigated using a modified S-curve MF and real-time data from chocolate makers. The issue of non-compliant MPS was described, with eight scenarios identified based on non-FP in the FP system, as well as the required size for each. The FLP approach was used to measure both value and quality. Given the multiple decisions required, the mechanisms for defining the solution and obtaining high profitability

and DOS are described. It is vital to understand that bigger earnings do not always equate to higher DOS. FS self-assembly can be used to produce satisfactory solutions to MPS problems, allowing researchers and practitioners to utilize their skills for the best results.

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# Empowering Academic Library System With Artificial Intelligence: A Study

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**Abstract:**
The adoption of AI technology by Indian academic libraries is seen as a new catalyst for the growth of smart libraries. Viewed as an extension of human intelligence, artificial intelligence (AI) has taken the lead in numerous industries. Artificial intelligence's use in libraries has changed the field in the information sector. This study has demonstrated the great value of applying and using AI technology in academic libraries to provide a new standard of flawless efficient library service delivery. The primary objective of this paper is to create a thorough framework for the strategic integration of AI into the current library systems of Indian academic institutions.

**Keywords:** *Artificial Intelligence, ICT, Academic Library Systems.*

## Introduction:

Libraries are becoming less important in a time of fast technological advancement and the emergence of artificial intelligence (AI). In the Indian educational system, academic librarians view artificial intelligence as an alternative source of inspiration for creating intelligent libraries. The general name for the technologies used to gather, store, edit, and communicate information in different formats is information and communication technology, or ICT. Libraries are presently among the organizations that are primarily employed for knowledge management, dissemination, and preservation.

Academic libraries should reposition themselves in this digital age to better capitalize on the possibilities of artificial intelligence by improving the caliber of services they offer. One new driver for the development of smart libraries is the academic libraries in India embracing AI technology. Artificial intelligence (AI) technologies are already widely recognized as vital tools for increasing organizational productivity and efficiency. It is suffice to say, therefore, that the workplace of the twenty-first century has been significantly impacted by AI technologies.

In this era of information, the employment of AI in libraries may improve services and provide users with trustworthy information, which can promote growth and development. Artificial intelligence technologies are being used by libraries to facilitate users' natural integration with the library. This enables readers to interact on the same platform, tracks and gathers the specific needs and information of users, and helps users acquire accurate information and humanized services at a cheaper cost and make more informed use of library resources.

Many libraries utilize information technology (IT) systems for various purposes, including cataloging, gate systems, and online public access to catalogs. Currently, most AI applications used in libraries are conventional solutions created for the commercial sector; however, more library-oriented app support (such as budget, reference, collection creation, etc.) may emerge in the next years.

## Information Retrieval And Knowledge Organization

Libraries have long been used as information centers, giving patrons' access to a broad array of books, periodicals, and other materials. Search engines and algorithms have made information retrieval appear simple in the era of artificial intelligence. But these automated procedures frequently require deeper contextual awareness, which libraries provide. Users may explore and find information more efficiently because librarians have unmatched competence in knowledge arrangement and classification. Though AI technologies have improved digital information access, there is still a digital divide that restricts equal access to knowledge. Libraries are essential in closing this gap by guaranteeing that all people have access to digital resources and information, irrespective of their financial situation. Libraries enable people to acquire vital digital skills, use internet resources, and critically assess information through programs like digital literacy campaigns and public computer facilities. Thus, in the AI era, libraries continue to support equal knowledge access and digital inclusion.

**Concept Of Artificial Intelligence**

The impact of AI on academic library activities is therefore likely to be no less complex. Many times, the term "artificial intelligence" brings up images of computers or talking robots. The study of how computers learn (machine learning), interpret data, and see the world via their eyes including character recognition, image analysis, three-dimensional perception, and eye function modeling is the focus of a branch of computer science called artificial intelligence. The field of natural language processing encompasses not only voice recognition and creation but also the increasingly popular expert systems and interpretation and usage of natural language. The creation and programming of computers to carry out tasks that call for human intelligence, including language translation, speech recognition, visual perception, decision-making, and emotional processing (The Impact of AI on Information Technology, Libraries, and Library Services). During this age, one of the rising technologies is artificial intelligence (AI).

Artificial Intelligence is a widely utilized technology in library services that has the potential to revolutionize the finest services in the information era. The discipline of library and information science is poised for significant advancement as artificial intelligence (AI) emerges as a disruptive technology. Libraries are adopting AI to boost operational efficiency, improve user experiences, and provide cutting-edge services since they are knowledge repositories and information service providers.

**Impact Of Artificial Intelligence In Library Operations**

The methods used to search for and process information are being altered by artificial intelligence (AI). Information specialists will be able to improve their offerings by offering more effective and customized information search features. Artificial Intelligence (AI) is the capacity of a computer or software-controlled device to carry out operations and activities based on intellectual properties held by people. AI aims to create systems that are capable of carrying out a variety of jobs and actions in an effective manner. Libraries in industrialized nations have already adopted technology advancements like virtual reality and augmented reality to leverage the promise of artificial intelligence in their operations. These have significantly enhanced how individuals find information.Artificial intelligence (AI) has a profound and wide-ranging impact on library services, opening up new possibilities to improve user experience, boost the efficacy and efficiency of library services, and change the way libraries are run. Artificial intelligence (AI) technology, including computer vision, natural language processing, and machine learning, can be used to automate repetitive processes, analyze data, and offer library patrons individualized services.

**Significance Of Ai In Academic Libraries**

1. Improved user experience by means of tailored services and suggestions.
2. Enhanced productivity through the automation of repetitive processes such as data management and categorization.
3. Analyzing data to make well-informed decisions and develop collections.
4. AI-driven content curation and production for enhanced accessibility and discoverability.
5. Predictive analytics to foresee trends and user needs.
6. Text and data mining for evidence-based decision-making and research trend analysis.
7. AI-powered tools that enable accessibility for individuals with disabilities.
8. Automating digital preservation to ensure resource accessibility throughout time.
9. AI-powered chatbots and recommendation systems facilitate collaboration and knowledge sharing.
10. Competitive edge, economy of scale, and flexibility for social impact and future-proofing

**The Future Of Indian Context Ai-Based Academic Libraries**

Academic libraries should be using AI tools and approaches to improve their services and better serve their users, as the emphasis on digitalization, automation, and data-driven decision-making grows. Applications with artificial intelligence (AI) can improve the efficiency with which librarians manage large collections, speed up laborious processes like resource cataloging and search, provide individualized recommendations based on user behavior and preferences, forecast future trends in usage or research interests, and offer insights that can guide strategic planning. When putting AI solutions into practice, ethical issues including data privacy, bias reduction, and decision-making openness must be carefully taken into account. Therefore, it is imperative that academic libraries establish relationships with tech firms or other organizations that are creating AI-based solutions that respect moral principles and satisfy user needs.

**The Function Of Artificial Intelligence In The Automation Of Libraries**

Libraries now have to manage enormous volumes of material, offer effective services, and guarantee a flawless user experience in the digital age. Automation and information technology integration have drastically changed traditional library systems. Artificial Intelligence (AI) is one such transformational technology that could completely change library services and operations. Artificial intelligence (AI) integration has emerged as a key area of concern for libraries as they change

in the digital era, presenting a range of benefits and problems. AI is a technology that is frequently employed in library services and has the ability to completely transform the greatest products available in the information age. With intelligent recommendations catered to their individual requirements, patrons using AI-enabled libraries may now explore the world of information like never before. All things considered, AI can improve the library experience for patrons as well as library personnel through creativity and astute decision-making. The use of computers and similar data processing technology in libraries has come to be known as "library automation" in general. The areas of information retrieval, automatic indexing and abstracting, and automatic textual analysis are often separated from library automation.

**Artificial Intelligence (Ai) In Library Services**

Artificial intelligence (AI) seeks to imitate or reproduce human cognitive functions in machines so they can evaluate information, make choices, and adjust to changing circumstances. Libraries have historically been repositories of knowledge and information, but with the advent of artificial intelligence (AI), they are undergoing significant transformations in how they deliver services and engage with their patrons. The integration of Artificial Intelligence (AI) into Library and Information Science (LIS) offers immense potential to revolutionize library services, enhance user experiences, and improve information access and management.

A number of library functions, including cataloging, classification, recommendation, reference, discovery, and preservation, can benefit from the application of artificial intelligence. AI, for instance, can assist librarians in improving the quality and consistency of bibliographic entries, automating the development and extraction of metadata, and spotting and fixing mistakes and inconsistencies. Based on their tastes, behavior, and context, AI can assist librarians in making recommendations that are pertinent and personalized for their clients. Through the use of semantic analysis and natural language processing, AI can help librarians respond to a wide range of complicated and varied questions. Additionally, by applying data mining and machine learning, AI can assist librarians in finding new and emerging subjects, trends, and patterns in the information ecosystem. Moreover, AI can use optical character recognition and picture recognition to assist libraries in digitizing and preserving their holdings.

**Ai's Advantages For Library Services:**

Artificial intelligence (AI) holds great promise for librarians and their clients in a number of areas, including enhancing the precision and effectiveness of library data, highlighting the importance and variety of services and resources, increasing information accessibility, and fostering creativity and learning. AI can help librarians in many ways, such as by taking over laborious and manual tasks, reducing errors and inconsistencies in data, offering personalized user recommendations, facilitating anytime, anywhere library interactions, and making it easier to find new material.

Artificial intelligence (AI) has been used in a variety of library services, and numerous studies have highlighted the potential advantages of AI. Chatbots are one of the main uses of AI in library services. These virtual assistants can help users right away by responding to their inquiries and pointing them in the direction of pertinent resources. AI in library services has a bright future ahead of it. Personalization, accessibility, automation, collaboration, and innovation are just a few areas where AI may be further integrated. To successfully integrate AI into library services, academics, and library workers need to be flexible, innovative, and adaptable.

**Availability Of Artificial Intelligence Integration In Library Services :**

Artificial intelligence (AI) is advancing at a rapid pace, revolutionizing several industries, including libraries. It can be claimed that major libraries, like academic libraries, have begun to adopt the use of AI, though not as quickly as large-scale enterprises, because the use of AI in libraries involves significant investment in infrastructure, money, and training. While there are certain challenges in integrating AI into library services, there are also many benefits that can boost effectiveness and efficiency and enhance user experience.

**Advantages:**

1. Better search and discovery: AI-powered recommendation engines and search engines make it easier and faster for consumers to find pertinent content.
2. Improved user experience: Chabot’s can offer tailored and prompt customer support, improving the convenience and smoothness of the user experience.
3. Enhanced efficiency: AI can reduce the time and effort needed to process and organize collections by automating repetitive processes like classification and cataloging.
4. Better Allocation of Resources: AI can assist libraries in making knowledgeable judgments regarding the acquisition and distribution of resources.

**Conclusion:**

The importance of artificial intelligence is growing every day. The importance of artificial intelligence is growing every day. Notwithstanding the many advantages of using and utilizing AI in the provision of library services, libraries still face a number of obstacles, including limited funding, a

lack of technical expertise, job loss, and an epileptic power supply. As AI becomes more widely used, library employees will need to keep learning new skills. Programs for professional growth and training are crucial, but they can take a lot of time and money. Libraries have to guarantee the efficient and successful management and provision of their services. Artificial intelligence must be integrated into academic libraries in every aspect. Academic libraries may find it difficult to effectively use and deploy AI technology due to a technological skills gap and the staff members' lack of technical experience. The application of artificial intelligence in academic libraries in India may face challenges if library staff members are not properly trained and retrained to keep up with the rapidly evolving technological landscape. It is strongly advised that academic libraries in India fully embrace integrating artificial intelligence into their daily operations.

**Suggestions:**

The study's conclusions led to the following recommendations being made.

1. Academic libraries must ensure that they provide ongoing training and development opportunities for all their staff to enable them to effectively implement artificial intelligence within the library system. Academic libraries should make it a priority to offer continuous training and development opportunities to their entire staff, empowering them to proficiently integrate artificial intelligence into the library system.
2. Policies that would direct the use and use of AI should be implemented with flexibility
3. The parent organization should provide reliable infrastructure and a backup power supply.
4. The library should be given enough money in order to support AI. Arranging workshops, seminars, video conferences, and other types of trainings to help library employees keep current in this technologically advanced world.
5. It is advisable for libraries that intend to introduce or have already included artificial intelligence into their operations to provide their staff with ongoing training and retraining on the use of this technology.
6. In order for academic libraries to keep up with the most recent standards for the use of AI in libraries, government and library management must work together to provide a path ahead.

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# India Vishwaguru

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**Abstract:**

Vishwa Guru is a Sanskrit word. Vishwa means world and guru mean guide. The whole word means world leader or teacher to the world or universe. India is the largest democracy in the world and the people of India see becoming world masters. with a population over 1.423 billion which is the biggest population in the world with a very large diverse culture, language, and religion which is very rich, old and Prosperous. India's progress towards Vishwa guru can be seen from many points such as economic, social, political, international relations, science and technology, defence, environment, education, disaster management, spirituality, food, and humanitarian perspective. India's foreign policy, military strength, natural and artificial disaster management, the conflict between nations, environmental balance, temperature rise, energy, summits and organisation, economic exchange, development, etc. for this reasons India becomes more prosperous and powerful. Indian diaspora is increasing and the whole world is getting to know this soft power. India never supports unipolarity or bipolarity, India has the mindset of the Multipolarity concept. Hence India will become a good leader. India's moto towards world from a humanitarian perspective and from Vasudev Kutumbakam's (World is One Family) concept journey India will become Vishwa guru by 2047. the research paper aims to provide a nuanced and critical analysis of India's identity as a Vishwaguru, while also highlighting its potential and contributions to the world. It aims to offer insights and recommendations for policymakers, scholars, and the general public to better understand and appreciate India's role in the contemporary global context.

**Keywords**: Vishwaguru, leadership, India, Democracy, International Relation, Culture, politics, Peace, Diplomacy, Foreign Policy, Education.

## Introduction:

Vishwa Guru or Vishwaguru is a Sanskrit phrase and idea which translates to world or global teacher, world guru, tutors of the world, world leader, or teacher to the world or universe.

"Vishwaguru" is a term that refers to a world teacher or a guru who has the potential to teach and guide the entire world. Their teachings and guidance will help countless people/countries to find purpose, meaning, and happiness in their lives, and they continue to inspire us to strive for greatness and excellence in all that they will do. The concept of India being a "Vishwaguru" is based on the belief that India has a rich cultural heritage and has contributed significantly to the world's knowledge in various fields such as philosophy, spirituality, mathematics, Military, medicine, and literature.

Vishwa guru is a term used to describe individuals who possess great knowledge, wisdom, and experience and are committed to sharing this knowledge with others. Their teachings and guidance will help countless people/countries to find purpose, meaning, and happiness in their lives, and they continue to inspire us to strive for greatness and excellence in all that they will do.

## Historical perspective:

India's rich and diverse cultural history dates back thousands of years. From the Indus Valley Civilization to the Maurya Empire, India has seen the rise and fall of many great civilizations. India's ancient texts, such as the Vedas, Upanishads, and Bhagavad Gita, are considered to be some of the most important philosophical and spiritual works in the world. The Vedic period is the period that followed the decline of the Indus Valley Civilization. This period of Ancient India had the greatest, prosperity in terms of Hindu religion, in terms of richness, in terms of literacy, in terms power to control the world. It is characterized by a pastoral lifestyle and adherence to the religious texts known as The Vedas. The great religious and literary works of the Puranas, the Mahabharata, Bhagavad-Gita, and the Ramayana all come from this period. The Vedic period had the greatest kings and their kingdoms also literature of that period is known as superior in the Hindu religion. Bhagwat Gita encourages us to live life with purity, strength, discipline, honesty, kindness, and integrity to find our purpose and live it fully.

Indian philosophy and spirituality have profoundly influenced the world, shaping how people think and perceive the world around them.

The teachings of Indian philosophy and spirituality have helped to promote social consciousness, ethical values, religious tolerance, and the pursuit of inner peace and harmony. The influence of Indian philosophy and spirituality can be seen in various fields and continues to inspire and influence people all over the world. The diversity of India's cultural heritage can be traced back to its ancient history, which saw the rise and fall of many great civilizations. The country's culture has been shaped by various influences, including those of invaders, traders, and migrants.

**Cultural Diversity**

India is known for its rich cultural diversity, which is reflected in its art, music, dance, food, and clothing. India has a diverse population that speaks over 1,600 languages and dialects and follows a variety of religions and cultural practices. The country's diverse population, languages, religions, and cultural practices have contributed to its unique and vibrant cultural heritage. Indian festivals, cuisine, art, music, and clothing are all reflective of this diversity and continue to inspire and fascinate people from all over the world.

India's soft power, including its culture, spirituality, and philosophy, has also played a significant role in promoting global peace and cooperation. Indian spiritual leaders such as Mahatma Gandhi and Swami Vivekananda have profoundly impacted global peace movements, and the country's rich cultural heritage has inspired people from all over the world.

**4. Contribution to the world**

India has made significant contributions to the world in various fields, including mathematics, science, literature and arts, yoga, meditation, and Ayurveda. India's contributions to the world in the fields of mathematics, science, literature and arts, yoga, meditation, and Ayurveda have had a significant impact on the world. These contributions have helped to shape the way people think and perceive the world around them and continue to inspire and influence people from all over the world.

Mathematics: India's contributions to mathematics are well-known and include the invention of the decimal system and the concept of zero. Indian mathematicians also made significant contributions to algebra, trigonometry, and geometry, and developed the concept of infinity.

Science: India has a rich tradition in science, with ancient texts such as the Vedas and Upanishads containing references to astronomy, physics, and biology. Indian scientists also made significant contributions to the field of medicine, with Ayurveda being one of the oldest medical systems in the world.

Literature and Arts: Indian literature and arts are renowned for their diversity and richness. Ancient texts such as the Vedas, the Mahabharata, and the Ramayana are considered to be some of the greatest literary works in the world. Indian art, including sculpture, painting, and architecture, is also renowned for its beauty and intricacy.

Yoga and Meditation: India is the birthplace of yoga and meditation, which have become popular all over the world for their numerous health benefits. The practice of yoga and meditation can help reduce stress, improve flexibility, and promote overall health and well-being.

Ayurveda: Ayurveda is an ancient system of medicine that originated in India over 5,000 years ago. It emphasizes the use of natural remedies and treatments and has been recognized as a valuable system of medicine by the World Health Organization.

**India’s role in promoting global peace and cooperation**

India has played a significant role in promoting global peace and cooperation over the years. The country has always been committed to the principles of non-violence, tolerance, and peaceful coexistence, which have been integral to its culture and philosophy. India has actively participated in various international organizations and initiatives aimed at promoting global peace and cooperation. Some countries in Asia and Africa decided not to join the group of America and Russia in 1946 which started the ‘non-alignment movement’. From this movement, India adopted a peaceful and separatist policy and led many nations along with it. The country is a founding member of the United Nations and has played an important role in the organization's peacekeeping operations. India has also been an active participant in various regional organizations such as the South Asian Association for Regional Cooperation (SAARC) and the Indian Ocean Rim Association (IORA).

India's commitment to non-violence, tolerance, and peaceful coexistence, its active participation in international organizations and initiatives, and its contributions to global nuclear disarmament, counterterrorism, and regional integration, have all helped promote global peace and cooperation. The country's soft power, including its culture and spirituality, has also played a significant role in inspiring people from all over the world to work towards a more peaceful and cooperative global order.

**Foreign Policies and their emphasis on peaceful coexistence**

India's foreign policy has always emphasized peaceful coexistence and good neighbourly relations with other countries. The country has always been committed to the principles of non-alignment and non-interference in the internal affairs of other countries. Recently PM of

India said that 'This is not an era of war' on Ukraine-Russia war.

India's foreign policy is based on the principles of Panchsheel, which were first proposed by India and China in 1954. The five principles of Panchsheel are mutual respect territorial integrity and sovereignty, mutual non-aggression, mutual non-interference in each other's internal affairs, equality and mutual benefit, and peaceful coexistence.

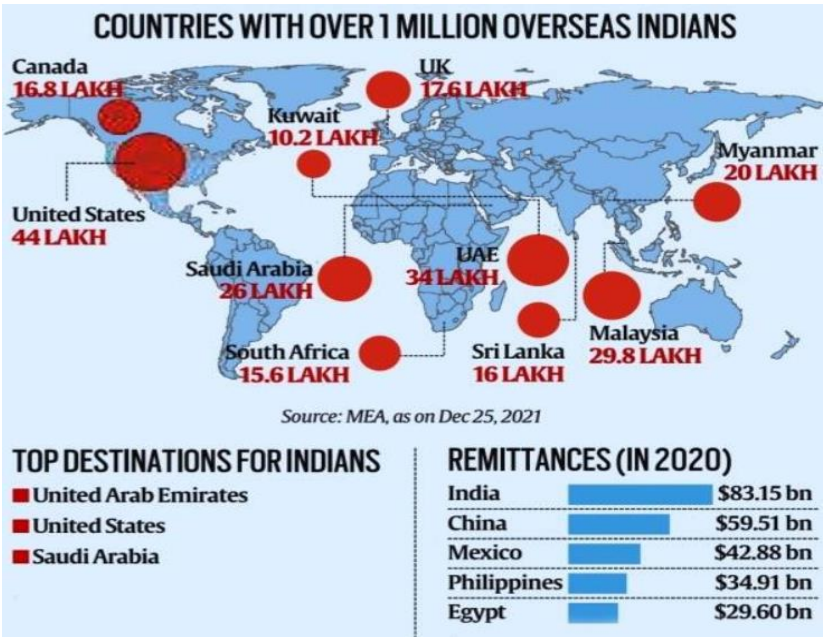
India has been a strong proponent of multilateralism and has actively participated in various regional and international organizations, including the United Nations, the World Trade Organization, and the G20. The country has also been actively engaged in regional groupings such as the South Asian Association for Regional Cooperation (SAARC), the Bay of Bengal Initiative for Multi-Sectoral Technical and Economic Cooperation (BIMSTEC), and the Indian Ocean Rim Association (IORA). The country has been actively engaged in regional and international organizations and has played a key role in promoting regional stability and resolving conflicts through peaceful means. India's emphasis on economic diplomacy and regional integration has also contributed to greater economic cooperation and stability in the region.

**India's Contribution to the United Nations and Other International Organizations**

India has developed strong diplomatic relations with countries across the world, including with major powers such as the United States, Russia, China, and the European Union. India has also developed strategic partnerships with key countries in its neighbourhood, including Nepal, Bhutan, Bangladesh, Sri Lanka, and Afghanistan. India has also been involved in various regional and global initiatives aimed at promoting economic growth and development, such as the BRICS grouping (comprising Brazil, Russia, India, China, and South Africa), the Shanghai Cooperation Organization, and the G-20. India has also been actively engaged in promoting South-South cooperation, including by providing technical and financial assistance to other developing countries.

India recently takes the presidency of G20 for 2023 which is the biggest step towards Vishwaguru. The tagline for the G20 is Vasudev Kutumbakam (World is One Family) which shows the belief, unity and leadership of India. As G20 President, India would be able to lead discussions on key global issues, including climate change, economic growth, financial stability, and trade. India would also be able to promote its vision of a more equitable and sustainable world, including by advocating for the inclusion of developing countries in the global economy and by promoting the use of technology and innovation to drive growth and development.

India would also be able to showcase its expertise in areas such as renewable energy, digital innovation, and skill development, and promote the use of these technologies to drive sustainable growth and development globally. India's G20 presidency could also provide an opportunity for India to deepen its engagement with countries in the Indo-Pacific region, including by promoting initiatives such as the QUAD and the Indian Ocean Rim Association (IORA).




**Indian Diaspora:**

The Indian diaspora plays an important role in promoting India's image as a Vishwaguru. Indian communities around the world have contributed to various fields, including science, technology, business, arts, and culture. They have also helped promote Indian culture and traditions by organizing events, festivals, and celebrations. In recent years,

the Indian government has also launched initiatives like "Make in India," "Digital India," and "Skill India" to promote economic growth and development. The Indian diaspora has been actively involved in these initiatives by investing in India, promoting Indian products and services, and sharing their expertise and knowledge.

**Health and Disaster and Humanitarian Diplomacy:**

Health diplomacy is a form of soft power that is being used in the 21st century. Against the outbreak of the COVID-19 pandemic, India has played an important role in addressing the demand for pharmaceuticals, diagnostics, and for vaccines to demonstrate India's global health diplomacy. The 'Vaccine Maitri' initiative in many ways reinforced India's credentials as the "pharmacy of the world".

For India, respecting sovereignty lies at the heart of providing Humanitarian Assistance and Disaster Relief (HADR). India not only safeguards the Indian citizens from conflict zone by using its hard power capabilities, but it also succeeds in projecting its soft power by evacuating foreign nationals of developed countries. Indian people studying or living in Russia and Ukraine were caught in a state of war during Russia-Ukraine war, India appealed to both nations to reduce the nature of war and then bring all the citizens back to their homelands safely through 'operation Ganga'. India Successfully completes many operations not in India but also in foreign countries. E.g., Operation Maitri, Operation Rahaat, Kuwait Airlift and many more.

In disaster situations, India has provided humanitarian aid and support to countries affected by natural disasters such as earthquakes, cyclones, and floods. India has also been a leading contributor to the United Nations Disaster Response Teams, providing both financial and logistical support.

India has also been actively engaged in humanitarian diplomacy, particularly in the context of refugee and migrant crises. India has provided support to countries hosting large numbers of refugees, including those from Afghanistan, Syria, and Myanmar. India has also been a strong advocate for the rights of refugees and migrants, working to ensure their protection and welfare.

**Economy:**

India has been one of the fastest-growing major economies in the world, with a GDP growth rate averaging around 7% over the past decade. The country has also undertaken significant economic reforms in recent years, including the introduction of the Goods and Services Tax (GST) and the Insolvency and Bankruptcy Code (IBC), which have helped improve the ease of doing business in India.

India has emerged as a major player in the global economy over the last few decades. The country's economic liberalization and reform policies in the early 1990s significantly improved economic growth and development. India's economic growth has been largely driven by its services sector, which includes information technology, business process outsourcing, and other knowledge-intensive industries.

India has also actively pursued economic cooperation with other countries and regions. The country has signed several free trade agreements with other countries and regions. India has also been actively participating in various international forums and organizations, such as the G20, the World Trade Organization, and the International Monetary Fund. The country has been advocating for greater economic cooperation and coordination among countries and has been working towards strengthening the global trading system.

Gross Domestic Product 2021:

| Ranking | Economy | (Millions of US dollars) |
|---|---|---|
| 1 | United States | 2,33,15,081 |
| 2 | China | 1,77,34,063 |
| 3 | Japan | 49,40,878 |
| 4 | Germany | 42,59,935 |
| 5 | India | 31,76,295 |
| 6 | United Kingdom | 31,31,378 |
| 7 | France | 29,57,880 |
| 8 | Italy | 21,07,703 |
| 9 | Canada | 19,88,336 |
| 10 | South Korea | 18,10,956 |
| 11. | Russia Federation | 17,78,783 |

*Sources: Gross Domestic Product Report 2021 from worldbank.org*

India's economy is also diverse, with a strong agricultural sector, a growing manufacturing sector, and a rapidly expanding services sector. The country is also home to a large pool of skilled and educated human capital, which has helped fuel growth in sectors such as information technology (IT) and biotechnology. India's technology and innovation sector, in particular, has been growing rapidly, with the country emerging as a major player in areas such as software development, e-commerce, and digital payments. India is also home to a growing number of start-ups and entrepreneurial ventures, which are driving innovation and growth in the country.

**Unicorns:**

The term 'Unicorn' refers to the rarest of the rare startups which become Unicorns attaining a valuation of more than USD 1 billion. The Indian Startup Ecosystem, the third-largest in the world in the number of Unicorns, as of 5th May 2022, is home to 100 unicorns with a total valuation of USD 332.7 billion. 2021 experienced a huge surge in the number of unicorns, registering a total of 44 startups entering the Unicorn club through the year with a total valuation of USD 93 billion. In the first four months of 2022, India has given birth to 14 unicorns with a total valuation of USD 18.9 billion (PIB, 2022). The high number of start-ups is part of the reason India has made remarkable progress in the global innovation index ranking finding a place in the top 40, said the annual report released by the World Intellectual Property Organisation (WIPO) on 29 September, 2022.

**Indian politics:**

India's democracy as a Vishwaguru is an important example for the world, as India is the world's largest democracy and has a long history of democratic institutions and practices. India's democracy is based on the principles of universal suffrage, regular free and fair elections, and the rule of law. These principles are enshrined in the country's constitution and have been upheld by independent institutions such as the Election Commission and the judiciary. India has also been instrumental in promoting democratic values globally.

India has been an active participant in international forums and has advocated for democratic values and principles. India has also provided support for democratic movements in other countries. Indian democracy has been a leader in promoting democratic values globally, and its success is recognized and respected internationally. However, there is still room for improvement, and efforts need to be made to address the challenges faced by Indian democracy.

In the realm of Indian politics, the idea of India as a Vishwaguru may be invoked by some political leaders or parties as part of their ideological vision or agenda. They may use this concept to highlight India's historical and cultural achievements and to promote nationalistic or cultural narratives. For instance, some political leaders may emphasize India's contributions to science, philosophy, and spirituality to project India as a global leader in various forums, including international relations.

**Building Connectivity:**

India signed a memorandum of understanding with Afghanistan for construction of the Lalandar (Shatoot) Dam in the war-torn nation on a tributary of the Kabul River that would provide safe drinking water to over 2.2 million people in the capital city and boost cross country irrigation facilities. Since 2001, when the US-led war on terrorism ousted the Taliban regime from Kabul, New Delhi had pledged and implemented development and reconstruction projects worth more than $3 billion. India has built roads, dams, electricity transmission networks and substations, schools, and most prominently, the Afghan Parliament. The Afghan Parliament in Kabul was built by India for $90 million. It was inaugurated in 2015, by Prime Minister Narendra Modi. It was a gift from India to the war-ravaged nation. Nepal has formally awarded the much-touted West Seti Hydropower Project and Seti River Project in western Nepal to India through a negotiation window, nearly four years after China withdrew from it. These types of building construction, and connectivity increases the good relationship between that country.

**Commonwealth diplomacy:**

The Commonwealth is a unique association of 54 equal member states, and 2.4 billion people spanning six continents, and accounting for a third of the World Trade Organisation, a quarter of the G20, and a fifth of all global trade. India is a founding member of the modern Commonwealth, and home to nearly 60% of Commonwealth citizens. India is the fourth largest contributor to the overall budget of the Commonwealth (High Commission of India, London) As a leading member, India provides impressive support to Commonwealth members, including funding to the Commonwealth Small States offices in New York and Geneva, training for officials from Commonwealth governments, and in 2019 held the first Commonwealth cricket camp. (British High Commission, 2022).

**Implementation to be Vishwaguru:**

In order to make India a knowledge superpower, to acquire requisite skills and knowledge among students and to address manpower shortages in science, technology, education and industrial sectors, to provide quality education, innovative education and research facilities to the population of India, the Government of India has implemented a new National Education Policy 2020.

India is seen to be making a huge contribution to the world in the form of a UN peacekeeping force. India lost its young prime minister during 1991 when India sent its army to Sri Lanka for defence purposes and to maintain peace in the neighbouring nation. Also, India has given its brain for research across the border. Also there are some companies that dominate the world. The CEO of those companies is Indian. After the brain drain, the brain gain seems to be returning to the Indian diaspora back home.. Along with this, the Indian diaspora is equally active in politics. There are Indians in high positions in many nations of the

world. E.g. Vice President of the United States Kamala Harris became the first woman to reach this position. It is believed to be Indian. British Prime Minister Rishi Sunook is also of Indian origin. Many other great political positions were reached by Indian descent. Many works like these are seen as if the world would call India the Guru of the World.

For all these, India should use its population as a guru and represent the country. India should come forward to represent itself in peace, multi-polarisation, democracy, disarmament, environment and many other things. It is seen that the implementation of India becoming a world guru has started. Looking at the situation in Asia, other nations will come across India in a representative form.

**Conclusion:**

Vishwaguru India is a term used to refer to India as a potential global leader or a world teacher. It is often associated with the idea that India has a rich cultural and spiritual heritage that can offer guidance and wisdom to the world in various aspects of life, including philosophy, spirituality, yoga, art, and more.

Supporters of the concept of Vishwaguru India highlight India's contributions to humanity throughout history, including its ancient scriptures, philosophical teachings, and cultural practices that promote peace, harmony, and well-being. They often emphasize India's diverse cultural heritage, including its many religions, languages, and traditions, as a source of strength and wisdom that can benefit the world.

Critics, on the other hand, may argue that the concept of Vishwaguru India can be seen as promoting a form of cultural chauvinism or nationalism that places India on a pedestal above other cultures and countries. They may highlight challenges and issues within India, such as poverty, inequality, social divisions, and political complexities, which they believe need to be addressed before claiming a global leadership position.

It's important to note that opinions on Vishwaguru India can vary widely depending on individual perspectives, cultural biases, and beliefs. It's essential to critically evaluate and consider multiple viewpoints to form a well-rounded understanding. India has all the ingredients to become a Vishwaguru or a global leader and play a significant role in shaping the future of the world. It is now up to India to capitalize on its strengths and opportunities and continue to build on them to become a beacon of hope and inspiration for the world.

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# Management In Electronic Commerce: Challeneges In An Emerging Economy

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**Abstract:**
Data Technology has been assuming an imperative function later on advancement of budgetary divisions and the method of working together in a rising economy like India. Expanded utilization of brilliant portable administrations and web as another dissemination channel for business exchanges and global exchanging requires more consideration towards internet business security for lessening the fake exercises. The headway of Information and Communication innovation has gotten a ton of changes all circles of day-by-day life of person. Web based business has a ton of advantages which increase the value of consumer loyalty's as far as client comfort in wherever and empowers the organization to acquire upper hand over different contenders. This investigation predicts a few difficulties in a developing economy.

**Keywords**: Data technology, Economy, Communication, Innovation

**Introduction:**

In today's world, online commerce is gaining popularity in developing economies. The concept of online commerce emerged in 1995, necessitating the exchange of sophisticated products. These are products that can be transported via a computer network (Laudon and Laudon, 2013). The advent of online commerce is swiftly transforming the dynamics of business interactions, as well as those between businesses, consumers, and governments. The evolution of Information and Communication Technology (ICT) landscape is propelling online commerce forward rapidly, especially in emerging markets and contributing to economic growth (UNCTAD/IER/2015). Efforts to enhance business transactions over the internet are also advancing quickly. However, we have yet to achieve the ideal of seamless and secure transactions online due to concerns over consumer protection issues that have slowed down innovation (Alberto, Avila, and Violeta-2007). Many view the internet as a gateway to developing countries, enhancing global trade. Online commerce can significantly boost a country's economy by expanding its influence in the supply chain and thereby enhancing market insights (Molla and Heeks, 2007). Online commerce, also known as electronic commerce, involves the buying and selling of goods and services over the internet. It also serves as a platform for consumers to research prices or browse the latest products available before making a purchase online or in a physical store. E-commerce is often used interchangeably with this term.

More commonly, it refers to the broader impact of the internet on how businesses collaborate, engage with customers and suppliers, and view marketing and coordination. In the context of this study, e-commerce is defined as the electronic aspect of business collaboration. (Lindsay P., 2002).

As the use of Information and Communication Technologies (ICTs), especially the Internet, becomes more widespread, the global business network is increasingly shifting towards Business-to-Business (B2B) e-commerce. Customers gain a lot of flexibility when the Internet opens up access to the global market, allowing them to compare prices across different regions, check for price differences by product category, and be aware of substitute products. This accessibility makes it easier for customers to consider the offerings of various online businesses without any hassle. For instance, if there's a problem with an online business, competitors are just a click away from the customer. Should customers be dissatisfied with the products, prices, or services provided by a specific online business, they can switch more easily than they could in a physical setting. From the perspective of sellers, they don't need to have a physical store.

**Survey of Literature:**

Research shows that web and online commerce are predominantly associated with developed countries. However, they can significantly benefit developing countries if they serve as a strategic advantage for business. Web commerce represents a shift in business strategies

(Ohidujjaman, et al 2013). The concept of commerce is understood as exchanges between partners. Electronic commerce is a growing concept that describes the process of buying and selling, as well as the exchange of goods, services, and information over computer networks, including the internet (Anupam-2011). Business transactions involve the exchange of significant value (e.g., money) across organizational or national boundaries as a result of goods and services. The exchange of significant value is crucial for understanding the scope of online commerce. Without such an exchange, no business transaction can take place (Laudon and Traver). Electronic commerce has altered business cycles both within and between companies. Electronic Data Interchange (EDI), which was introduced over 25 years ago through dedicated connections between companies, showed how data could be securely transferred from one company's systems to another's for request processing, creation, and coordination (Clayton and Criscuolo). When implemented correctly, electronic trade can lead to business improvements and increased efficiencies.

The use of e-commerce technologies should lead to benefits for developing countries, although the results have not yet been as expected (Jeffrey S. Beam 2011).

**e- Commerce situation in India:**

Online business has revolutionized the way business is done in India. The Indian e-commerce market is expected to grow to US$200 billion by 2026 from US$38.5 billion in 2017. Much of the business development has been driven by the expansion of online and mobile revenues. Expanding India's vast online customer base to 2021 from 636.73 million in FY19 will require continued incremental change in the country, doubling from $125 billion in April 2017 to $250 billion by 2020, supported in principle. electronic commerce. India's e-commerce revenue is expected to grow from USD 39 billion in 2017 to USD 120 billion in 2020, a growth of 51%, the highest revenue on the planet.

**Market Size**

The e-commerce sector in India is projected to expand from $38.5 billion to $200 billion by 2026, driven by rising mobile usage, the adoption of 4G networks, and an increase in the number of consumers. It is anticipated that India's e-commerce sector will experience a 31% growth, reaching $32.70 billion by 2018. The leading players in this sector include Flipkart, Amazon India, and Paytm Mall. The number of mobile phone sales in India has surged by eight percent annually, reaching 152.5 million units in 2019, positioning it as the world's fastest-growing mobile phone market among the top 20 markets. Internet coverage in India has increased from just 4% in 2007 to 52.08% in 2019, showcasing a compound annual growth rate (CAGR) of 24% over the same period. It is projected that the number of online shoppers in India will rise from 687.62 million in September 2019 to 829 million by 2021. E-commerce has significantly impacted small, medium, and large enterprises in India by offering financial support, innovative solutions, and training methods, which also benefits other businesses. The e-commerce sector in India is growing and is poised to surpass the US to become the second-largest e-commerce market in the developing world by 2034. The expansion of e-commerce is expected to boost customer engagement and digital marketing efforts, further supporting the sector's growth. The growth of e-commerce benefits businesses by increasing shipping revenue, offering more payment options for cash transactions, and providing customers with improved product selection and management services over time. To achieve a market size of 859 million by 2022, there will be a need for an 84% increase in mobile phone usage.

**Difficulties in E-trade**

The development of internet business does not involve mutual partnerships between the public and private sectors. Collaboration between the public and private sectors is anticipated to grow the online business. Collaborative endeavors give people legitimacy, which is necessary for an online business to succeed. The framework's security, consistency in quality, rules, and some correspondence convention are missing. A client's money is lost if an online business website is compromised. The most common problem with internet-based business websites is inadequate network security. Financial institutions and representatives. Financial institutions and banks in developing countries have so far been hesitant to contribute significantly to the growth of internet commerce. Nevertheless, banks must be involved with vendors in order to expand the potential and appeal of online commerce and to prevent extortion.

**Conclusion:**

In the upcoming years, the web-based business sector will be a trailblazer in the electronic business world. On a fundamental level, the upheaval in online business has altered the exchange situation by opening up new opportunities and effortlessly shattering boundaries. It has significantly impacted India's traditional business structure and improved people's lives by simplifying things. Online business presents challenges to traditional businesses for significant positions, even though it benefits customers and vendors. Developing countries encounter various obstacles that impact the productive application of internet commerce with the support of developed and contrasting countries. The web-based business will

thrive and generate a substantial amount of revenue when the cost of the web is low.

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# Understanding the Role of Library and Information Science Discipline in National Education Policy 2020 : Challenges and Opportunities in Higher Education System of India

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**Abstract:**
The National Education Policy (NEP) 2020 of India introduces transformative changes aimed at overhauling the educational landscape. Among the various disciplines, Library and Information Science (LIS) plays a crucial role in supporting and enhancing educational objectives. This study explores the challenges and opportunities presented by NEP 2020 for the LIS discipline within higher education. It examines the policy's implications for LIS curriculum, research, and professional practice, highlighting how LIS can contribute to achieving NEP's goals. The study also addresses the potential obstacles faced by LIS professionals and institutions in adapting to the new policy framework.

**Keywords :** National Education Policy 2020, Library and Information Science, Higher Education, Curriculum Development, Research Opportunities, Professional Practice, Challenges, Opportunities, India.

## Introduction:

The National Education Policy (NEP) 2020 marks a significant milestone in the history of Indian education, aiming to make education more holistic, flexible, multidisciplinary, and aligned with the needs of the 21st century. This policy envisions a complete overhaul of the educational system, with a strong emphasis on innovation, critical thinking, and digital literacy. Library and Information Science (LIS) is a discipline that intersects with these goals, playing a pivotal role in the dissemination of knowledge, fostering research, and supporting the information needs of educational institutions.

Libraries and information centers are the backbone of academic institutions, providing essential resources and services that facilitate learning and research. In the context of NEP 2020, the role of LIS becomes even more significant as it supports the policy's vision of accessible, inclusive, and high-quality education. This study seeks to explore the implications of NEP 2020 for the LIS discipline, identifying the challenges and opportunities that arise in higher education. The National Education Policy (NEP) 2020, introduced by the Government of India, aims to bring about a paradigm shift in the country's educational landscape. It seeks to make education more holistic, flexible, multidisciplinary, and aligned with the needs of the 21st century, promoting critical thinking, creativity, and digital literacy. In this context, the discipline of Library and Information Science (LIS) emerges as a pivotal player, with a unique role in supporting the educational objectives of NEP 2020.

Libraries and information centers are essential components of educational institutions, serving as hubs of knowledge and learning. They provide access to a vast array of resources, support research activities, and facilitate lifelong learning. The LIS discipline, which encompasses the principles and practices of library management, information organization, and information retrieval, is integral to the functioning of these institutions. In the wake of NEP 2020, the role of LIS becomes even more critical, as the policy emphasizes the need for accessible, inclusive, and high-quality education.

NEP 2020 envisions a comprehensive overhaul of the Indian education system, with key focus areas including the integration of technology, promotion of research and innovation, and the development of digital infrastructure. These goals align closely with the core functions of LIS, highlighting the discipline's potential to contribute significantly to the policy's implementation. However, the transition also presents several challenges, such as updating LIS curricula, enhancing professional skills, and ensuring adequate funding and resources for libraries.

This study aims to explore the implications of NEP 2020 for the LIS discipline within higher education in India. It seeks to identify the challenges and opportunities that arise from the policy changes, examining how LIS can support the broader

educational goals outlined in NEP 2020. By analyzing the current state of LIS education and practice, this study aims to provide insights and recommendations for maximizing the impact of LIS in the context of India's evolving educational framework.

In addition to highlighting the opportunities for LIS, this study will also address the potential obstacles faced by LIS professionals and institutions. These include the need for updated and relevant curricula that align with the interdisciplinary and technology-driven focus of NEP 2020, the importance of fostering research and innovation within LIS, and the necessity of developing robust digital infrastructures to support information access and management.

Ultimately, this study underscores the crucial role that LIS plays in the successful implementation of NEP 2020. By leveraging the strengths of the LIS discipline, educational institutions can enhance their capacity to deliver high-quality education, support cutting-edge research, and foster an inclusive and accessible learning environment. As India embarks on this ambitious educational reform, the contributions of LIS will be instrumental in achieving the policy's vision of a vibrant, equitable, and dynamic educational ecosystem.

**Definition:**

**National Education Policy (NEP) 2020:** A comprehensive framework for the development of education in India, aiming to make education more inclusive, flexible, and aligned with the needs of the 21st century.

**Library and Information Science (LIS):** An academic discipline that deals with the principles and practices of library management, information organization, retrieval, and dissemination of information resources.

**Aims**

1. To analyze the role of LIS in the context of NEP 2020.
2. To identify the challenges faced by the LIS discipline in adapting to NEP 2020.
3. To explore the opportunities presented by NEP 2020 for LIS professionals and institutions.
4. To provide recommendations for enhancing the contribution of LIS to the goals of NEP 2020.

**Objectives**

1. To study the implications of NEP 2020 for LIS curriculum and education.
2. To assess the impact of NEP 2020 on LIS research and professional practices.
3. To identify potential barriers to the effective integration of LIS within the NEP 2020 framework.
4. To suggest strategies for overcoming challenges and leveraging opportunities for LIS in higher education.

**Need**

The NEP 2020's emphasis on digital literacy, research, and interdisciplinary learning necessitates a strong foundation in information management and dissemination. LIS professionals are uniquely positioned to support these objectives. Understanding the role of LIS within the NEP 2020 framework is essential for maximizing its contribution to the policy's success and for ensuring that LIS education and practice are aligned with the evolving needs of the educational sector.

**Scope**

The scope of this study includes:

1. Examination of NEP 2020 and its relevance to LIS.
2. Analysis of current LIS curricula and potential changes required to align with NEP 2020.
3. Exploration of new research opportunities for LIS under the NEP 2020 framework.
4. Evaluation of professional practices in LIS in the context of NEP 2020.
5. Recommendations for LIS educators, researchers, and practitioners to effectively contribute to NEP 2020 goals.

**History**

The evolution of Library and Information Science as a discipline has been closely linked with developments in education and technology. In India, LIS education began in the early 20th century with the establishment of formal library science courses. Over the decades, the discipline has grown, incorporating advances in information technology and adapting to the changing needs of academic and research institutions.

The introduction of NEP 2020 represents a significant shift in educational policy, with a focus on multidisciplinary learning, digital literacy, and research excellence. This policy recognizes the importance of libraries and information centers in supporting educational goals and emphasizes the need for well-equipped libraries and trained LIS professionals.

Historically, LIS has faced challenges such as inadequate funding, lack of infrastructure, and limited recognition of its importance within the academic framework. However, the digital revolution and the increasing importance of information management have highlighted the critical role of LIS. NEP 2020 offers a unique opportunity to address these historical challenges and to position LIS as a key player in achieving the policy's ambitious goals.

In conclusion, understanding the role of LIS in the context of NEP 2020 is crucial for maximizing its potential impact on higher education in India. By addressing the challenges and leveraging the opportunities presented by the policy, LIS professionals can significantly contribute to creating an inclusive, innovative, and research-

oriented educational environment. The discipline of Library and Information Science (LIS) has a rich history intertwined with the development of education and information management. In India, LIS education and practice have evolved significantly over the past century, reflecting broader societal, technological, and educational changes. The introduction of the National Education Policy (NEP) 2020 marks a pivotal moment in this ongoing evolution, presenting both challenges and opportunities for LIS within higher education.

**Early Development of LIS in India**

The formalization of LIS education in India can be traced back to the early 20th century. The first formal training program in library science was established by Asa Don Dickinson at the Punjab University in Lahore in 1915. This was followed by the establishment of several other library schools in major universities, including the University of Madras and Banaras Hindu University. These early programs laid the foundation for professional library education in India, focusing on traditional librarianship skills.

**Mid-20th Century: Expansion and Professionalization**

The mid-20th century saw significant growth in LIS education and the professionalization of librarianship in India. The establishment of the Indian Library Association (ILA) in 1933 provided a national platform for advocating for the interests of the profession. The Ranganathan Committee Report of 1957, led by S.R. Ranganathan, a pioneer in library science, was instrumental in shaping modern library practices and education in India. Ranganathan's Five Laws of Library Science became foundational principles guiding the profession.

During this period, the curriculum of LIS programs expanded to include various aspects of library management, cataloging, classification, and reference services. The establishment of the University Grants Commission (UGC) in 1956 further supported the development of higher education, including LIS.

**Late 20th Century: Technological Advancements and Challenges**

The late 20th century brought about significant technological advancements that transformed the field of LIS. The advent of computers and the internet revolutionized information storage, retrieval, and dissemination. LIS curricula began to incorporate information technology, database management, and digital libraries, reflecting the changing landscape of information services.

However, the profession also faced challenges during this period, including inadequate funding for libraries, limited infrastructure, and a lack of recognition of the importance of LIS within the broader educational framework. Despite these challenges, LIS continued to adapt and evolve, integrating new technologies and methodologies.

**Early 21st Century: Digital Era and Globalization**

The early 21st century saw the rise of the digital era and globalization, further impacting LIS education and practice. The proliferation of digital information resources, electronic journals, and online databases necessitated new skills and knowledge for LIS professionals. The role of libraries expanded to include digital curation, information literacy training, and support for open access publishing.

Globalization also brought about increased collaboration and exchange of ideas between LIS professionals and institutions worldwide. Indian LIS programs began to align more closely with international standards and practices, enhancing the quality and relevance of LIS education. The National Education Policy 2020 represents a comprehensive and forward-looking framework aimed at transforming the Indian education system. It emphasizes holistic, flexible, and multidisciplinary education, with a strong focus on critical thinking, digital literacy, and research. For LIS, NEP 2020 presents both opportunities and challenges. The policy recognizes the importance of libraries and information centers in supporting education and research. It calls for the modernization of library infrastructure, integration of digital resources, and the development of information literacy programs. These provisions align closely with the goals of LIS, positioning the discipline as a key player in achieving the policy's objectives.

**Strong Points of National Education Policy 2020**

1. **Holistic and Multidisciplinary Education**: NEP 2020 emphasizes a broad-based, multidisciplinary, and holistic education approach at all levels, moving away from rote learning and towards critical thinking and creativity.
2. **Focus on Early Childhood Education**: The policy acknowledges the importance of early childhood care and education (ECCE) and aims to provide universal access to quality ECCE for all children aged 3-6 years.
3. **Flexibility in Subject Choices**: NEP 2020 introduces flexibility in the curriculum, allowing students to choose subjects based on their interests and career aspirations, which can lead to a more personalized and engaging learning experience.
4. **Integration of Technology**: The policy advocates for the extensive use of technology in teaching, learning, and administration. It promotes digital literacy and the development of online and digital education platforms.

5. **Emphasis on Vocational Education**: The policy aims to integrate vocational education into mainstream education from the secondary level, ensuring that students acquire practical skills alongside academic knowledge.
6. **Promotion of Regional Languages**: NEP 2020 emphasizes the importance of mother tongue/local language as the medium of instruction at least until Grade 5, which can enhance comprehension and learning outcomes for young children.
7. **Teacher Training and Professional Development**: The policy focuses on improving teacher education and continuous professional development to ensure high-quality teaching standards.
8. **Focus on Research and Innovation**: NEP 2020 proposes the establishment of the National Research Foundation to foster a strong research culture and build research capacity across disciplines.
9. **Equity and Inclusion**: The policy emphasizes inclusive education and aims to reduce disparities in access and participation across different socioeconomic groups, genders, and geographical regions.
10. **Higher Education Reforms**: NEP 2020 envisions a revamp of the higher education sector with a focus on multidisciplinary institutions, holistic and flexible curricula, and the establishment of a Higher Education Commission of India (HECI) for better regulation.

**Weak Points of National Education Policy 2020**

1. **Implementation Challenges**: The ambitious scope of NEP 2020 presents significant implementation challenges, including the need for substantial investment in infrastructure, training, and resources.
2. **Resource Constraints**: Achieving the goals set out by NEP 2020 requires significant financial investment, which may be challenging given the existing budgetary constraints and competing priorities.
3. **Teacher Readiness and Training**: While the policy emphasizes teacher training, the current system may not be adequately prepared to retrain existing teachers and recruit new ones at the scale required.
4. **Digital Divide**: The emphasis on technology and digital learning may exacerbate existing inequalities, particularly for students from rural areas or lower socioeconomic backgrounds who may lack access to necessary digital infrastructure.
5. **Regional Disparities**: The effectiveness of NEP 2020's implementation may vary significantly across different states and regions, potentially leading to uneven educational outcomes.
6. **Language Policy Controversy**: The emphasis on regional languages as the medium of instruction has been met with mixed reactions. Some stakeholders argue it might limit students' future opportunities, particularly in a globalized economy.
7. **Transition and Adaptation Period**: The transition to the new education system proposed by NEP 2020 is extensive and may face resistance from institutions, educators, and students accustomed to the existing framework.
8. **Overemphasis on Assessment**: While the policy aims to reduce the focus on rote learning, there is concern that the continued emphasis on assessments may still lead to a test-centric education system.
9. **Coordination and Regulation**: The establishment of multiple new regulatory bodies and frameworks may lead to complexities in coordination and potential overlaps in roles and responsibilities.
10. **Lack of Specific Roadmap**: While NEP 2020 sets ambitious goals, it lacks a detailed implementation roadmap, making it difficult to measure progress and hold accountable the various stakeholders involved.

**Conclusion:**

NEP 2020 presents a visionary framework for transforming India's education system to meet the needs of the 21st century. Its strengths lie in its holistic and inclusive approach, emphasis on technology and vocational education, and focus on early childhood and teacher development. However, significant challenges in implementation, resource allocation, and addressing regional disparities need to be carefully managed to realize the policy's full potential. The National Education Policy (NEP) 2020 of India stands as a transformative blueprint designed to revamp the country's educational landscape. Its emphasis on holistic, multidisciplinary, and flexible education aims to cultivate critical thinking, creativity, and digital literacy among students, equipping them for the demands of the 21st century. By fostering inclusivity, equity, and innovation, NEP 2020 seeks to make education accessible and relevant to all, regardless of socioeconomic background or geographic location.

The policy's strong points lie in its comprehensive approach, integrating early childhood education, vocational training, and higher education reforms. The focus on regional languages and teacher training underscores the policy's commitment to foundational learning and quality teaching. The promotion of research, innovation, and the integration of technology in education aligns with

global educational trends and prepares India for future challenges.

However, NEP 2020 is not without its challenges. Implementation requires substantial investment, coordinated effort across various levels of government, and a readiness to adapt existing systems and practices. The digital divide, resource constraints, and regional disparities pose significant hurdles that must be addressed to ensure equitable and effective policy execution. Additionally, the policy's ambitious scope necessitates a clear and detailed roadmap to guide its implementation and measure progress. While NEP 2020 presents an ambitious and forward-thinking vision for Indian education, its success hinges on addressing these challenges through strategic planning, adequate resource allocation, and inclusive stakeholder engagement. By effectively leveraging the strengths of the Library and Information Science (LIS) discipline and other educational resources, NEP 2020 has the potential to transform India's educational framework, fostering a dynamic, inclusive, and innovative learning environment for future generations. The role of LIS, in particular, will be crucial in supporting research, managing information, and enhancing digital literacy, thereby contributing significantly to the policy's goals and the broader educational ecosystem.

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# Problems and challenges faced by sugarcane farmers in Vidarbha

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**Abstract:**
Sugarcane is an important crop in India. It plays an important role in the overall socio-economic development of the farming community. Sugar business is one of the major industries in India. This study was conducted to know the problems of sugarcane farmers in Vidarbha, Maharashtra state. This study was based on primary source of data. Simple statistical tools were used in this study. This study has revealed that sugarcane farmers in Vidarbha are facing some problems. 30 respondents were selected for this study.

**Introduction:**

The sugar industry is an important agro-based industry that affects the rural lives of about 50 million sugarcane farmers and about 5 lakh workers directly employed in sugar mills. Employment is also generated in various ancillary activities related to transport, trade services of machinery and supply of agricultural inputs. India is the second largest producer of sugar in the world after Brazil and is also the largest consumer. Sugarcane production should be increased for the sugar industry.

Because the sugar industry needs a large amount of sugarcane as raw material. Sugarcane can be produced from seeds, stalks and roots. The prepared sugarcane is cut from the roots. Last about 30 cm. These parts are cut off along with the bark and reserved for further cultivation. Sugarcane can also be grown from sugarcane seeds. Since sugarcane ripens at different times in the fall, it is important to plant sugarcane at different times. Considering the agricultural land and tropical climate of Maharashtra, if the land can be brought under irrigation, the cultivated area of Maharashtra can produce good sugarcane production. Sugarcane is also cultivated in Vidarbha in Maharashtra. Sugarcane is cultivated in Amravati, Yavatmal, Wardha, Nagpur and Bhandara districts of Vidarbha. Sugarcane cultivation in Vidarbha is mainly dependent on rain water. Sugarcane cultivation starts around the month of June. Regarding sugar factories in Vidarbha, currently 6 sugarcane factories are working.

**Objective of the study**

To study the problem sand challenges faced by sugarcane farmers of Vidarbha region.

**Scope of Research**

This study helps to understand the problems and challenges of sugarcane far ers of vidarbh region.

**Limitations of the study**

Only sugarcane farmers of Vidarbha have been included in this study. This study is also time bound. Only 30 respondents from different districts of Vidarbha are included.

**Need of Research study**

This study helps to understand the problems and challenges of sugarcane farmers in Vidarbha. By understanding the problems and challenges of the farmers, the government should devise a suitable policy for the sugarcane growers. This study can help in understanding the sugar industry in Vidarbha.

**Research methodology**

The study was conducted in the year 2024 in Vidarbha region of Maharashtra state. This study is an analytical research based on questionnaire method. Primary data was collected from 30 sugarcane farmers for the study. The respondents were selected by adopting convenience sampling method. Data collected from primary sources were analyzed using various statistical tools, such as percentage and simple mean ranking.

**Data analysis and presentation**

1. Challenges in the sugarcane seed procurement process.

| Valid Values | Value | Count | Percent |
|---|---|---|---|
| 1 | Transportationissue | 3 | 10.0% |
| 2 | High prices | 8 | 26.7% |
| 3 | Quality concerns | 8 | 26.7% |
| 4 | Limited availability | 11 | 36.7% |
| 5 | Other | 0 | .0% |

**Table 1**

Table 1 shows that the main challenges in the seed procurement process are the limited availability of seeds. Out of 30 respondents 11 farmers have problems with availability of seeds, 8 farmers have concerns about quality of seeds and 8 farmers have problems with high cost of seeds. Therefore, 90% of the farmers are facing difficulties in procuring seeds due to high cost of seeds, quality of seeds and limited availability of seeds.

2. Irrigation system for sugarcane crop

| Valid Values | Value | Count | Percent |
|---|---|---|---|
| 1 | Rain fed | 15 | 50.0% |
| 2 | Sprinklerirrigation | 15 | 50.0% |
| 3 | Drip irrigation | 0 | .0% |
| 4 | Flood irrigation | 0 | .0% |
| 5 | Other | 0 | .0% |

**Table 2**

Table 2 shows the irrigation methods used by sugarcane farmers. Out of 30 respondents, 15 farmers are dependent on rainwater and the rest are dependent on frost irrigation. It is found that 50% farmers are using rain water for irrigation and 50% farmers are using sprinkler irrigation.

3. Climatic conditions affect the production of sugarcane in the region

| Valid Values | Value | Count | Percent |
|---|---|---|---|
| 1 | Positively | 9 | 30.0% |
| 2 | Negatively | 21 | 70.0% |
| 3 | No significantimpact | 0 | .0% |

**Table 3**

Table 3 shows that out of 30 respondents, 21 farmers are facing weather problems, as weather is negatively affecting their sugarcane production. Only 9 farmers are having a positive impact on their agriculture due to weather conditions. Therefore, 70 percent of the farmers are facing the problem of climate change.

4. Government Support and Subsidies

| Valid Values | Value | Count | Percent |
|---|---|---|---|
| 1 | Sufficient | 0 | .0% |
| 2 | Insufficient | 13 | 43.3% |
| 3 | No Support | 17 | 56.7% |

**Table 4**

Table 4 shows the government assistance and subsidies. Out of 30 responses, 17 farmers received no support from the government and 13 farmers received insufficient government assistance and subsidies. It is seen that the farmers have not received enough government help and subsidy.

5. Storage Facilities

| Valid Values | Value | Count | Percent |
|---|---|---|---|
| 1 | Adequate | 0 | .0% |
| 2 | Insufficient | 10 | 33.3% |
| 3 | Non-existent | 20 | 66.7% |

**Table 5**

Table 5 shows the sugarcane storage facilities. Out of 30 respondents, 20 farmers are facing problems with storage facilities, while 10 farmers have insufficient storage space. Therefore, 67 percent of the farmers have storage problems.

6. Sugar mills faced delayed payments for sugarcane deliveries

| Valid Values | Value | Count | Percent |
|---|---|---|---|
| 1 | Yes | 16 | 53.3% |
| 2 | No | 14 | 46.7% |

**Table 6**

Table 6 shows that sugarcane farmers are facing payment problems. Out of 30 respondents 16 farmers are facing payment problems from vendors and 14 respondents are not facing that problem. It is observed that more than 50% of the respondents have payment problems.

7. Use of Technology in Farm Management

| Valid Values | Value | Count | Percent |
|---|---|---|---|
| 1 | High | 0 | .0% |
| 2 | Moderate | 16 | 53.3% |
| 3 | Low | 14 | 46.7% |

**Table 7**

Table 7 shows the extent to which farmers have used technology in farm management. Out of 30 respondents 16 farmers are using medium level of technology for farming and 14 farmers are not using technology in their farming. 53% used technology moderately and remaining 47% used very little technology in their farming.

**Conclusion:**

It has been concluded that availability of water, lack of technology, storage facilities, weather problem, availability of seeds, government support and subsidy are the critical problems and challenges facing sugarcane farmers in Vidarbha. Delay in payment of goods is a major problem faced by farmers.

**Suggestion:**

Farmers have very little knowledge about what new and modern techniques can be used in agriculture. Therefore, training (agricultural exhibitions, lectures etc.) should be organized for the farmers on adopting modern techniques of sugarcane production. The study revealed that water is the most important production problem faced by sugarcane farmers. So the government should work on irrigation schemes like Jalyukta Shivar Yojana. Better disease management can be done by providing farmers with magazines, books or leaflets related to agriculture. The government or the sugar industry should provide storage facilities for the farmers and also pay the sugarcane farmers.

**Future researcher scope:**

Future, researchers can use this study to learn more about the problems of sugarcane farmers in Vidarbha. This study can also be used to study sugar industry in Vidarbha. With the help of this study, further researchers can find modern solutions to farmers' problems.

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# Non – Existence Magnetized Ruban's Cosmological Model with Cosmic String in Lyra Manifold

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**Abstract:**
We have derived Ruban's Cosmological model in Lyra geometry in this study, both in the presence and absence of an electromagnetic field and cosmic string coupling. By utilizing a metric potential, the Einstein field equation can be solved exactly. A few of the model's geometrical and physical properties are also covered.

**Keywords:** Ruban's Space time, Cosmic String, Lyra Geometry.

**Introduction:**

Many scientists studying the universe are interested in learning more about how the universe behaves. Among them was Einstein, who invented the general theory of gravitation, or theory of relativity, which attracted an enormous amount of attention due to its use in creating cosmological models and understanding the universe's creation and evolution. However, this theory does a poor job of explaining the universe's late-time acceleration. Thus, it was essential to locate alternate gravitational theories. Alternative gravitational theories have been presented to certain scientists as a way of explaining the universe's late-time acceleration. There are number of alternative theories and examined by few researchers. Yet we have interest in Lyra geometry since Lyra [1] proposed a different view of Riemannian geometry introduces the new notion of gauge function, which solves non-integrability issue. Bhamra [2] discussed cosmological models in Lyra's geometry with a constant gauge-vector in the time direction. Using the Lyra's changes of Riemannian geometry. Patil et al. [3] and Khadekar et al. [4] have determined various aspects of the Einstein theory's field equations. Pawar et al. [5] have studied magnetized strange quark matter in Lyra geometry. A five-dimensional cosmological model with a one-dimensional cosmic string connected to a zero mass scalar field in the Lyra manifold has been studied by Mete et al. [6]. A cylindrically symmetric Einstein-Rosen cosmological model in Lyra geometry with bulk viscosity and zero-mass scalar field was studied by Katore et al. [7]. Bali et al. [8] have constructed cosmological models with Bianchi type I string dust magnetized in Lyra geometry. Pawar et al. [9] looks at the characteristics of particular physical systems or phenomena. The specifics of the study's substance are not given here, although it probably include theoretical analysis, experimental data, or simulations that concentrate on particular physics-related topics. Yadav et al. [10] have studied dark energy dominated universe in Lyra geometry. Adhav [11] examines a particular area of the science, perhaps with reference to theoretical models or astrophysical events. Analyses, mathematical models, or observational data which may be used in the research to answer a specific astronomical or astrophysical topic or issue. The work advances our knowledge of cosmic processes or structures. Reddy [12] talks about developments in space science and astrophysics, emphasizing new findings, theoretical models, and observational methods. In the context of Lyra geometry, Sahoo et al [13] studies the Bianchi type-III string cosmological model with bulk viscous fluid. The paper investigates exact solutions, the effect of bulk viscosity on the dynamics of the cosmos, and the significance of Lyra's geometry for the comprehension of anisotropies and cosmological history. Singh et al. [14] analyse how different cosmological models affect the dynamics of the cosmos.

Moreover, the magnetic field exists in both intergalactic and galactic space and has significance on a cosmic scale. It is crucial to the explanation of the flow of energy in the universe due to the highly charged items it contains. Strong magnetic fields can be generated in a cluster of galaxies by adiabatic compression. The large-scale magnetic field can be derived from the effects on the cosmic microwave background (CMB) radiation. The physical

characteristics of cosmic strings are examined, along with their implications for the structure of the universe, by Pund and Nimkar [15]. Tyagi et al. [16] Study cosmological mathematical models with an emphasis on statistical techniques for analyzing cosmic data. In addition to advancing the discipline of mathematical astrophysics, the work offers new methods for modeling and understanding the large-scale structure of the universe, improving the precision and dependability of cosmological predictions. Ram et al. [17] examine astrophysics theoretical models with an emphasis on cosmic structures and spacetime dynamics. Their study, which was looks at the mathematical foundations of cosmic phenomena and gives light on the basic principles of the universe's structure construction and expansion. Parikh et al. [18] examine the relationship between cosmology and quantum gravity, with an emphasis on the early universe. Their study focuses on the behavior of fundamental particles and possible significance for our awareness of the beginning and development of the cosmos. Singh et al. investigates the effects of bulk viscosity and massive strings in the investigates the effects of bulk viscosity and massive strings in the presence of an electromagnetic field. It examines the role of these factors in the dynamics and evolution of the universe. Daimary and Baruah [20] examine a five-dimensional, magnetic field-influenced Bianchi type-I string cosmological model. The study looks at the history of the universe when electromagnetic and string tensions are combined.

Banerjee et al. [21] study string cosmology in the context of Bianchi I space-time. With an emphasis on the anisotropic expansion and the impact of strings on the dynamics of the universe, their study explores the function of cosmic strings in the early cosmos. Bali and Upadhayay [22] examine cosmological versions of LRS Bianchi Type I that include magnetic fields and string dust. They investigate the anisotropic expansion of the universe caused by the interaction of magnetism and string dust. Within the context of general relativity, Banerjee and Banerji [23] look at the equilibrium configurations of dust and electromagnetic fields. Understanding the existence of matter and fields in a relativistic setting is simplified by the study's analytical answers and discussion of their physical effects. In general relativity, Pawar et. al. [24] create a cosmic model that includes magnetization, plane symmetry, bulk viscous fluid, and string dust. They solve the Einstein field equations and investigate how magnetic fields and viscosity affect the evolution of the universe. A general relativistic cosmological model with bulk viscous fluid, plane symmetry, string dust, and magnetization is presented by Pawar and Patil [25]. They analyze the effects of viscosity and magnetic fields on the expansion and structure of the universe by deriving exact solutions to Einstein's field equations. In general relativity, Bayaskar [26] investigate a cosmological model that includes magnetic fields, string dust, and a bulk viscous fluid. Under these circumstances, they solve the Einstein field equations and examine the effects of viscosity and magnetism on the evolution of the cosmos. A generic relativistic cosmic model with electromagnetic fields, string dust, and bulk viscous fluid is presented by Sharma and Singh [27]. They investigate the impact of electromagnetic fields and bulk viscosity on the evolution of the cosmos and derive answers to Einstein's field equations. The study gives light on how electromagnetic forces, viscosity, and the dynamics of cosmic structures interacted in the early cosmos. Our paper is organized as follows. In section 2, we derive the metric and field equations. Section 3 is mainly concerned with the physical and kinematical properties of the model. The last section contains some conclusions.

**The Metric and Field equations:**

We examine Ruban's space-time in the following style.

$$ds^2 = dt^2 - Q^2(x,t)dx^2 - R^2(t)(dy^2 + h^2 dz^2) \qquad (1)$$

Where $h(y) = \dfrac{\sin\sqrt{k}\,y}{\sqrt{k}} = \begin{cases} \sin y & if \quad k = 1 \\ y & if \quad k = 0 \\ \sinh y & if \quad k = -1 \end{cases}$

where t and x constants are the homogeneous 2-spaces, and k is their curvature parameter. We shall determine the free functions Q and R.

In Lyra's manifold, the relativistic field equations in normal gauge are as follows:

$$R_{ij} - \frac{1}{2}g_{ij}R + \frac{3}{2}\phi_i\phi_j - \frac{3}{4}g_{ij}\phi_k\phi^k = -T_{ij} \qquad (2)$$

Where $\phi_i$ is a vector field of displacement and the other symbols denote the same things as in Riemannian geometry. We now consider the time-like constant vector to be the vector displacement field $\beta$.

$$\phi_i = (0,0,0,\beta) \qquad (3)$$

where $\beta = \beta(t)$ is a function of time alone.

When a magnetic field is present, the cosmic strings' energy momentum tensor is defined as

$$T_{ij} = \rho u_i u_j - \lambda x_i x_j + E_{ij} \quad (4)$$

With

$$u^i u_i = -x^i x_i = 1$$

And

$$u^i x_i = 0 \quad (5)$$

Here, we get $\lambda$ = tension density of string, $u^i$ = cloud four-velocity, $x^i$ = direction of anisotropy, i.e. direction of strings, and $\rho$ = rest energy density of cloud of string with particles attached to them.

We consider,

$$\rho = \rho_p + \lambda \quad (6)$$

Where $\rho_p$ is the particles' rest energy density that connects them to the string. These $\rho$ and $\lambda$ are the functions of t alone.

The electromagnetic field's energy momentum tensor is

$$E_{ij} = \frac{1}{4\pi}[-F_{is}F_{jp}g^{sp} + \frac{1}{4}g_{ij}F_{sp}F^{sp}] \quad (7)$$

The only $F_{ij}$ non-vanishing component of the electromagnetic field tensor is because the magnetic field is $F_{23}$ taken along the x-axis in the commoving coordinates system. Then the first set of Maxwell equation

$$F_{ij;k} + F_{jk;l} + F_{ki;j} = 0 \quad (8)$$

Outcomes

$$F_{23} = \text{D, D = Constant.} \quad (9)$$

From equation (7) we have,

$$E_1^1 = \frac{D^2}{8\pi R^4 h^2}, \quad E_2^2 = E_3^3 = -\frac{D^2}{8\pi R^4 h^2} \text{ and } E_4^4 = \frac{D^2}{8\pi R^4 h^2} \quad (10)$$

Equation (2) generate,

$$T_1^1 = \lambda + \frac{D^2}{8\pi R^4 h^2}, \quad T_2^2 = T_3^3 = -\frac{D^2}{8\pi R^4 h^2} \text{ and } T_4^4 = \rho + \frac{D^2}{8\pi R^4 h^2} \quad (11)$$

The field equation (2) for the metric (1) declines

$$2\frac{\ddot{R}}{R} + \frac{\dot{R}^2}{R^2} + \frac{k}{R^2} + \frac{3}{4}\beta^2 = \lambda + \frac{D^2}{8\pi R^4 h^2} \quad (12)$$

$$\frac{\dot{R}\dot{Q}}{RQ} + \frac{\ddot{R}}{R} + \frac{\ddot{Q}}{Q} + \frac{3}{4}\beta^2 = -\frac{D^2}{8\pi R^4 h^2} \quad (13)$$

$$2\frac{\dot{R}\dot{Q}}{RQ} + \frac{\dot{R}^2}{R^2} + \frac{k}{R^2} - \frac{3}{4}\beta^2 = \rho + \frac{D^2}{8\pi R^4 h^2} \quad (14)$$

**Case I: When D ≠ 0**

Above equation does not have any physical interest, so we have another case that is,

**Case II: When D = 0**

For the metric (1), the field equations (2) become.

$$2\frac{\ddot{R}}{R} + \frac{\dot{R}^2}{R^2} + \frac{K}{R^2} + \frac{3}{4}\beta^2 = \lambda \quad (15)$$

$$\frac{\dot{R}\dot{Q}}{RQ} + \frac{\ddot{R}}{R} + \frac{\ddot{Q}}{Q} + \frac{3}{4}\beta^2 = 0 \quad (16)$$

$$2\frac{\dot{R}\dot{Q}}{RQ} + \frac{\dot{R}^2}{R^2} + \frac{K}{R^2} - \frac{3}{4}\beta^2 = \rho \quad (17)$$

The overhead dot in this instance stands for partial differentiation regarding t.

One must make a mathematical or physical assumption to find an accurate solution. We have string's model equation of state in the literature, as defined by Letelier.

$$\rho = \lambda \text{ (Geometric string or Nambu string)} \quad (18)$$

Using equation (18) and using the relationship between the metric potential

$$Q = x^n R^n \quad (19)$$

The solution of the field equations (15-17), we have

$$R = M(c_1 t + c_2)^{\frac{1}{n+2}} \quad \text{and} \quad Q = N(c_1 t + c_2)^{\frac{n}{n+2}} \quad (20)$$

Where $M = (n+2)^{\frac{1}{n+2}}$ and $N = x^n M^n$

Using the equation (20), equation (1) becomes

$$ds^2 = dt^2 - N^2(c_1 t + c_2)^{\frac{2n}{n+2}} dx^2 - M^2(c_1 t + c_2)^{\frac{2}{n+2}}(dy^2 + h^2 dz^2) \quad (21)$$

With the proper choice of coordinate selection, the metric can be converted into

$$ds^2 = \frac{dT^2}{c_1^2} - N^2 T^{\frac{2n}{n+2}} dx^2 - M^2 T^{\frac{2}{n+2}}(dy^2 + h^2 dz^2) \quad (22)$$

Where $T = c_1 t + c_2$

**The Physical and Kinematical Properties**

For the model (1), the tension density $\lambda$ and rest energy density $\rho$ are provided by

$$\lambda = \rho = \frac{k}{M^2 T^{\frac{2}{n+2}}}$$

$$\frac{3}{4}\beta^2 = \frac{c_1^2(1+2n)}{(n+2)^2 T^2}$$

Also,

The spatial volume, $V = hNM^2 T$

The Scalar expansion, $\theta = \frac{c_1}{T}$

Shear scalar, $\sigma^2 = \frac{1}{2}\sigma_{ij}\sigma^{ij} = \frac{c_1^2}{6T^2}$

Hubble parameter, $H = \frac{1}{3}\frac{\dot{V}}{V} = \frac{\theta}{3} = \frac{c_1}{3T}$

**Conclusion:**

Essentially, this is what drives our investigation into the magnetized Ruban's cosmological model in the Lyra Manifold using cosmic string. String cosmology, which includes space time and a magnetic field, is of cosmological importance because of its significant role in the structural construction of the cosmos. We noticed that the resulting equations have no physical significance while talking about case I. Thus, we chose case II. In this instance, we have introduced string cosmology models featuring a magnetic field for Ruban's background along the X axis. Both the cosmic string density and the tension density are present along this route. It can be seen that at the beginning, when T=0. There will be no special volume. While shear scalar and scalar expansion reach infinite values. We found that scalar expansion and shear scalar reach zero for large values of T (T ).

The models are growing, shearing, and non-rotating in a conventional manner, and they are free of starting singularities.

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# Nutritional Safety of Fast Food: A Comprehensive Health Impact Study

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**Abstract:**
The rise of fast food has revolutionized global eating habits, offering convenience and affordability but raising significant concerns about its impact on health. This study, "Nutritional Safety of Fast Food: A Comprehensive Health Impact Study," delves into the nutritional profile of fast food, examining its implications for public health. By analyzing existing literature and conducting empirical research, the study assesses the risks associated with regular fast food consumption, including obesity, cardiovascular disease, diabetes, and other chronic conditions. The research also explores the role of fast food in modern diets and its contribution to the global burden of non-communicable diseases. This comprehensive analysis aims to provide insights into the safety of fast food from a nutritional standpoint, offering recommendations for healthier eating practices and policy interventions to mitigate health risks.

**Keywords:** Fast Food, Nutritional Safety, Public Health, Obesity, Chronic Diseases, Non-Communicable Diseases, Dietary Impact, Health Risks, Nutritional Profile

## Introduction:

The fast food industry has experienced explosive growth over the past few decades, becoming a staple in the diets of millions around the world. This rapid expansion has been driven by the convenience, affordability, and widespread availability of fast food, making it an attractive option for busy individuals and families. However, the increasing consumption of fast food has sparked significant public health concerns due to its nutritional content and its potential role in the rising prevalence of obesity and other chronic diseases.

Fast food is often characterized by high levels of calories, unhealthy fats, sugars, and sodium, coupled with low nutritional value in terms of vitamins, minerals, and fiber. The regular consumption of such foods has been linked to a range of adverse health outcomes, including weight gain, cardiovascular disease, type 2 diabetes, and metabolic syndrome. As societies grapple with the growing burden of non-communicable diseases, understanding the nutritional safety of fast food has become a pressing issue. This study seeks to provide a comprehensive analysis of the nutritional safety of fast food by examining its impact on health.

Through a detailed review of existing research and empirical studies, the study aims to shed light on the potential health risks associated with fast food consumption and to explore strategies for mitigating these risks. The findings of this research are intended to inform public health policies and consumer choices, promoting healthier dietary practices in an increasingly fast-paced world. The fast food industry has transformed global eating habits, offering a convenient and affordable solution for busy lifestyles. Since the early 20th century, the proliferation of fast food chains has been a hallmark of modern urbanization, reflecting a broader trend towards increased consumption of processed and convenience foods. The allure of fast food—characterized by its quick preparation, consistent taste, and often enticing marketing—has made it an integral part of diets across the globe.

However, as its popularity has surged, so too have concerns about its nutritional safety and the potential health implications of its widespread consumption. Fast food is typically defined by its high caloric density and low nutritional value, featuring items rich in unhealthy fats, sugars, and sodium. These characteristics are often linked to negative health outcomes, including obesity, cardiovascular disease, diabetes, and metabolic syndrome. The reliance on such foods in modern diets has contributed to a global health crisis, with rising rates of non-communicable diseases (NCDs) increasingly attributed to poor dietary choices.

### Nutritional Profile of Fast Food

The nutritional profile of fast food is marked by several key components:

1. **High Caloric Content:** Fast food items are often high in calories, primarily due to large portion sizes and the use of calorie-dense ingredients such as refined sugars and fats. This excessive caloric intake contributes to weight gain and obesity, a major risk factor for numerous chronic diseases.
2. **Unhealthy Fats:** Many fast food products contain high levels of saturated fats and trans

fats, which are associated with elevated levels of low-density lipoprotein (LDL) cholesterol in the blood. High LDL cholesterol is a known risk factor for cardiovascular diseases, including heart attacks and strokes.

3. **Excessive Sodium:** Fast food is typically high in sodium, which is used to enhance flavor and preserve food. Excessive sodium intake is linked to high blood pressure, a significant risk factor for heart disease and stroke.
4. **High Sugar Content:** Many fast food items, particularly beverages and desserts, are high in added sugars. Excessive sugar consumption is associated with weight gain, insulin resistance, and an increased risk of type 2 diabetes.
5. **Low Nutrient Density:** Fast food is often low in essential nutrients such as vitamins, minerals, and fiber. This nutritional imbalance can contribute to deficiencies and negatively impact overall health.

**Health Implications**

The health implications of regular fast food consumption are profound and multifaceted:

1. **Obesity:** The high caloric density and low nutritional value of fast food contribute significantly to obesity. Obesity is a major public health concern, as it is associated with an increased risk of developing a range of chronic diseases, including heart disease, diabetes, and certain cancers.
2. **Cardiovascular Disease:** The consumption of unhealthy fats and excessive sodium in fast food can lead to the development of cardiovascular diseases. High levels of LDL cholesterol and high blood pressure are both strongly linked to heart disease.
3. **Diabetes:** The high sugar content of fast food can contribute to insulin resistance and the development of type 2 diabetes. Frequent consumption of sugary foods and beverages is a well-documented risk factor for diabetes.
4. **Metabolic Syndrome:** The combination of obesity, high blood pressure, and abnormal cholesterol levels associated with fast food consumption can lead to metabolic syndrome. This condition increases the risk of heart disease, stroke, and diabetes.
5. **Nutritional Deficiencies:** The lack of essential nutrients in fast food can lead to deficiencies that affect overall health and well-being. For example, inadequate intake of vitamins and minerals can impair immune function, bone health, and cognitive performance.

**Public Health Concerns**

The widespread consumption of fast food has become a significant public health concern, particularly as the global prevalence of obesity and chronic diseases continues to rise. The economic burden of these health issues is substantial, with increased healthcare costs and loss of productivity contributing to a growing financial strain on healthcare systems.

Efforts to address these concerns include public health campaigns aimed at raising awareness about the risks of fast food consumption and promoting healthier dietary choices. Additionally, some fast food chains have introduced healthier menu options in response to consumer demand and regulatory pressures. However, the effectiveness of these measures in mitigating the health impacts of fast food remains a topic of ongoing debate.

**Consumer Behavior and Fast Food**

Consumer behavior plays a crucial role in the prevalence of fast food consumption. Factors such as convenience, affordability, and marketing strategies influence dietary choices, often outweighing considerations of nutritional quality. Understanding these behavioral drivers is essential for developing effective interventions and policies to promote healthier eating habits.

**Policy and Regulatory Perspectives**

Policy and regulatory approaches to addressing the health impacts of fast food vary across regions. Some countries have implemented measures such as labeling requirements, marketing restrictions, and tax initiatives to curb unhealthy food consumption. Evaluating the effectiveness of these policies and identifying best practices can provide valuable insights for improving public health outcomes.

The nutritional safety of fast food is a critical issue with far-reaching implications for individual and public health. This study aims to provide a comprehensive analysis of the health impacts associated with fast food consumption, exploring its nutritional profile, associated health risks, and the effectiveness of current public health interventions. By understanding the complexities of fast food and its role in modern diets, this research seeks to inform strategies for promoting healthier eating practices and reducing the global burden of diet-related diseases.

**Definition:**

**Fast Food**: Fast food refers to mass-produced food that is typically prepared and served quickly, often at fast food restaurants or chains. It is designed for convenience and usually features items that are high in calories, fats, sugars, and sodium, with limited nutritional benefits.

**Nutritional Safety**: Nutritional safety in this context refers to the assessment of the potential health risks and benefits associated with the consumption of fast food, particularly in relation to its nutritional content and its impact on long-term health outcomes.

**Aims**

The primary aim of this study is to evaluate the nutritional safety of fast food by assessing its impact on public health. The study seeks to:

1. Analyze the nutritional composition of fast food and identify key components that may pose health risks.
2. Investigate the association between fast food consumption and the prevalence of obesity, cardiovascular diseases, diabetes, and other chronic conditions.
3. Explore the broader implications of fast food consumption on public health and the global burden of non-communicable diseases.

**Objectives**

1. **Nutritional Analysis:** To conduct a detailed analysis of the nutritional content of popular fast food items, focusing on calories, fats, sugars, sodium, and essential nutrients.
2. **Health Impact Assessment:** To examine the correlation between regular fast food consumption and the incidence of obesity, heart disease, diabetes, and other health conditions.
3. **Consumer Behavior Study:** To understand consumer attitudes and behaviors towards fast food and how these influence dietary patterns and health outcomes.
4. **Policy Review:** To evaluate existing public health policies related to fast food and suggest improvements for reducing the associated health risks.
5. **Recommendations:** To provide actionable recommendations for consumers, health professionals, and policymakers to promote healthier eating practices.

**Need**

The need for this study stems from the growing public health concerns associated with the widespread consumption of fast food. As fast food becomes an integral part of daily diets, especially in urbanized societies, it is crucial to understand its nutritional safety and its long-term effects on health. The findings from this study will contribute to the ongoing discourse on dietary health, offering insights that can help shape public health strategies and consumer choices in favor of healthier, more balanced diets.

**Scope**

This study covers a comprehensive analysis of the nutritional safety of fast food, focusing on its impact on public health. The scope includes:

- A detailed review of the nutritional content of popular fast food items.
- An examination of the health outcomes associated with regular fast food consumption, with a particular focus on obesity, cardiovascular disease, and diabetes.
- A study of consumer behavior and attitudes towards fast food, identifying factors that drive its consumption.
- An evaluation of current public health policies related to fast food and suggestions for policy enhancements.
- Recommendations for improving nutritional safety through consumer education, policy changes, and industry reforms.

**History**

The fast food industry originated in the early 20th century, with the opening of the first fast food restaurants in the United States. The industry grew rapidly in the post-World War II era, as economic growth and urbanization led to increased demand for convenient, affordable food options. By the mid-20th century, fast food chains like McDonald's, Burger King, and KFC had become household names, expanding their operations both domestically and internationally.

As fast food gained popularity, concerns about its nutritional content and health impact began to emerge. Early research in the 1970s and 1980s highlighted the high calorie and fat content of fast food, linking its consumption to rising obesity rates in the United States. In the following decades, a growing body of research explored the broader health implications of fast food, including its association with heart disease, diabetes, and other chronic conditions. The late 20th and early 21st centuries saw increased scrutiny of the fast food industry, with public health campaigns, documentaries, and books such as "Fast Food Nation" and "Super Size Me" raising awareness of the potential health risks.

In response, some fast food chains have made efforts to offer healthier options, although the overall nutritional quality of fast food remains a significant concern. This historical context highlights the need for ongoing research into the nutritional safety of fast food, particularly as its consumption continues to rise globally. Understanding the evolution of fast food and its impact on health is essential for developing effective public health strategies to address the associated risks.

**Current Trends**

1. **Ingredient Transparency**: Consumers are increasingly demanding transparency about ingredients and nutritional information. Fast food chains are responding by providing detailed nutritional data on menus and websites, as well as emphasizing natural and less processed ingredients.
2. **Healthier Options**: Many fast food companies are expanding their menus to include healthier options such as salads, fruit, and lower-calorie items. This shift is partly driven by growing consumer awareness of health issues related to diet.
3. **Nutritional Fortification**: Some fast food chains are fortifying their products with additional nutrients to counteract the negative health impacts typically associated with their offerings. This includes adding vitamins and minerals to items like burgers and fries.

4. **Regulations and Standards**: Governments and health organizations are increasingly setting stricter nutritional standards for fast food products. This includes limits on sodium, trans fats, and added sugars, as well as requirements for clearer labeling.
5. **Consumer Education**: There is a growing emphasis on educating consumers about the potential health risks of fast food consumption. This includes public health campaigns and educational programs focusing on making informed dietary choices.
6. **Sustainable Practices**: Some fast food chains are incorporating sustainable practices into their operations, which can have indirect effects on nutritional safety. This includes sourcing ingredients responsibly and reducing the environmental impact of their packaging.
7. **Technological Innovations**: Advances in food technology are influencing the nutritional profile of fast food. For example, the development of plant-based meat alternatives and other innovations aimed at reducing the reliance on unhealthy ingredients.
8. **Focus on Mental Health**: There is an increasing recognition of the link between diet and mental health. Fast food chains are beginning to consider the mental health impacts of their offerings and exploring ways to improve their nutritional profiles to support overall well-being.

**Strong Points**

1. **Increased Transparency**: Fast food chains are providing more detailed nutritional information, helping consumers make informed choices. This transparency can lead to healthier eating habits.
2. **Healthier Menu Options**: The introduction of healthier menu items, such as salads and lower-calorie options, offers consumers more choices that align with better dietary practices.
3. **Nutritional Fortification**: Adding nutrients to fast food products can help mitigate some of the negative health effects associated with these foods.
4. **Regulatory Measures**: Stricter nutritional standards and regulations can improve the overall quality of fast food and reduce the risks associated with excessive consumption of unhealthy ingredients.
5. **Educational Initiatives**: Public health campaigns and consumer education programs are increasing awareness about the health impacts of fast food and promoting better dietary choices.
6. **Sustainable Practices**: Incorporating sustainable practices can contribute to overall health improvements and reduce environmental impacts, which indirectly benefits nutritional safety.
7. **Technological Innovations**: Advances in food technology, such as plant-based alternatives, can offer healthier options and reduce the reliance on unhealthy ingredients.
8. **Focus on Mental Health**: Recognizing the link between diet and mental health can lead to the development of products that support overall well-being.

**Weak Points**

1. **Limited Impact of Healthier Options**: Healthier menu items often make up a small percentage of the overall menu, and traditional fast food items may still be heavily promoted.
2. **Nutritional Fortification Limitations**: Adding nutrients to fast food products does not fully address the negative health impacts associated with high levels of sodium, sugar, and unhealthy fats.
3. **Regulatory Gaps**: Despite regulations, enforcement and compliance can vary, and some fast food products may still contain unhealthy levels of certain ingredients.
4. **Consumer Education Challenges**: While education efforts are growing, they may not reach all consumers effectively, and some may still make poor dietary choices despite having information available.
5. **Sustainability vs. Nutrition**: Sustainable practices may not always align with nutritional improvements, and the focus on environmental impact might overshadow immediate nutritional concerns.
6. **Technological Innovations Limitations**: New food technologies may not always be widely adopted or may still involve unhealthy components, and the long-term health impacts of these innovations are not always clear.
7. **Mental Health Focus**: While some chains are addressing the link between diet and mental health, this focus may still be in its early stages and not fully integrated into all fast food offerings.
8. **Overall Health Impact**: The cumulative impact of consuming fast food regularly can still pose significant health risks, and efforts to improve nutritional safety may not fully counteract these risks.

**Conclusion:**

The nutritional safety of fast food is a complex issue influenced by various factors including ingredient transparency, healthier menu options, and regulatory measures. While there have been significant strides in improving the nutritional profile of fast food, challenges remain. The industry has made progress in offering healthier choices, incorporating nutritional fortification, and adhering to stricter regulations.

However, the impact of these measures is limited by factors such as the continued promotion of traditional unhealthy options, varying regulatory enforcement, and challenges in consumer education.

Despite these advancements, the overall health impact of fast food consumption continues to be a concern, as does the alignment of sustainability practices with nutritional improvements. Addressing these issues requires a multifaceted approach involving industry changes, regulatory action, and increased consumer awareness.

**Suggestions**

1. **Enhanced Menu Innovation**: Fast food chains should continue to innovate by expanding their range of healthy options and ensuring these options are prominently featured and promoted.
2. **Improved Nutritional Fortification**: While fortification can be beneficial, it should not be a substitute for addressing the core nutritional issues. Efforts should be made to reduce unhealthy ingredients and improve overall product quality.
3. **Stronger Regulatory Frameworks**: Governments and health organizations should enforce stricter nutritional standards and provide clear, consistent regulations to ensure that all fast food products meet health criteria.
4. **Comprehensive Consumer Education**: Increased investment in consumer education and public health campaigns can help raise awareness about the health impacts of fast food and promote healthier dietary choices.
5. **Sustainability and Nutrition Integration**: Fast food companies should work towards integrating sustainable practices with nutritional improvements, ensuring that efforts to reduce environmental impact also consider health outcomes.
6. **Ongoing Technological Evaluation**: Continued research and evaluation of new food technologies are essential to understand their long-term health impacts and ensure they contribute positively to nutritional safety.
7. **Mental Health Considerations**: Fast food chains should incorporate mental health considerations into their product development, recognizing the connection between diet and mental well-being.

**Future Research Scope**

1. **Impact of Healthier Menu Options**: Research could explore the effectiveness of healthier menu options in changing consumer behavior and improving public health outcomes.
2. **Long-term Effects of Nutritional Fortification**: Investigating the long-term health impacts of fortifying fast food with additional nutrients could provide insights into the efficacy and limitations of this approach.
3. **Effectiveness of Regulatory Measures**: Studies could assess the effectiveness of current nutritional regulations and identify areas for improvement in enforcement and compliance.
4. **Consumer Behavior and Education**: Research could focus on understanding consumer behavior in relation to nutritional information and education, and how to enhance the impact of educational initiatives.
5. **Sustainable Practices and Health Outcomes**: Future studies could examine the relationship between sustainable practices in fast food and their impact on nutritional safety and health outcomes.
6. **Technological Innovations**: Research could investigate the health implications of emerging food technologies and their potential to improve or compromise nutritional safety.
7. **Diet-Mental Health Link**: Further research into how fast food consumption affects mental health and how to address this in product development and marketing could be valuable.
8. **Global Comparisons**: Comparative studies of fast food nutritional safety across different countries could provide insights into best practices and policy effectiveness.

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# Impact of Sustainability Practices on Various Stages of Chemical Disaster Preparedness and Management in the Mumbai Region

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**Abstract:**
Chemical disasters present significant threats to urban environments, particularly in densely populated areas like the Mumbai region. This research paper explores the impact of sustainability practices on the various stages of chemical disaster preparedness and management. The study examines how the integration of sustainable practices influences the prevention, preparedness, response, and recovery stages of chemical disaster management. Through an analysis of existing literature, case studies, and policy frameworks, the paper highlights the benefits and challenges of adopting sustainability practices in mitigating the effects of chemical disasters. The findings emphasize the necessity of sustainable approaches to enhance resilience and ensure long-term safety in chemical disaster management.

**Keyword:** Chemical Disaster, Mumbai, Region, Sustainable Practices.

## Introduction:

Mumbai, the financial capital of India, is a bustling metropolis with a high density of industries, including chemical manufacturing and storage facilities. The region's vulnerability to chemical disasters is exacerbated by its dense population, urbanization, and proximity to industrial zones. The need for effective disaster preparedness and management is paramount to mitigate the potential impact of chemical accidents.

While traditional disaster management approaches focus on immediate response and recovery, there is a growing recognition of the importance of sustainability in disaster preparedness and management. This research investigates the impact of sustainability practices on the various stages of chemical disaster preparedness and management in the Mumbai region.

### Objectives

- To analyze the role of sustainability practices in chemical disaster prevention.
- To examine how sustainable practices influence disaster preparedness in chemical management.
- To assess the impact of sustainability on response strategies during chemical disasters.
- To evaluate the role of sustainability in the recovery phase after chemical disasters.

### Literature Review

- **Chemical Disaster Management:** Overview chemical disasters involve the release of hazardous substances that pose significant risks to public health, the environment, and infrastructure. The management of such disasters includes prevention, preparedness, response, and recovery stages. Effective disaster management is critical to minimizing the impact of chemical accidents.
- **Sustainability in Disaster Management** Sustainability in disaster management refers to the adoption of practices that not only address immediate risks but also ensure long-term resilience and environmental protection. Sustainable disaster management emphasizes the reduction of vulnerability, the use of eco-friendly technologies, and the incorporation of social and environmental considerations into disaster planning.
- **Sustainable Practices in Chemical Disaster Prevention** The prevention stage involves measures taken to avoid the occurrence of chemical disasters. Sustainable practices in this stage include the adoption of green chemistry principles, safer production processes, and stringent regulatory frameworks that promote environmental safety. The role of sustainability in reducing the frequency and severity of chemical accidents is critical.
- **Sustainability in Disaster Preparedness** Preparedness involves planning and preparing for potential chemical disasters. Sustainability in this stage includes the development of eco-friendly emergency plans, the use of renewable energy sources in disaster management infrastructure, and the training of communities in sustainable disaster response practices.
- **Sustainable Response to Chemical Disasters** The response stage involves actions taken immediately after a chemical disaster occurs.

Sustainable response strategies include the use of non-toxic materials in containment and cleanup operations, minimizing environmental impact during emergency response, and ensuring the health and safety of responders through sustainable practices.

- **Sustainability in the Recovery Phase:** The recovery phase focuses on restoring normalcy after a chemical disaster. Sustainable recovery practices include the rehabilitation of affected areas using environmentally friendly methods, the promotion of green infrastructure, and the implementation of long-term strategies to prevent future disasters.

**Research Methodology**

The research adopts a qualitative approach, utilizing case studies, policy analysis, and expert interviews to examine the impact of sustainability practices on chemical disaster management in Mumbai.

**Data is collected through:**

- Review of existing literature on sustainability and disaster management.
- Analysis of policy documents and regulatory frameworks in Mumbai.
- Case studies of chemical disasters in the Mumbai region.
- Interviews with experts in disaster management, sustainability, and chemical safety.

The data is analysed using thematic analysis to identify key themes and patterns related to the integration of sustainability practices in chemical disaster management.

**Sustainable Practices in Chemical Disaster Prevention in Mumbai**

The study found that sustainable practices such as green chemistry, safer industrial processes, and stringent regulatory frameworks have significantly reduced the occurrence of chemical accidents in Mumbai. However, challenges such as enforcement gaps and lack of awareness among smaller industries persist.

Chemical disaster prevention is a critical aspect of ensuring the safety of communities, protecting the environment, and maintaining economic stability. The role of sustainability practices in this domain has gained prominence as industries, governments, and communities increasingly recognize the importance of integrating environmentally responsible strategies into disaster prevention efforts. Sustainability practices are essential in reducing the frequency and severity of chemical disasters by promoting safer processes, minimizing hazardous waste, and encouraging the use of green technologies.

**1. Green Chemistry and Safer Industrial Processes**

One of the fundamental aspects of sustainability in chemical disaster prevention is the adoption of green chemistry principles. Green chemistry focuses on designing products and processes that minimize the generation of hazardous substances. By using less toxic raw materials, reducing waste production, and optimizing energy efficiency, industries can significantly lower the risk of chemical accidents. For instance, the replacement of highly volatile solvents with safer alternatives reduces the likelihood of explosions or leaks, which are common causes of chemical disasters.

Incorporating safer industrial processes also plays a crucial role in prevention. This includes the implementation of process safety management (PSM) systems, which ensure that potential hazards are identified, assessed, and controlled. Sustainability practices in PSM emphasize continuous improvement, regular maintenance of equipment, and the use of non-hazardous materials wherever possible. These measures not only prevent chemical disasters but also contribute to overall environmental protection by reducing the emission of pollutants.

**2. Regulatory Frameworks and Corporate Responsibility**

Sustainability practices in chemical disaster prevention are also reinforced through regulatory frameworks and corporate responsibility initiatives. Governments and international organizations have established stringent regulations to control the use, storage, and disposal of hazardous chemicals. These regulations often require companies to adopt sustainable practices, such as proper waste management, spill prevention strategies, and emergency response planning.

Corporate responsibility initiatives, including the adoption of Environmental, Social, and Governance (ESG) criteria, further promote sustainability in chemical disaster prevention. Companies that prioritize ESG factors are more likely to implement sustainable practices that minimize environmental risks and enhance safety. For example, adopting sustainable supply chain practices can reduce the transportation and storage risks associated with hazardous materials, thereby preventing potential chemical disasters.

**3. Hazardous Waste Management and Pollution Prevention**

Effective hazardous waste management is another critical component of sustainability in chemical disaster prevention. Improper disposal or storage of hazardous waste can lead to environmental contamination and increase the risk of chemical accidents. Sustainable waste management practices involve reducing waste at the source, recycling and reusing materials, and ensuring the safe disposal of hazardous substances.

Pollution prevention strategies also play a significant role in disaster prevention. By minimizing the release of pollutants into the

environment, industries can reduce the likelihood of chemical spills and accidents. This includes adopting cleaner production techniques, using renewable energy sources, and implementing zero-waste programs. Sustainable pollution prevention not only protects the environment but also reduces the health risks associated with chemical exposure.

**4. Community Engagement and Education**

Sustainability practices in chemical disaster prevention extend beyond the industrial and regulatory spheres to involve communities. Engaging local communities in disaster prevention efforts is essential for building resilience and ensuring long-term sustainability. Public awareness campaigns, education programs, and community participation in safety drills can significantly enhance preparedness and reduce the risk of chemical disasters.

Educating communities about the potential risks of chemical industries in their vicinity and promoting sustainable practices, such as proper waste disposal and emergency preparedness, empower residents to take an active role in disaster prevention. This collaborative approach fosters a culture of safety and sustainability, where both industry and community stakeholders work together to prevent chemical disasters.

**Impact of Sustainable Practices on Disaster Preparedness in Chemical Management**

Sustainable preparedness strategies, including eco-friendly emergency plans and renewable energy-powered infrastructure, have enhanced the region's ability to manage chemical disasters. The involvement of local communities in sustainable disaster planning has also improved preparedness levels.

Disaster preparedness in chemical management is essential to mitigate the risks associated with chemical accidents and protect communities, the environment, and industrial assets. Sustainable practices, which emphasize long-term environmental stewardship, resource efficiency, and community involvement, significantly influence disaster preparedness by promoting safer, more resilient, and eco-friendly approaches. These practices enhance preparedness at multiple levels, from planning and infrastructure development to community engagement and education.

**1. Sustainable Emergency Planning**

Sustainable practices in emergency planning for chemical management involve the integration of environmental considerations into disaster preparedness strategies. This includes the development of comprehensive risk assessments that account for potential environmental impacts and the use of eco-friendly materials and technologies in response efforts. For instance, emergency plans may prioritize the use of non-toxic firefighting foams, biodegradable absorbents for chemical spills, and renewable energy sources for emergency power. These practices not only reduce the environmental footprint of disaster response but also ensure that preparedness measures align with broader sustainability goals.

Moreover, sustainable emergency planning involves scenario analysis and drills that incorporate environmental protection measures. By simulating chemical disaster scenarios with a focus on minimizing environmental harm, industries and emergency responders can develop more effective, sustainable strategies for real-life incidents. This approach enhances the overall resilience of chemical management systems, making them better equipped to handle disasters in a way that safeguards both human health and the environment.

**2. Infrastructure and Technology**

The influence of sustainable practices on disaster preparedness is also evident in the design and construction of chemical management infrastructure. Sustainable infrastructure is designed to withstand the impacts of potential disasters while minimizing environmental damage. This includes the use of green building materials, energy-efficient systems, and environmentally friendly technologies that reduce the risk of chemical releases during disasters.

For example, sustainable chemical storage facilities may incorporate advanced leak detection systems, secondary containment structures, and ventilation systems that reduce the likelihood of hazardous emissions. Additionally, the adoption of clean technologies, such as real-time monitoring and automated shutdown systems, enhances the ability to detect and respond to chemical incidents swiftly, thereby preventing escalation and mitigating potential disasters.

**3. Resource Efficiency and Waste Reduction**

Sustainable practices in disaster preparedness also emphasize resource efficiency and waste reduction. In chemical management, this translates to the minimization of hazardous materials used and stored, as well as the reduction of waste generated during routine operations. By adopting practices such as just-in-time inventory management and green chemistry principles, industries can decrease the quantity of hazardous substances on-site, thereby reducing the potential scale of a disaster.

Furthermore, sustainable waste management practices, such as recycling and the use of environmentally friendly disposal methods, ensure that waste generated during disaster preparedness exercises or actual incidents does not pose additional environmental risks. These practices contribute to a more sustainable approach to chemical management, where preparedness efforts are aligned with the goal of minimizing environmental harm.

**4. Community Involvement and Education**

Sustainability in disaster preparedness is also reflected in the active involvement of communities in preparedness efforts. Sustainable practices promote the inclusion of local communities in planning and decision-making processes, ensuring that disaster preparedness measures are culturally appropriate, socially inclusive, and environmentally responsible. This approach fosters a sense of ownership and accountability among community members, making them more likely to participate in and support disaster preparedness initiatives.

Educational programs that raise awareness about chemical risks and sustainable practices are crucial for building community resilience. By educating the public about the potential dangers of chemical disasters and the importance of sustainable preparedness measures, communities can be better prepared to respond effectively to incidents. This includes training on how to safely store and handle chemicals, recognizing early warning signs of chemical hazards, and understanding emergency evacuation procedures.

**5. Long-Term Resilience and Sustainability**

Sustainable practices in disaster preparedness contribute to the long-term resilience of chemical management systems. By focusing on prevention, environmental protection, and community engagement, these practices create a more robust framework for disaster preparedness that can withstand and recover from chemical incidents with minimal long-term impact. The emphasis on sustainability ensures that preparedness measures are not only effective in the short term but also support the continued safety and well-being of future generations.

**Impact of Sustainability on Response Strategies during Chemical Disasters**

The use of non-toxic materials and environmentally friendly containment methods during recent chemical disasters in Mumbai has minimized environmental damage. However, the study highlights the need for better training of responders in sustainable practices.

Chemical disasters, which can result from industrial accidents, transportation mishaps, or natural events, pose significant threats to public health, the environment, and infrastructure. Effective response strategies are crucial in mitigating the immediate impacts of such disasters. The integration of sustainability into response strategies has increasingly become a focus, as it ensures that emergency actions not only address immediate threats but also consider long-term environmental and social consequences. Assessing the impact of sustainability on these response strategies reveals a multi-faceted approach that enhances resilience, reduces harm, and fosters a culture of safety and responsibility.

**1. Minimization of Environmental Impact**

One of the primary impacts of sustainability on chemical disaster response strategies is the minimization of environmental damage. Traditional response methods often involve the use of chemicals and techniques that, while effective in controlling the disaster, can cause additional harm to the environment. Sustainable response strategies, however, prioritize the use of eco-friendly materials and methods. For example, biodegradable absorbents may be used to contain chemical spills, and non-toxic agents can replace harmful solvents in decontamination processes.

Moreover, sustainability emphasizes the importance of preventing secondary contamination. This might involve the careful management of runoff water from firefighting efforts to prevent it from carrying hazardous substances into nearby water bodies. In addition, sustainable practices may involve creating temporary barriers or using natural filtration methods to protect sensitive ecosystems during the response phase. These practices ensure that the environmental impact of the disaster response is as limited as possible, thereby preserving the integrity of local ecosystems.

**2. Resource Efficiency and Waste Reduction**

Sustainable response strategies also emphasize resource efficiency and waste reduction during chemical disasters. Traditional disaster responses can generate significant amounts of waste, particularly hazardous waste that requires careful disposal. Sustainable approaches aim to minimize this waste through efficient resource use, recycling, and the selection of materials that produce less waste or can be more easily decontaminated and reused.

For instance, the use of reusable protective gear or decontamination units can significantly reduce the volume of waste generated during a chemical disaster. Similarly, optimizing the use of water and other resources during cleanup operations not only conserves valuable resources but also reduces the volume of contaminated runoff that needs to be managed. These practices contribute to a more sustainable response by lessening the environmental burden and reducing the long-term costs associated with waste disposal.

**3. Health and Safety of Responders**

Sustainability in disaster response also extends to the health and safety of the emergency responders. Sustainable strategies prioritize the use of less toxic and safer materials, which can reduce the health risks to those involved in disaster response operations. For example, sustainable practices might involve substituting hazardous decontaminants with safer alternatives that do not pose inhalation or skin contact risks to responders.

Additionally, sustainability emphasizes the importance of proper training in the use of eco-friendly response tools and methods. Well-trained responders are more capable of effectively implementing sustainable practices, which not only protects their health but also ensures the efficacy of the response efforts. The emphasis on sustainability thus creates a safer working environment for responders, which is crucial in maintaining the overall efficiency and effectiveness of disaster response operations.

**4. Long-Term Recovery and Resilience**

Sustainable response strategies are also closely linked to the long-term recovery and resilience of affected communities and environments. By focusing on sustainability during the response phase, the groundwork is laid for a smoother transition to recovery. For example, using sustainable materials and methods during the response can reduce the long-term environmental degradation that needs to be addressed during recovery. This approach helps in quicker rehabilitation of affected areas, leading to more resilient communities that are better prepared for future incidents.

Sustainability also fosters the integration of green infrastructure and eco-friendly technologies during the recovery phase, further strengthening the resilience of communities against future disasters. This holistic approach ensures that the response to a chemical disaster does not exacerbate long-term vulnerabilities but instead builds a stronger foundation for future safety and sustainability.

**5. Community Engagement and Transparency**

Sustainable response strategies often involve greater community engagement and transparency. Communities affected by chemical disasters are increasingly demanding that response strategies not only be effective but also environmentally and socially responsible. By integrating sustainability into response efforts, authorities can better align with community values and expectations, fostering trust and cooperation.

Incorporating local knowledge and resources into response strategies can enhance their sustainability and effectiveness. Communities can contribute valuable insights into the local environment and potential risks, helping to tailor response efforts to the specific context of the disaster. This collaborative approach not only improves the immediate response but also strengthens community resilience in the long term.

**Evaluating the Role of Sustainability in the Recovery Phase After Chemical Disasters**

The recovery phase presents significant challenges in the adoption of sustainable practices. While efforts to rehabilitate affected areas using green infrastructure are ongoing, financial constraints and lack of technical expertise hinder the full implementation of sustainable recovery strategies.

The recovery phase after a chemical disaster is a critical period during which affected communities, environments, and economies begin to rebuild and restore normalcy. The role of sustainability in this phase is increasingly recognized as essential to ensuring that recovery efforts do not merely return conditions to their pre-disaster state but also improve resilience, reduce future risks, and promote long-term environmental and social health. Evaluating the role of sustainability in the recovery phase involves examining how sustainable practices contribute to effective, inclusive, and eco-friendly recovery strategies that benefit both current and future generations.

**1. Environmental Remediation and Restoration**

One of the most significant roles of sustainability in the recovery phase after a chemical disaster is in environmental remediation and restoration. Chemical disasters can cause widespread environmental damage, including soil contamination, water pollution, and harm to local ecosystems. Sustainable recovery efforts prioritize the use of environmentally friendly methods and technologies to remediate these damages.

For instance, phytoremediation, which involves the use of plants to absorb or neutralize contaminants, is a sustainable technique that can be employed to restore contaminated soils. Similarly, bioremediation, which uses microorganisms to break down hazardous substances, offers a natural and sustainable approach to cleaning up contaminated water sources. These methods not only effectively address the immediate environmental damage but also contribute to the long-term health and resilience of ecosystems.

Sustainability also dictates that recovery efforts aim not just to remediate, but to restore environments to a condition that is as close to their natural state as possible or even improve them. This could involve replanting native species, restoring wetlands, or creating green spaces that enhance biodiversity. Such efforts ensure that the environment is better prepared to withstand future incidents, contributing to overall ecological resilience.

**2. Community Resilience and Social Sustainability**

Sustainable recovery practices extend beyond environmental concerns to encompass social sustainability, particularly in enhancing community resilience. After a chemical disaster, the recovery phase offers an opportunity to rebuild communities in ways that are more equitable, inclusive, and resilient to future disasters. This involves engaging local communities in the recovery process, ensuring that their needs, concerns, and knowledge are incorporated into recovery plans.

Sustainability in this context means that recovery efforts are not solely focused on rebuilding physical infrastructure but also on strengthening social infrastructure. This includes improving healthcare services, providing mental health support, and ensuring that all community members have access to the resources they need to recover. Sustainable recovery plans often emphasize the importance of social equity, ensuring that vulnerable populations, who are often disproportionately affected by disasters, are prioritized in recovery efforts.

Additionally, sustainable recovery fosters the development of community-based disaster preparedness programs that build local capacity to respond to future incidents. By involving communities in the planning and implementation of these programs, sustainability ensures that recovery efforts contribute to long-term resilience and self-sufficiency.

**3. Economic Recovery and Green Jobs**

Economic recovery is another area where sustainability plays a crucial role. Chemical disasters can have devastating impacts on local economies, particularly if they disrupt industrial activities, reduce property values, and cause job losses. Sustainable recovery strategies seek to rebuild economies in a way that is more resilient and environmentally responsible, often through the promotion of green jobs and sustainable industries.

Investing in green infrastructure projects during the recovery phase, such as renewable energy installations, energy-efficient buildings, and sustainable transportation systems, can stimulate economic growth while reducing environmental impact. These projects not only create jobs but also build a foundation for a more sustainable economy that is less vulnerable to future chemical disasters.

Moreover, encouraging businesses to adopt sustainable practices as part of their recovery process can lead to long-term economic benefits. For example, companies that invest in clean technologies and resource efficiency during recovery are better positioned to reduce operating costs, improve their environmental performance, and enhance their reputation, which can lead to increased market competitiveness.

**4. Policy and Governance**

Sustainable recovery also involves the development and implementation of policies and governance structures that support long-term resilience and sustainability. This includes revising building codes, land use planning, and industrial regulations to ensure that they incorporate sustainability principles and reduce the risk of future chemical disasters.

Governments and local authorities play a key role in promoting sustainable recovery by providing incentives for sustainable practices, ensuring compliance with environmental regulations, and facilitating collaboration between stakeholders. This holistic approach ensures that recovery efforts are aligned with broader sustainability goals, creating a safer, healthier, and more resilient environment for all.

**Conclusion and Recommendations**

Sustainability practices are integral to effective chemical disaster prevention. By adopting green chemistry principles, enforcing regulatory frameworks, managing hazardous waste, and engaging communities, industries and governments can significantly reduce the risks associated with chemical disasters. These practices not only protect the environment and public health but also contribute to the long-term sustainability and resilience of urban and industrial areas.

Sustainable practices play a vital role in enhancing disaster preparedness in chemical management. By integrating environmental considerations, promoting resource efficiency, involving communities, and focusing on long-term resilience, these practices help create a safer, more sustainable approach to managing chemical risks. As industries and governments continue to prioritize sustainability, the influence of these practices on disaster preparedness will become increasingly significant, leading to more effective and environmentally responsible chemical management strategies.

Sustainability significantly enhances response strategies during chemical disasters by minimizing environmental impact, promoting resource efficiency, ensuring the safety of responders, and laying the foundation for long-term recovery and resilience. By integrating sustainable practices into every aspect of disaster response, authorities can not only address the immediate threats posed by chemical disasters but also contribute to a more sustainable and resilient future.

Sustainability plays a critical role in the recovery phase after chemical disasters by promoting environmentally friendly remediation, enhancing community resilience, fostering sustainable economic recovery, and shaping policies that support long-term sustainability. By integrating sustainability into recovery efforts, affected regions can not only rebuild but also emerge stronger and better prepared for the challenges of the future.

Sustainability practices have a positive impact on the various stages of chemical disaster preparedness and management in the Mumbai region. The integration of sustainable approaches enhances resilience, reduces environmental impact, and promotes long-term safety. However, the successful implementation of these practices requires addressing challenges such as regulatory enforcement, financial constraints, and technical expertise. Future research should focus on the development of specific sustainability metrics for chemical disaster management and the exploration

of innovative technologies that can further enhance sustainable disaster preparedness and response.

**Recommendations**

- Strengthen regulatory frameworks to ensure the adoption of sustainable practices in chemical industries.
- Enhance community awareness and involvement in sustainable disaster preparedness and response.
- Provide training for disaster responders in sustainable practices.
- Increase investment in green infrastructure and sustainable recovery strategies.

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# "वर्तमान शैक्षिक प्रक्रिया में संगीत की भूमिका का अध्ययन"

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**शोध–सार:**
वर्तमान परिस्थितियों व सामाजिक महत्व को ध्यान में रखते हुए शैक्षिक प्रक्रिया को और अधिक सुनियोजित रूप देने की आवश्यकता है। संगीत एक सार्वभौमिक उपहार है और लोगों को जोड़ने की, इसकी शक्ति बिना किसी सन्देह के प्रतीत होती है। यह एक ऐसी कला है जिसके केंद्र में मानवीय अंतःक्रिया होती है। स्कूलों में विद्यार्थियों के लिए संगीत के लिए व्यापक कार्यक्रम पूरी लगन और उत्साह से आयोजित किया जाए तो ज्यादा बेहतर होगा। शिक्षा संचार का एक रूप है जो समाज में ज्ञान अनुभव, कौशल और विचारों को एक समूह से दूसरे समूह तक पहुंचाती है। यह बुद्धि को विकसित करने सामाजिक कौशल के विकास, महत्वपूर्ण विश्लेषणात्मक क्षमताओं, किसी की अपनी संस्कृति के बारे में ज्ञान और स्वयं के ज्ञान को संदर्भित करती है। अंत में यहां संगीत सीखने के साथ बच्चों के समक्ष गुरु का संगीत कार्यक्रम सीधे आयोजित करने की नियमित व्यवस्था की जाए तो बहुत उपयोगी सिद्ध होगी। संगीत के महान साधक 'गुरु' की संगत में बिताया समय विद्यार्थी के जीवन में परिवर्तन लाने का बड़ा कार्य कर सकता है क्योंकि विद्यार्थी संभवतः इन क्षणों की स्मृति जीवन भर संजोए रखेगा। इसलिए ऐसे अवसर जुटाना हमारा दायित्व बनता है। रविंद्रनाथ टैगोर के अनुसार सर्वोत्तम शिक्षा वही है जो संपूर्ण सृष्टि से हमारे जीवन का सामंजस्य स्थापित करती है। रविंद्रनाथ टैगोर के अनुसार भी छात्रों में संगीत की योग्यताओं का विकास किया जाना चाहिए।
संगीत शिक्षा से मिलने वाले फायदे शैक्षिक योग्यता प्राप्त कर लेने से कहीं ज्यादा है और इसमें भाषा की कोई बाधा भी नहीं होती है। आज के समय में तेजी से बढ़ रहे विश्व में संगीत शिक्षा के व्यावहारिक लाभ वास्तव में प्रेरणादायक और मुक्त बनाने वाले हैं। इसलिए संगीत शिक्षा न केवल स्कूल कॉलेजों में फिर से लाई जाए बल्कि से वैकल्पिक विषय हीन रखकर अनिवार्य विषय बनाया जाना चाहिए।

**मुख्य बिन्दु** : शैक्षिक प्रक्रिया और संगीत।

**प्रस्तावना–**

वर्तमान की शैक्षिक प्रक्रिया की बात की जाए तो हमें देखने को मिलता है कि आज का दौर परिवर्तन और आधुनिकता का दौर है। वर्तमान परिस्थितियों व सामाजिक महत्व को ध्यान में रखते हुए शैक्षिक प्रक्रिया को और अधिक सुनियोजित रूप देने की आवश्यकता है। रविंद्रनाथ टैगोर के अनुसार सर्वोत्तम शिक्षा वही है जो संपूर्ण सृष्टि से हमारे जीवन का सामंजस्य स्थापित करती है। रविंद्रनाथ टैगोर के अनुसार भी छात्रों में संगीत की योग्यताओं का विकास किया जाना चाहिए। हम जैसे–जैसे विकासशील देश से विकसित देश बनने की दिशा में प्रगति कर रहे हैं, वैसे ही हमें बुनियादी जरूरतों को परिवर्तित करना होगा। हमारे जीवन में संगीत की अहम भूमिका है और इस प्रक्रिया में शिक्षक एक ऐसे मार्गदर्शक होते हैं। विद्यार्थियों में शिक्षण प्रक्रिया के द्वारा मनोशारीरिक एवं समाज के उपयोगी मूल्यों को धारण करने में सहयोग देते हैं। शिक्षक ही विनम्रता और सामाजिकता में अधिक समन्वय विकसित करते हैं। संगीत एक कला है जिसका माध्यम ध्वनि और मौन है जो समय के साथ–साथ घटित होता है। संगीत सामाजिक एकता पैदा करता है। जब शब्द विफल हो जाते हैं तब सभी से बात करता है और हम दुनिया में कहीं भी जाते हैं इसे समझा जाता है। संगीत एक सार्वभौमिक उपहार है और लोगों को जोड़ने की, इसकी शक्ति बिना किसी सन्देह के प्रतीत होती है। यह एक ऐसी कला है जिसके केंद्र में मानवीय अंतःक्रिया होती है। शिक्षा के हर स्तर पर संगीत की विशेष भूमिका होती है स्कूली शिक्षा के दौरान तो इसका महत्व और भी अधिक होता है परंतु फिर भी देश के अधिकांश विद्यालयों में संगीत को बहुत कम बढ़ावा दिया जा रहा है। अक्सर संगीत को पाठ्यक्रम में न रखकर पाठयेत्तर गतिविधियां ही माना जाता है। स्कूलों में विद्यार्थियों के लिए संगीत के लिए व्यापक कार्यक्रम पूरी लगन और उत्साह से आयोजित किया जाए तो ज्यादा बेहतर होगा।

**शोध पत्र के उद्देश्यः**

1. वाद्य यंत्रों की कार्यप्रणाली के बारे में जानना।
2. स्वर की संरचना को बारीकी से समझना।
3. विद्यार्थियों में संगीत के प्रति रुचि एवं जिज्ञासा जागृत करना।
4. प्राचीन परंपराओं के बारे में ऐतिहासिक दृष्टिकोण विकसित करना।
5. संगीत की विभिन्न परिभाषाओं और युक्तियों को जानना।

**शोध विधिः**

यह शोध पत्र द्वितीयक स्रोतों के माध्यम से लिखा गया है। इस हेतु विभिन्न रिपोर्ट, समाचार–पत्रों योजनाओ, नई शिक्षा नीति प्रपत्र एवं पुस्तकों से तथ्यों का संकलन किया गया है।

**शैक्षिक प्रक्रिया**

शिक्षा एक ऐसी प्रक्रिया है जो मानवता को अपने समाज और दुनिया के साथ बेहतर संबंध विकसित करने के लिए ज्ञान, अनुभव और नैतिक मूल्यों का अध्ययन करने एवं उन्हें सीखने की अनुमति प्रदान करती है। शिक्षा संचार का एक रूप है जो समाज में ज्ञान अनुभव, कौशल और विचारों

को एक समूह से दूसरे समूह तक पहुंचाती है। यह बुद्धि को विकसित करने सामाजिक कौशल के विकास, महत्वपूर्ण विश्लेषणात्मक क्षमताओं, किसी की अपनी संस्कृति के बारे में ज्ञान और स्वयं के ज्ञान को संदर्भित करती है।

**संगीत की दो शिक्षण पद्धति**

**व्यक्तिगत पद्धति** — **संस्थागत पद्धति**

19 वीं सदी के अंत तक संगीत की शिक्षा गुरु–शिष्य परंपरा द्वारा दी जाती थी। व्यक्तिगत पद्धति गुरुकुल पद्धति कहलाती थी। भारत के दो महान संगीतकार रहे हैं पंडित विष्णु दिगंबर पलुस्कर तथा पंडित विष्णु नारायण भारत खंडे जी है। इनके ही प्रयास से दिव्या संगीत जन–जन तक पहुंचने लगा। 25 से 30 वर्षों में ही पूरे उत्तर भारत में संगीत की विभिन्न शिक्षण संस्थानों की स्थापना हुई। अनेक विद्यार्थी संगीत कला का ज्ञान प्राप्त करने में रुचि लेने लगे। भारतीय शास्त्रीय संगीत का स्वरूप गीत वाद्य तथा नृत्य का सम्मिलित रूप है। प्राचीन काल से लेकिन वर्तमान काल तक शास्त्रीय–संगीत, संगीत का केंद्र बिंदु है। जो इसे दूसरी परंपराओं से पृथक करता है।

**संगीत की परिभाषा**

"संगीत एक साथ अनेक विषयों के बीच समन्वय स्थापित करता है। संगीत शिक्षा से विद्यार्थियों में संगीत के प्रति रुचि तो विकसित होती ही है साथ ही गणित से जुड़ी प्रतिभा का भी विकास होता है। और विषयों की बारीकियाँ समझने तथा इतिहास का ज्ञान अर्जित करने की बौद्धिक क्षमता भी उसमें विकसित होने लगती है।"

**संगीत का महत्व**

संगीत से विभिन्न विषयों के बीच समन्वय रखने में मदद मिलती है। संगीत एक साथ अनेक विषयों के बीच संबंध स्थापित करने में सहायक है। संगीत–शिक्षा से विद्यार्थियों में संगीत के प्रति रुचि व जिज्ञासा प्रवृत्ति बढ़ती है। संगीत से विद्यार्थियों में गणित से जुड़ी प्रतिभा का विकास, विषयों की बारीकियां को समझना, इतिहास का ज्ञान अर्जित करने की बौद्धिक क्षमता का विकास तथा बौद्धिक कौशल के साथ–साथ बेहतर प्रदर्शन करने में भी सहायक है। संगीत से विद्यार्थियों में तनाव का स्तर भी घटता है और भावनात्मक विकास के साथ–साथ आनंद की अनुभूति भी होती है।

**संगीत का महत्व इस प्रकार है–**

1. संगीत से विद्यार्थियों में अनुशासन और अध्ययन में लगन बढ़ती है।
2. संगीत से मस्तिष्क विकसित तथा बुद्धि कुशाग्र होती है।
3. भारतीय शास्त्रीय संगीत और कलाओं का अनुभव प्रदान करता है।
4. संगीत, सामाजिक भेदभाव और मनोवृतियों से बचाने में सहायक है।

**संगीत से विद्यार्थियों में अनुशासन अध्ययन में लगन बढ़ती है–**

संगीत सीखने और संगीत का अभ्यास करने से विद्यार्थियों में समय का महत्व और समय प्रबंधन करने की क्षमता बढ़ती है। जीवन के प्रारंभिक समय में ही मूल्य का विकास होने से विद्यार्थियों में जीवन जीने की कौशलात्मक वृद्धि होती है। विद्यार्थियों में पढ़ाई–लिखाई के बोझ की प्रवृत्ति को सरल और सहज तरीके से बेहतर बनाने में भी सहायक है।

**संगीत से मस्तिष्क विकसित तथा बुद्धि कुशाग्र होती है–**

कई शोधों से पता चलता है की पढ़ाई लिखाई के साथ–साथ संगीत का अभ्यास करने से विद्यार्थियों में बौद्धिक क्षमता भी बढ़ती है

**भारतीय शास्त्रीय संगीत और कलाओं का अनुभव प्रदान करता है–**

भारत की सांस्कृतिक परंपरा समृद्ध तथा देश के सभी भागों में कल की विभिन्न विधाएं प्रचलित है। हमारे देश के प्रत्येक बच्चे को संगीत की विभिन्न विधाओं का ज्ञान अर्जित करने का अधिकार है।

**संगीत सामाजिक भेद–भाव और मनोवृतियों से बचाने में सहायक है–**

संगीत मनोरंजन करने के साथ ही विद्यार्थियों के व्यक्तिगत निर्माण और बौद्धिक विकास का बहुत सशक्त माध्यम है। संगीत के लाभ तो बहुत व्यापक है और दूरगामी है। यह विद्यार्थियों में नस्लभेद जाति–भेद या सामाजिक–भेदभाव जैसे– तुच्छ प्रवृत्तियों से बचाए रखता हैं।

**संगीत की शिक्षा प्रदान करने वाले उच्च स्तरीय शिक्षण संस्थान**

1. संगीत एवं मंच कला संकायकाशी हिंदू विश्वविद्यालय वाराणसी।
2. इंदिरा कला संगीत विश्वविद्यालय खैरागढ़।
3. रविंद्र भारती विश्वविद्यालय कोलकाता।
4. सेंटर फॉर परफॉर्मिंग आर्ट्स पुणे विश्वविद्यालय।
5. विश्व भारती शांति निकेतन।
6. संगीत एवं ललित कला संकाय दिल्ली विश्वविद्यालय।
7. राजा मानसिंह तोमर संगीत एवं कला विश्वविद्यालय ग्वालियर।
8. म्यूजिक कॉलेज डांस एवं ड्रैमेटिक्स बड़ौदा महाराजा सयाजीराव यूनिवर्सिटी।

हमें यह नहीं भूलना चाहिए कि 19वीं शताब्दी के अंतिम दौर और 20वीं शताब्दी के महानतम आर्थिक विज्ञानी अल्बर्ट आइंस्टीन अत्यंत निपुण संगीत शास्त्री थे। अपनी सफलतम खोज और आविष्कारों के लिए आइंस्टीन ने संगीत को ही मुख्य साधन बनाया था।

भारत के पूर्व राष्ट्रपति डॉ0 एपीजे अब्दुल कलाम ने 1985–1995 के दौरान वीणा बजाना सीखा था। उसे समय वे रक्षा अनुसंधान और विकास संगठन डीआरडीओ में कार्यरत थे। उन्हें जब भी अपने व्यस्त कार्यक्रम से कुछ अवकाश मिल पाता था। और विश्राम की आवश्यकता महसूस होती थी तो वह वीणा वादन करके आनंद प्राप्त करते थे।

महान वायलिन शिक्षक शिनिची की सुजुकी ने एक बार कहा था **"संगीत शिक्षा का उद्देश्य युवाओं को प्रशिक्षित करना तो है विद्यार्थियों को प्रशिक्षित करना तो है पर इसका एकमात्र लक्ष्य उन्हें पेशेवर संगीत बना देना नहीं है बल्कि उन्हें संगीतज्ञ बनाना है ताकि वह जिस क्षेत्र में भी जाएं अपनी उच्च योग्यता का प्रदर्शन करें।"** अभिभावकों के साथ ही स्कूल कॉलेजों को भी विद्यार्थियों में कलाओं की जानकारी समझ और कौशल विकसित करने का दायित्व

**मनोरमा सिंह** (शिक्षा–संकाय ), **डॉ. नीतू सिंह** (शिक्षा–संकाय)

संभालना चाहिए ताकि वे आगे चलकर संयमित संवेदनशील सज्जनशील प्रगतिशील और उत्साही बनकर समाज में अपनी भूमिका का बखूबी निर्वहन करें

**निष्कर्ष**

अंत में यहां संगीत सीखने के साथ बच्चों के समक्ष गुरु का संगीत कार्यक्रम सीधे आयोजित करने की नियमित व्यवस्था की जाए तो बहुत उपयोगी सिद्ध होगी। संगीत के महान साधक **'गुरु'** की संगत में बिताया समय विद्यार्थी के जीवन में परिवर्तन लाने का बड़ा कार्य कर सकता है क्योंकि विद्यार्थी संभवतः इन क्षणों की स्मृति जीवन भर संजोए रखेगा। इसलिए ऐसे अवसर जुटाना हमारा दायित्व बनता है।

संगीत शिक्षा से मिलने वाले फायदे शैक्षिक योग्यता प्राप्त कर लेने से कहीं ज्यादा है और इसमें भाषा की कोई बाधा भी नहीं होती है। आज के समय में तेजी से बढ़ रहे विश्व में संगीत शिक्षा के व्यावहारिक लाभ वास्तव में प्रेरणादायक और मुक्त बनाने वाले हैं। इसलिए संगीत शिक्षा न केवल स्कूल कॉलेजों में फिर से लायी जाए बल्कि से वैकल्पिक विषय हीन रखकर अनिवार्य विषय बनाया जाना चाहिए।

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# भारतीय बँकिंग उद्योगाचा कल आणि प्रगती यावर विश्लेषणात्मक अभ्यास

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**गोषवारा:**

आज आपल्याकडे सार्वजनिक क्षेत्रातील बँका, परदेशी बँका, खाजगी क्षेत्रातील बँका, जुन्या आणि नव्या पिढीच्या तसेच प्रादेशिक ग्रामीण बँका आणि भारतीय रिझर्व्ह बँकेसह सहकारी बँकांच्या विविध वर्गांसह बऱ्यापैकी विकसित बँकिंग प्रणाली आहेत. बँकिंग क्षेत्रात, अभूतपूर्व वाढ झाली आहे आणि बँकिंग उद्योगाचे वैविध्य इतके विलक्षण आहे की जगात कोठेही बँकिंगच्या इतिहासात त्याची समांतर नाही. बऱ्याच उदयोन्मुख बाजारपेठांमध्ये, एकूण वित्तीय क्षेत्रातील मालमत्तेच्या 80% पेक्षा जास्त बँकांच्या मालमत्तांचा समावेश होतो. बहुतेक उदयोन्मुख बाजारपेठेतील अर्थव्यवस्थांमध्ये, पाच सर्वात मोठ्या बँका (सामान्यतः देशांतर्गत) बँक मालमत्तेच्या दोन-तृतीयांशपेक्षा जास्त आहेत. विकसित अर्थव्यवस्थांमध्ये हे आकडे खूपच कमी आहेत. विकसित आणि उदयोन्मुख अर्थव्यवस्थांमधील बँकिंग उद्योगातील आणखी एक फरक म्हणजे बँकिंग व्यवहाराचे आंतरराष्ट्रीयीकरण.

बँकिंग उद्योगाने गेल्या काही दशकांमध्ये अनेक महत्त्वपूर्ण बदलांचा अनुभव घेतला आहे. त्यापैकी सर्वात महत्वाचे म्हणजे लँडस्केपवर वर्चस्व असलेल्या संस्थांच्या प्रकारात बदल. ऐंशीच्या दशकापासून, बँकांनी त्यांच्या क्रियाकलापांची व्याप्ती आणि प्रमाण वाढवले आहे आणि अनेक बँका देशाच्या अनेक क्षेत्रांमध्ये अस्तित्वात असलेल्या खूप मोठ्या संस्था बनल्या आहेत.

**मुख्य शब्द:** भारतीय बँकिंग क्षेत्र, उदयोन्मुख कल आणि प्रगती आणि उदयोन्मुख अर्थव्यवस्था.

**प्रस्तावना:**

विकसनशील देशांच्या आर्थिक विकासात बँका महत्त्वाची भूमिका बजावतात. आर्थिक विकासामध्ये अर्थव्यवस्थेच्या विविध क्षेत्रांमध्ये गुंतवणूक समाविष्ट असते. विविध प्रकल्पांमध्ये गुंतवणूक करण्यासाठी बँका बचत गोळा करतात. सामान्य बँकिंगमध्ये बँका त्यांच्या ग्राहकांसाठी एजन्सी सेवा करतात आणि देशाच्या आर्थिक विकासास मदत करतात. भागांची खरेदी विक्री करणे, पेमेंट करणे, सबस्क्रिप्शन फंड मिळवणे आणि सरकारी विभागासाठी युटिलिटी बिले गोळा करणे. अशाप्रकारे बँका व्यस्त लोकांचा वेळ आणि शक्ती वाचवतात. बँका इतर देशांसोबतच्या व्यावसायिक व्यवहारांसाठी परकीय चलनाची व्यवस्था करते. बँकिंग क्षेत्र केवळ निधी गोळा करत नाही तर ग्राहकांना त्यांच्या पैशाच्या गुंतवणुकीबद्दल मार्गदर्शक म्हणून काम करते. सध्याच्या बँकिंग क्षेत्राने अनेक उपक्रम राबवले आहेत जेणेकरून नवीन तंत्रज्ञानाच्या साहाय्याने उत्तम ग्राहक सेवा प्रदान करता येतील. बँकिंग क्षेत्र मोठ्या अर्थव्यवस्थेला प्रतिबिंबित करते आणि त्याचे सर्व क्षेत्रांशी जोडलेले संबंध संपूर्ण अर्थव्यवस्थेचे प्रतिनिधित्व करतात. आज भारतीय बँकिंग क्षेत्रामध्ये उत्साह आणि संधीची समान भावना आहे जी भारतीय अर्थव्यवस्थेचा पुरावा आहे. जागतिक बाजारपेठेतील घडामोडी बँकिंग क्षेत्राला अनेक संधी देतात. स्पर्धात्मक बँकिंग वातावरणात ग्राहक सेवांमध्ये दिवसेंदिवस सुधारणा करणे हे त्यांच्या चांगल्या वाढीसाठी सर्वात उपयुक्त साधन आहे. बँक त्यांच्या बँकिंग आणि इतर सेवांमध्ये प्रगती करण्यासाठी बऱ्याच बदलांचा स्वीकार करते.

**अभ्यासाची उद्दिष्टे:**

1. बदलत्या बँकिंग परिस्थितीतील अलीकडील कल स्पष्ट करण्यासाठी.
2. बदलत्या बँकिंग परिस्थितीत बँकांच्या संधींचा अभ्यास करणे.

**अभ्यासाची पद्धत:**

हा अभ्यास माहितीच्या दुय्यम स्त्रोतावर आधारित आहे.

**दुय्यम माहिती:** माहितीचे दुय्यम स्त्रोत म्हणजे बँकिंग पुस्तके, आरबीआयचे वार्षिक अहवाल, इंटरनेट (वेबसाइट्स) आणि शोधनिबंध इ.

**उदयोन्मुख कल:**

बौद्धिक भांडवल निर्माण करणारी संस्थात्मक रचना तयार करणे हे बँका आणि वित्तीय संस्थांसाठी मोठे आव्हान आहे. सर्जनशील विनाशाच्या प्रक्रियेत, नवीन रचना उदयास येतात. इथेच 'नव्या पिढीतील' व्यवस्थापकांची भूमिका पूर्वीच्या व्यवस्थापकांपेक्षा अधिक मागणी निर्माण करू शकतात. एक अशी भूमिका जी फक्त ' प्रामाणिकपणा

आणि विवेकबुद्धी' पेक्षा जास्त गरजेची गरज आहे जी जुन्या काळातील बँकरचे वैशिष्ट्य आहे आणि 'स्पर्धात्मक अत्यावश्यकता' व्यवस्थापित करण्यावर जे अधिकाधिक लक्ष केंद्रित करते. नवीन पिढी म्हणजे काय? नवीन पिढी जुन्यापेक्षा वेगळी कशी? काय बदलले आहे आणि बदलत आहे? आणि काही फरक पडतो का? वेळेच्या मोजमापाच्या संदर्भात, एक पिढी साधारणतः 23 ते 30 वर्षांच्या कालावधीचा संदर्भ देते, ज्यामध्ये बहुतेक मानव प्रौढ होतात. अशा प्रकारे 'नवीन पिढी' व्यवस्थापकांची ओळख आपल्या सभोवतालच्या बदलत्या जगाच्या सामान्य अनुभवातून निर्माण होईल.

इतिहासकार परिवर्तनात्मक बदलाच्या संदर्भात भूतकाळाचे असंख्य तुकडे करू शकतात, परंतु स्वातंत्र्योत्तर भारतामध्ये बँकिंग क्षेत्रामध्ये फार थोडे फरक जाणवतात. पहिला बँकिंग नियमन कायदा, 1949 लागू करण्यात आला ज्याने भारतात बँक नियमन आणि पर्यवेक्षणाची व्यापक आणि औपचारिक रचना आणली. आपल्या देशातील बँकांचे राष्ट्रीयीकरण हा असा दुसरा मुद्दा आहे. यातून अशा शक्ती निर्माण झाल्या ज्यांनी बँकिंगला उच्चभ्रू वर्गाकडून सामान्य जनतेपर्यंत नेले. यामुळे उपमहाद्वीपच्या भौगोलिक विस्तारामध्ये खूप मोठ्या पायाभूत सुविधांची स्थापना झाली आणि हेच सामान्य माणसाच्या सक्षमीकरणासाठी हे एक महत्त्वपूर्ण ट्रिगर ठरले. 1990 च्या दशकाच्या सुरुवातीला सुरू करण्यात आलेला आर्थिक क्षेत्रातील सुधारणांचा बँकिंगमधील तिसरा वळणाचा मुद्दा होता. या सुधारणांमुळे भारतात बँकांच्या कार्यपद्धतीत नाट्यमय बदल घडून आला. बदललेले वातावरण आणि मोठ्या स्पर्धेमुळे उद्भवलेल्या अंतर्गत सक्ती आणि त्यांचा बाजारातील हिस्सा/नफा सुधारण्याची गरज यामुळे अधिक कार्यक्षमतेचा शोध सुरू झाला आणि पर्यावरणाची वास्तविकता आणि त्यांची अंतर्गत ताकद आणि कमकुवतता लक्षात घेऊन त्यांना पुनर्स्थित करण्याची गरज निर्माण झाली. हा कालावधी माहिती क्रांतीच्या सुरुवातीशी देखील जुळला ज्याने एक प्रचंड तिसरी लाट सुरू केली - जसे की आर्थिक, तांत्रिक आणि सामाजिक बदलांचे अल्विन टॉफलरने प्रसिद्ध वर्णन केले आहे आणि तरीही व्यवसायांना मूलभूतपणे नवीन, सतत बदलत्या मार्गांनी कार्य करण्यास भाग पडत आहे. औद्योगिक-युगातील विचारांचा प्रत्येक भाग खरं तर आता पुन्हा नव्याने छाननी करून तयार केला जात आहे. तंतोतंत जेव्हा एखादा जुना नमुना तुटतो आणि नवीन नमुना अद्याप निश्चित केला जात नाही तेव्हा आपल्याला सर्जनशील विचारांचा मोठा स्फोट होतो. हा कदाचित असाच एक क्षण आहे. भविष्यात काय आहे? एक गोष्ट निश्चित आहे; - भविष्य भूतकाळासारखे कायम राहणार नाही. त्याऐवजी ती खंडितांची मालिका असेल. खंडितपणाची रोमांचक गोष्ट म्हणजे ती संधी निर्माण करते. आपण अभूतपूर्व संधीच्या युगात जगत आहोत. पण संधीसोबत जबाबदारी येते. उद्याच्या व्यवस्थापकांनी स्वतःचे स्थान तयार करणे, मार्ग कधी बदलायचा हे जाणून घेणे आणि स्वतःला संपूर्णपणे व्यस्त आणि उत्पादक ठेवणे हे आहे. गोष्टी चांगल्या रीतीने करण्यासाठी, एखाद्याला स्वतःची सखोल समज विकसित करणे आवश्यक आहे - केवळ सामर्थ्य आणि कमकुवतपणाच नाही तर एखादी व्यक्ती कशी शिकते, इतरांसोबत कसे कार्य करते, त्याची मूल्ये काय आहेत आणि तो किंवा ती कुठे सर्वात मोठे योगदान देऊ शकते. कारण जेव्हा एखादी व्यक्ती शक्तीने कार्य करते तेव्हाच खरी उत्कृष्टता प्राप्त करू शकते. ही आव्हाने ग्राहक संबंध, उत्पादन भिन्नता, ब्रँड मूल्ये, प्रतिष्ठा, कॉर्पोरेट गव्हर्नन्स आणि नियामक प्रिस्क्रिप्शनच्या मागण्या पूर्ण करण्यासाठी नवीन व अधिक गतिमान तसेच आक्रमक आणि आव्हानात्मक कार्य संस्कृतीची मागणी करतात. यामुळे नवीन व्यवस्थापकांना त्यांच्या संस्थांसाठी धोरणे आखण्यासाठी कठीण संक्रमण समजून घेण्यासाठी मदत होईल

**सध्याची बँकिंग परिस्थिती:**

2009-10 मध्ये शेड्युल्ड कमर्शियल बँक्स (SCBs) च्या ताळेबंदाच्या वाढीमध्ये त्यांच्या मालमत्तेची गुणवत्ता आणि नफा यांमध्ये काही घसरण झाली होती. 2009-10 मध्ये एका वर्षात बँक क्रेडिटमध्ये 16.6 टक्क्यांनी वाढ कमी झाली होती परंतु ऑक्टोबर 2009 पासून आर्थिक उलाढालीच्या सुरुवातीपासून पुनर्प्राप्तीची चिन्हे दिसून आली. एकूणच SCBs साठी एकूण प्रगतीचे गुणोत्तर म्हणून ग्रॉस अनुत्पादक संपत्ती (NPAs) 2008 - 09 मध्ये 2.25 टक्क्यांवरून 2009 - 10 मध्ये 2.39 टक्क्यांपर्यंत वाढले. जागतिक आर्थिक संकटाचे काही ठसठशीत परिणाम असूनही, भारतीय बँकांनी हा धक्का सहन केला आणि संकटानंतरच्या काळात स्थिर राहिला. भारतीय बँका आता वाढ, नफा आणि कर्ज दोष गुणोत्तर यांसारख्या मेट्रिक्सवर परदेशातील बँकांशी अनुकूलपणे तुलना करतात. सर्वसाधारणपणे बँकांचा नावीन्य, वाढ आणि मूल्य निर्मितीचा ट्रॅक रेकॉर्ड असतो. तथापि, बँकिंग विकासाची ही प्रक्रिया बँकिंग सेवांच्या विस्ताराद्वारे आर्थिक समावेशाची मोठी गरज पूर्ण करण्यासाठी पुढे नेणे आवश्यक आहे.

2010-11 दरम्यान, बँकांना त्यांची नफा आणि मालमत्तेची गुणवत्ता सुधारण्यात यश आले. तणाव चाचणीने दर्शवले की बँकिंग क्षेत्र तरलता आणि व्याजदराच्या धक्क्यांसाठी वाजवीपणे लवचिक राहिले. तरीही, रिअल इस्टेट, पायाभूत सुविधा, NBFCs आणि किरकोळ विभाग, सतत मालमत्ता-दायित्व विसंगती, उच्च तरतुदीची आवश्यकता आणि मालमत्तेच्या वाढीसाठी अल्प मुदतीच्या कर्जावर अवलंबून राहणे यासारख्या क्षेत्रांतील कर्जामध्ये

असमान वाढीशी संबंधित बँकिंग क्षेत्राच्या स्थिरतेबद्दल चिंता व्यक्त केली जात होती.

आज बँकिंग उद्योगाची भूमिका एक अग्रगण्य आणि मुख्यतः आवश्यक सेवा क्षेत्र म्हणून खूप महत्वाची आहे. 130 कोटींहून अधिक लोकसंख्या असलेली भारत ही जगातील सर्वात मोठी अर्थव्यवस्था आहे. आज भारतातील सेवा क्षेत्र भारतीय GDP मध्ये निम्मे योगदान देत आहे आणि बँकिंग हे भारतातील सर्वात लोकप्रिय सेवा क्षेत्र आहे. सामाजिक आर्थिक विकासाला गती देण्यासाठी बँकिंग उद्योगाची महत्त्वपूर्ण भूमिका आवश्यक आहे. सध्याची बँकिंग परिस्थिती खूप संधी प्रदान करते. गेल्या काही वर्षांत आम्ही पाहिले की जागतिक वित्त संकटामुळे बँकिंग क्षेत्रात खूप खाली आणि वरचा कल होता. बँकिंग क्षेत्रातील प्रमुख क्षेत्रांमध्ये सुधारणा करण्यासाठी भारतीय सरकार व आरबीआय ने अनेक उल्लेखनीय प्रयत्न केले आहेत. बाजारात कार्यरत असलेल्या अनेक आघाडीच्या बँकांनी बदललेले नियम जसे की CRR, विशेष व्याजदराचा वापर केला आहे जसे की शून्य शिल्लक मध्ये खाते उघडणे.

भारतीय बँकिंग प्रणाली आता पूर्णपणे नवीन स्तरावर कार्यरत होणार आहे. त्याचा भविष्यात बँकिंग व्यवस्थेची ताकद वाढण्यास मदत होईल. उदारीकरणामुळे बँका कमी स्प्रेडवर कार्यरत आहेत. त्यांचा मुख्य फोकस ग्राहकवाद आणि ग्राहक बँकेशी कसे जोडले जावे यावर प्रकाश टाकणारा आहे. त्यामुळे आजकाल बँका नॉन-बँकिंग उत्पादनांमध्ये प्रवेश करत आहेत जसे की विमा ज्या क्षेत्रात प्रचंड संधी आहे.

**अलीकडचा बँकिंग क्षेत्रातील कल:**

**आजकाल ऑटोमॅटिक टेलर मशीन (ATM):**

ऑटोमॅटिक टेलर मशीन हे भारतातील सर्वात लोकप्रिय डिव्हाइस आहे, जे ग्राहकांना आठवड्याचे 7 दिवस व दिवसाचे 24 तास पैसे काढण्यास सक्षम करते. हे एक असे उपकरण आहे जे एटीएम कार्ड असलेल्या ग्राहकाला मानवी टेलरशी संवाद न साधता नियमित बँकिंग व्यवहार करण्याची परवानगी देते. एटीएमचा उपयोग रोख रक्कम काढण्याव्यतिरिक्त, युटिलिटी बिले भरणे, खात्यांमधील निधी हस्तांतरण, चेक आणि खात्यांमध्ये रोख जमा करणे, शिल्लक चौकशी इत्यादीसाठी केला जाऊ शकतो.

**टेली बँकिंग:** टेलि बँकिंग ग्राहकाला संपूर्ण नॉन-कॅश संबंधित बँकिंग व्यवहार टेलिफोनवर करण्याची सुविधा देते. या अंतर्गत सोप्या प्रश्नांसाठी आणि व्यवहारांसाठी स्वयंचलित व्हॉईस रेकॉर्डर वापरले जाते. क्लिष्ट प्रश्न आणि व्यवहारांसाठी, मानवयुक्त फोन टर्मिनल्स वापरले जातात.

**इलेक्ट्रॉनिक क्लिअरिंग सर्व्हिस (ECS):**

इलेक्ट्रॉनिक क्लिअरिंग सर्व्हिस ही एक किरकोळ पेमेंट करणारी सिस्टम आहे ज्याचा वापर समान स्वरूपाची व मोठ्या प्रमाणात पेमेंट/पावत्या करण्यासाठी केला जाऊ शकतो, विशेषत: जेथे प्रत्येक वैयक्तिक पेमेंट पुनरावृत्ती स्वरूपाचे आणि तुलनेने कमी रकमेचे असते. ही सुविधा कंपन्या आणि सरकारी विभागांसाठी व्यक्तींद्वारे निधी हस्तांतरण करण्याऐवजी ईसीएस द्वारे पेमेंट करण्यासाठी/प्राप्त करण्यासाठी आहे.

**इलेक्ट्रॉनिक फंड ट्रान्सफर (EFT):**

इलेक्ट्रॉनिक फंड ट्रान्सफर (EFT) ही एक प्रणाली आहे ज्याद्वारे कोणीही दुसऱ्या व्यक्ती/कंपनी इ.ला पेमेंट करू इच्छितो तो त्याच्या बँकेत जाऊन रोख पेमेंट करू शकतो किंवा थेट स्वतःहून निधी हस्तांतरित करण्यासाठी सूचना/अधिकार देऊ शकतो. प्राप्तकर्ता/लाभार्थीच्या बँक खात्यात प्राप्तकर्त्याचे नाव, बँक खाते क्रमांक, खाते प्रकार (बचत किंवा चालू खाते), बँकेचे नाव, शहर, शाखेचे नाव इत्यादी संपूर्ण तपशील भरून बँकेला विनंती केली जाते जेणेकरून खात्यात पैसे जमा होतील.

**रिअल टाइम ग्रॉस सेटलमेंट (RTGS):**

मार्च 2004 पासून भारतात सुरू करण्यात आलेली रिअल टाइम ग्रॉस सेटलमेंट ही एक अशी प्रणाली आहे ज्याद्वारे बँकांना त्यांच्या खात्यातून दुसऱ्या बँकेच्या खात्यात निधी हस्तांतरित करण्यासाठी इलेक्ट्रॉनिक सूचना दिल्या जाऊ शकतात. RTGS प्रणाली RBI द्वारे राखली जाते आणि चालविली जाते आणि बँकांना त्यांच्या आर्थिक ऑपरेशन्स सुलभ करण्यासाठी कार्यक्षम आणि जलद निधी हस्तांतरणाचे साधन प्रदान करते. नावाप्रमाणेच, बँकांमधील निधी हस्तांतरण 'रिअल टाइम' आधारावर होते. त्यामुळे लाभार्थ्यापर्यंत पैसे त्वरित पोहोचू शकतात आणि लाभार्थीच्या बँकेची जबाबदारी लाभार्थ्यांच्या खात्यात दोन तासांत जमा करण्याची जबाबदारी आहे.

**पॉइंट ऑफ सेल टर्मिनल:**

पॉइंट ऑफ सेल टर्मिनल हे एक संगणक टर्मिनल आहे जे बँकेतील संगणकीकृत ग्राहक माहिती फायलींशी ऑनलाइन जोडलेले असते आणि चुंबकीय पद्धतीने एन्कोड केलेले प्लास्टिक व्यवहार कार्ड जे ग्राहकाला संगणकावर बरोबर ओळखते. व्यवहारादरम्यान, ग्राहकाच्या खात्यातून रक्कम डेबिट केले जाते आणि किरकोळ विक्रेत्याच्या खात्यात संगणकाद्वारे खरेदीची रक्कम जमा केली जाते. आम्ही वर काही नवीन उदयोन्मुख ट्रेंड हायलाइट केले आहेत. आता मी आपल्या देशातील बँकिंग क्षेत्रातील वाढ आणि विकासात नवीन कल आणणाऱ्या संधींवर प्रकाश टाकतो.

**संधी:**

**इंटरनेट बँकिंग:** हे स्पष्ट आहे की ऑनलाइन फायनान्स वाढेल आणि डेटा वेअरहाउसिंग आणि डेटा मायनिंग तंत्रज्ञानाच्या आधारे बँकिंग सेवा, शेअर ट्रेडिंग, विमा, कर्जे यांमध्ये उत्पादन ऑफरिंगच्या बाबतीत वाढती अभिसरण होईल. केव्हाही - कोठेही बँकिंग व्यवहार सामान्य होईल आणि त्याला अपस्केल करावे लागेल, अशा अप स्केलिंगमध्ये पारंपारिक बँकिंग सेवांव्यतिरिक्त स्वतंत्र इंटरनेट बँकिंग सेवा सुरू करणाऱ्या बँकांचा समावेश असू शकतो.

**किरकोळ कर्ज:** अलीकडे बँकांनी ग्राहक वर्गीकरण पद्धत स्वीकारली आहे ज्यामुळे त्यांचे उत्पादन फोलिओ चांगल्या प्रकारे सानुकूलित करण्यात मदत झाली आहे. अशाप्रकारे किरकोळ कर्ज देणे म्हणजे विशेषत: ग्राहकोपयोगी वस्तू, गृहनिर्माण, ऑटोमोबाईल्स इत्यादींच्या वित्तपुरवठ्याच्या संदर्भात एक फोकस क्षेत्र बनले आहे, किरकोळ कर्जामुळे जोखीम दूर करण्यात आणि चांगल्या वसुली दरांसह बँकांचे उत्पन्न वाढविण्यात देखील मदत झाली आहे.

**ग्रामीण भागातील ग्राहक:** भारतातील एकूण लोकसंख्येच्या 70% लोकांचे योगदान बँकिंग क्षेत्रासाठी मोठ्या प्रमाणावर न वापरलेली बाजारपेठ आहे. सर्व शहरी भागात बँकिंग सेवा दाखल झाल्या आहेत. फक्त काही मोठ्या गावांमध्ये बँकांनी प्रवेश केला आहे. त्यामुळे उर्वरित सर्व गावांमध्ये बँका पोहोचल्या पाहिजेत कारण बहुसंख्य भारतीय अजूनही ग्रामीण भागात राहतात.

**विविध सेवा प्रदान करणे:** बँका त्यांच्या बँकिंग कार्यप्रणाली आणि बँकिंग व्यवसाय वाढवण्यासाठी एटीएम, स्थानिक शाखा, टेलिफोन/मोबाइल बँकिंग, व्हिडिओ बँकिंग इत्यादीसारख्या सेवा प्रदान करताना दिसतात.

**चांगल्या ग्राहक सेवा:** कोणत्याही बँकेचा व्यवसाय वाढवण्यासाठी चांगल्या ग्राहक सेवा या सर्वोत्तम ब्रँड अँम्बेसेडर असतात. ग्राहकासोबतची प्रत्येक गुंतवणूक ही ग्राहकाचा बँकेवर विश्वास वाढवण्याची संधी असते. स्पर्धा वाढत असताना ग्राहक सेवा हा बँकांच्या कामगिरीचा कणा बनला आहे.

**भारतीय ग्राहक:** आज भारतीय बँकिंग क्षेत्रासाठी सर्वात मोठी संधी म्हणजे भारतीय ग्राहक आहेत. भारतीय ग्राहक आता त्याच्या जीवनशैलीतील आकांक्षा लहान वयात पूर्ण करू पाहत आहेत ज्यात इक्विटी आणि कर्जाचा वापर आणि मालमत्ता निर्मितीसाठी वित्तपुरवठा करण्यासाठी इष्टतम संयोजन आहे. तो शहरे,आणि खेड्यांमध्ये म्हणजेच ग्रामीण भागात सुद्धा प्रतिनिधित्व करतो. ग्राहकोपयोगी वस्तू तयार करणाऱ्या कंपन्या आधीच या संभाव्यतेचा वापर करत आहेत, बँकांना या संधीचा पुरेपूर फायदा घ्यायचा आहे.

**इतर संधी:** भारतीय बँकिंग क्षेत्रात भविष्यात इतर अनेक संधी आहेत उदा. नवीन व्यवसाय आणि नवीन बाजारपेठांमध्ये प्रवेश करणे, काम करण्याचे नवीन मार्ग विकसित करणे, कार्यक्षमता सुधारणे, उच्च स्तरीय ग्राहक सेवा वितरीत करणे.

**अभ्यासाचा निष्कर्ष**

या एकूणच परिस्थितीत, वित्तीय सेवांशी संबंधित धोरण आणि विशेषतः बँकिंगचा क्षेत्राचा विचार करणे आवश्यक आहे. हे लक्षात घेणे मनोरंजक आहे की वित्तीय सेवांवरील जागतिक व्यापार संघटनेच्या वाटाघाटी सावध आहेत आणि विशेषत: बँकिंग क्षेत्रातील अनेक मोठ्या अर्थव्यवस्थांच्या वचनबद्धता मर्यादित आहेत. दुसऱ्या शब्दांत, आर्थिक मध्यस्थांच्या राष्ट्रीय मालकीच्या समस्येच्या संदर्भात, बँकांना सार्वजनिक धोरणात एक अद्वितीय स्थान असल्याचे दिसते. सर्व प्रमुख अर्थव्यवस्थांमध्ये बँकांच्या मालकीची आणि नियंत्रणाची अनेक लक्षणीय वैशिष्ट्ये आहेत - मग ती विकसित किंवा उदयोन्मुख असोत. जवळजवळ सर्व प्रकरणांमध्ये, बँका एकतर मोठ्या प्रमाणावर मालकी धारण केलेल्या असतात किंवा त्यांच्याकडे राज्य मालकी असते. शिवाय, मालकीची व्याप्ती, मालकी आणि नियंत्रणाचे स्वरूप आणि वैधानिक पाठिंब्याद्वारे अशा मालकी किंवा नियंत्रणाचे हस्तांतरण यासाठी विशेष अटी आहेत. बँक हे क्षेत्र विशेष असल्याने हे न्याय्य आहे. देशांतर्गत बँकिंग क्षेत्र, परदेशी बँका/मालकीसाठी उघडण्यासंबंधीच्या वचनबद्धतेवर जागतिक व्यापार संघटना मधील चर्चा या चिंता दर्शवतात.

बँक ऑफ इंग्लंडचे गव्हर्नर सर एडी जॉर्ज यांनी बँका विशेष या विषयावर काय म्हटले होते ते आठवण्यासारखे आहे:

"ते करत असलेल्या विशिष्ट कार्यांच्या दृष्टीने ते विशेष राहतात - अर्थव्यवस्थेच्या तत्काळ उपलब्ध तरलतेचे भांडार म्हणून तसेच मुख्य पेमेंट यंत्रणा म्हणून आणि अर्थव्यवस्थेच्या मोठ्या भागासाठी गैर-बाजार वित्ताचा प्रमुख स्त्रोत म्हणून. आणि ते त्यांच्या ताळेबंदांच्या विशिष्ट वैशिष्ट्यांच्या दृष्टीने सुद्धा विशेष राहतात, जे ती कार्ये पार पाडण्यासाठी आवश्यक आहेत."

माहिती स्पष्टपणे सुचित करते की विकसनशील देशांमधील आर्थिक मध्यस्थीमध्ये बँका पूर्व-प्रबळ भूमिका बजावत आहेत. हे अनेक कारणांमुळे समजण्यासारखे आहे उदा. निश्चित उत्पन्नासाठी बचतकर्त्यांची उत्सुकता आणि आर्थिक जोखीम व्यवस्थापित करण्याची अपुरी क्षमता आणि वस्तुस्थिती अशी आहे की बँकिंग संस्था काही अर्थाने आणि वेगवेगळ्या प्रमाणात, ठेव विम्याचा आणि सरकारच्या गर्भित किंवा स्पष्ट हमीचा आनंद घेतात. हे लक्षात घेणे महत्त्वाचे आहे की बँकिंग संकटामुळे सरकारला नेहमीच मोठा खर्च करावा लागतो, मग ते सार्वजनिक मालकीचे असो, खाजगी मालकीचे असो, देशांतर्गत मालकीचे असो किंवा परदेशी मालकीचे असो. बँकिंग संकटांचे वित्तीय खर्च मालकी-तटस्थ असतात. या संदर्भात एक महत्त्वाचा प्रश्न हा आहे की विकसित देशांमधील आर्थिक एकात्मतेमध्ये बँकांची भूमिका उदयोन्मुख बाजारपेठेच्या अर्थव्यवस्थांपेक्षा वेगळी आहे का. विकसित बाजारपेठेच्या तुलनेत उदयोन्मुख बँकिंग उद्योगाच्या संरचनेतील महत्त्वपूर्ण फरकांचे मूल्यांकन करणे उपयुक्त आहे.

बहुतेक उदयोन्मुख बाजारपेठांमध्ये, बँकांच्या मालमत्तेमध्ये एकूण वित्तीय क्षेत्रातील मालमत्तेच्या 80%

पेक्षा जास्त समावेश आहे, तर विकसित अर्थव्यवस्थांमध्ये ही आकडेवारी लक्षणीयरीत्या कमी आहे. बहुतेक उदयोन्मुख बाजारपेठेतील अर्थव्यवस्थांमध्ये, पाच सर्वात मोठ्या बँका (सामान्यतः देशांतर्गत) बँक मालमत्तेच्या दोन-तृतीयांशपेक्षा जास्त आहेत. विकसित अर्थव्यवस्थांमध्ये हे आकडे खूपच कमी आहेत. विकसित आणि उदयोन्मुख अर्थव्यवस्थांमधील बँकिंग उद्योगातील आणखी एक फरक म्हणजे बँकिंग ऑपरेशन्सचे आंतरराष्ट्रीयीकरण. एकूण बँक मालमत्तेची टक्केवारी म्हणून परदेशी मालकीच्या बँकांचा हिस्सा म्हणून परिभाषित केलेले आंतरराष्ट्रीयीकरण, उदयोन्मुख अर्थव्यवस्थांमध्ये खूपच कमी असते. तथापि, हा नमुना जागतिक क्षेत्रांमध्ये एकसमान नाही.

शेवटी, विकसित विरुद्ध उदयोन्मुख अर्थव्यवस्थांमधील बँकिंगचे एक महत्त्वपूर्ण वैशिष्ट्य,म्हणजे अलीकडच्या काळात, एकत्रीकरणाची प्रक्रिया होय. विकसित आणि उदयोन्मुख बाजारपेठांमधील एकत्रीकरण प्रक्रियेतील सर्वात लक्षणीय फरक म्हणजे नंतरच्या काळात विलीनीकरण आणि अधिग्रहणांचे जबरदस्त क्रॉस-बॉर्डर स्वरूप. विशेषतः, महाद्वीपीय युरोपमध्ये आणि यूएस आणि युरोपीय संस्थांमधील क्रॉस-बॉर्डर विलीनीकरण नियमापेक्षा अपवाद आहेत. याउलट, खाजगीकरणाच्या प्रक्रियेमुळे अनेकदा संकटांशी संबंधित काही उदयोन्मुख बाजार बँकांच्या परदेशी मालकीमध्ये तीव्र वाढ झाली आहे.

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