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The international conference at MES Kalladi college offers a captivating experience of academic rigor giving insights into different domains of knowledge. Scholars and experts from various fields will converge to explore the frontiers of research and innovation. With a diverse array of topics ranging from technology to humanities, the conference promises to be a melting pot of ideas. Renowned speakers are set to grace the event, imparting their wisdom and insights to the eager audience. The vibrant campus of MES Kalladi college will provide a welcoming backdrop, creating an environment conducive to intellectual exchange and collaboration. This conference is expected to contribute to the academic landscape and faster a sense of global camaraderie among participants.

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PREFACE

The International Conference 2025 – *Explore, Engage, Evolve: Navigating the Future*- MESKCON, held on January 31st and February 1st, represents the culmination of extensive intellectual collaboration, rigorous research, and academic inquiry. In an era marked by rapid technological advancements and the dynamic evolution of innovation, continuous learning and adaptability have become imperative. Academic conferences serve as critical platforms for bridging emerging trends with existing knowledge, enabling participants to remain at the forefront of their respective disciplines.

By facilitating the exchange of research findings, innovative methodologies, and technological breakthroughs, such gatherings foster critical thinking, stimulate novel ideas, and refine scholarly approaches. MESKCON 2025 brought together a diverse community of scholars, researchers, practitioners, and students, embodying the essence of interdisciplinary engagement that is crucial for addressing complex global challenges.

In a world increasingly characterized by complexity and interdependence, multidisciplinary perspectives are essential. Global issues such as climate change, public health crises, technological disruption, and social inequality necessitate collaborative solutions that transcend traditional disciplinary boundaries. MESKCON provided a forum for intellectual convergence, encouraging the cross-pollination of ideas and facilitating dialogue that promotes holistic and impactful problem-solving. Academic conferences like MESKCON play a pivotal role in the generation and dissemination of knowledge. They not only provide a platform for presenting original research and refining theoretical frameworks but also enable meaningful discourse among scholars from diverse backgrounds. These interactions enhance understanding within individual disciplines and reveal novel insights at their intersections, often serving as catalysts for transformative innovation.

We extend our sincere appreciation to the distinguished dignitaries who honoured the inaugural session with their presence and insightful addresses. Our profound gratitude also goes to the speakers for their invaluable contributions, which enriched the intellectual fabric of the conference. We acknowledge with deep thanks the participants and organizing team whose commitment and enthusiasm were instrumental in the successful execution of this academic event. Lastly, we are immensely grateful to the Management Committee for their steadfast support and encouragement, which have played a significant role in fostering the institution's pursuit of academic excellence.

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"A STUDY ON ROLE OF SMALL SCALE INDUSTRIES IN KERALA ECONOMIC DEVELOPMENT: AN OVERVIEW"

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ABSTRACT

India is predominantly an agrarian country. Apart from agricultural industries, small scale industries are the backbone of our industrial structure as they provide a variety of non-traditional, low technology products. Small scale industries are actual wheels that keep the economy of our country running. Small scale industries are referred to those industries in which the process of manufacturing, production and servicing are done on a small scale. The investment on such industries is one time and these investments are mostly done on small plant and machinery. The primary objective of developing small scale industries is to generate better employment opportunities, raise income level and standard of living of the people. They are essential for providing subsidiary or alternate occupation and utilization of local labour and raw materials. They also facilitate an effective mobilization of resources of capital and skill, and also stimulate the growth of industrial entrepreneurship. Thus, the development of small scale industries is an integral part of overall economic, social and industrial development of a country. The study focuses on the role of small scale industries in the economic development of Kerala, and also the role of government in the development of small scale industries. The theoretical framework incorporates the current status of small scale industries in India and Kerala. Thus, the study discloses the importance of small scale industries in the economic development of our economy.

Keywords: India, Kerala, small scale industries, low technology, economy, employment

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INTRODUCTION

Kerala is one of the smallest states in India. Kerala, by any standard has a rich agricultural base yielding high value cash crops and abundance and cheap electric power. The high demographic pressure combined with fast growth of population and high literacy has been mainly responsible for the economic insecurity and other problems of instability faced in the state. Hence economic development is accorded top priority with an emphasis on the industrial development of the state, to absorb as much man power as possible out of 2 lakh people coming to labour market every year. On the industrial scene, Kerala has a preponderance of small industries, most of them traditional industries utilizing mainly local resources. Although they have hither to account for a major share of industrial income and employment, the scope for their development is limited.

Agro based industries are important small scale industries in Kerala. Agricultural products are the important resource for the development of large scale industries like food processing industries. Handloom industry is the second largest traditional industry providing employment of over 2.5 lakh people particularly in the rural and semi urban areas and contributes a good deal towards the export of textile from India. Fish processing industries in India is mainly concerned in Kerala. Small scale industries also include bamboo industry, ayurvedic based production, coconut oil production and production other coconut based products, coir industry, cashew industry, handicrafts industry, khadi and village industry, leather and leather goods industry etc.

LITERATURE REVIEW

Ganapathy, S.Natarajan and David.A.Wyrick (2011) Most SMEs expected information and some financial support from the support programmes. The different support programmes were evaluated based on how well they perform in providing information, advice financial support and constant feedback. A good support programme affected and improved the environmental performance of SMEs. It was noted that public sector purchasing fostered sustainable practices among the SMEs and in turn helped the native and regional economy. Since public sector industries have the

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financial power and also improve the bottom line of the sourcing SMEs, sustainable development was seen as feasible and economically viable.

Chuthamas Chittithaworn (2011) Customer and market, and resources and finance played an important role in ensuring the SMEs business success in Thailand. Innovative product, quality, cost, reliability and services are the key strategic dimensions in the success of a business. Innovative product gives added value to the customer and it is significant to attain a suitable balance between product quality and costs.

Ujjal Bhuyan (2016) has determined that one of the most dynamic and vibrant segments of the Indian economy as the Micro, Small, and Medium Enterprises (MSME) sector. MSMEs are essential for creating a large number of jobs at a relatively lower capital cost than large industries. They also aid in the industrialization of rural and underdeveloped areas, which lessens regional imbalances and ensures a more equitable distribution of wealth and income across the country. MSMEs are supplementary to major industries as auxiliary units, and this sector makes a significant contribution to the nation's socioeconomic advancement.

Kankipati et al (2017) has noted that, in general, entrepreneurship refers to the entire set of activities an owner takes to launch and run his business in order to make a profit. Over the past 50 years, the Micro, Small, and Medium-Sized Enterprises (MSME) sector in India's economy has become a very dynamic and lively one. The MSME sector has become one of the most vibrant and active sectors of the Indian economy in the last fifty years. Over the past seven years, MSME employment has continued to rise and have created more job opportunities.

OBJECTIVES

- To analyze the role of small scale industries in Kerala economic development.
- To understand the problems faced by small scale industries.
- To identify the role of government in the development of small scale industries.

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RESEARCH DESIGN

This study has been designed, on the basis of both primary and secondary data sources, to analyze the problems of small scale industries. Primary data is being collected by using a highly structured interview schedule from adequate sample. Further, reports of several agencies have also been incorporated in the study. The study is being focused in Kerala.

THEORETICAL FRAMEWORK: DISCUSSION AND RESULT

Small-scale industries occupy a vital position in the planned industrial development in our country. Not only they provide immediate large-scale employment, but also offer a method of ensuring a more equitable distribution of the national income. Moreover, they facilitate an effective mobilization of capital. The Planning Commission of India is also aware of the vital role of SSIs, which has been reflected in different plans and policies.

An industrial undertaking in which the investment in fixed assets in plant and machinery whether held on ownership terms on lease or hire purchase does not exceed Rs. 10 million is called a small scale industry. According to SSI Board," Small-scale unit is the one which employ less than 50 persons if the use of power and less than 100 persons without the use of power and with a capital investment of Rs. 5 lakh". Next to agriculture, small scale industries are the most important employment generating sector in the economy. It also contributes a substantial part of manufacturing output.

Characteristics and Significance of Small-Scale Industries

As discussed earlier, SSIs play an important role in the economic development of an economy. Following are the characteristics of an SSI:

- **Labour Intensive**: SSIs provide employment opportunities to individuals in urban and rural areas, which, in turn, enhance the economic position of the country.
- **Flexibility**: Implies that SSIs adapt themselves as per the dynamic industrial environment.
- **Innovative**: SSIs use new and innovative techniques, materials, methods of production, new markets, sources of materials, and even new forms of organizations like sole proprietorship, partnership, and co-operatives.

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- **Decentralization**: SSIs facilitate a balanced growth of the economy as a whole due to dispersal of industries.
- **Outlet of Entrepreneurial Spirit**: It represents enthusiasm, persistence, and creativity of an individual who establishes the enterprise.

The significance and relevance of SSIs are discussed below:

- Utilize locally available human and material resources and expertise/experience.
- Create jobs at relatively low cost.
- Improve the lifestyle and living standard of people.
- Diversify the industrial structure.
- Help in increasing the national productivity.
- Contribute approximately 35 to 40 percent of export.
- Prevent the creation of monopoly.
- Ensure more equitable income distribution.
- Attract and utilize indigenous entrepreneurship and encourage women entrepreneurs.
- Develop a pool of skilled and semi-skilled workers for future industrial expansion.
- Prevent regional imbalances by their presence in backward, rural, and the exterior part of the country.
- Adapt appropriate technological managerial approaches optimally
- Facilitate a favorable balance of trade.

Contributions or role of SSIs in the economic development are employment generation, higher productivity, poverty alleviation, better utilization of local resources, tapping of savings, utilization of domestic technology, regional balance and rural development, export contribution, contribution to decentralization and complementary to large-scale industries.

Performance

There are 2,24,524 registered SSI units in the state. Cumulative Number of SSI Units granted Permanent Registration in Kerala is as follows:

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1995-96	1996-97	1997-98	1998-99	1999-2000	2000-2001
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The tiny, small, medium or large units in sectors like Information Technology, Tourism, Agro-based units including food processing, readymade garments, ayurvedic medicines, marine products, light engineering, biotechnology & rubber based industries have been identified as the thrust sector industries.

The details of the Small Scale Industrial Units are as follows:

Newly registered SSI units during 2003-04	5305
Total Investment in SSI Units during 2003-04	Rs. 4031 crores

Problems faced by SSIs

Small-scale industries are indispensable to the economic prosperity of our country. Furthermore, SSIs are not able to perform their role efficiently due to various hurdles.

- **Financial problems**: Money is the most important issue for small businesses. Money is the lifeblood of an organization and no organization can perform successfully without adequate finance. The main causes for the strand are lack of money and credit alternatives; entrepreneurs also have worse creditworthiness due to weak economic base. They have no resources of their own and none is willing to lend them compared to multinational companies.
- **Problems of raw-materials**: Small businesses often purchase raw materials from local suppliers. These units have to deal with several barriers like inadequate quantity, poor quality and irregular supply of raw materials.

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- **Marketing problem**: These small units also have marketing challenges. They cannot get direct knowledge about the market like competitor tastes, consumer likes and dislikes, and popular fashions. They produce fewer items of lower quality at a higher cost. As a result, even when competing with better equipped large units, they are at a pitfall.
- **Under-utilization of capacity**: Most small units work at less than full capacity or are gruesomely underutilized. Large units work 24 hours a day, but small units use only 40 to 50% of their installed capacity. Several factors for this huge underutilization of capacity include problems with money, raw materials, electricity, and untamed markets for their products.
- **Issues in quality work**: A small facility in a remote backward location may not have a problem of unskilled labour but skilled labour is not available. First and foremost skilled employees may vacillate to work in such environments and the company may not be able to pay wages.
- **Project planning**: Poor project planning is a problem for small businesses. Because of their zeal and enthusiasm, these entrepreneurs do not place a high value on survival. The project feasibility study, which includes all these issues as well as technical and financial sustainability of the projects, is not given sufficient weight. Moreover, because of limited financial resources, they cannot hire project consultants. As a result, project planning and execution suffer.
- **Infrastructure inadequacy**: Most of the small units and industrial estates in the cities have many weaknesses like lack of electricity, problem of water and sewerage, inadequate roadways, raw materials and marketing problems. The lack of adequate infrastructure, therefore, has a negative impact on the quality, quantity and production scheme of companies, which results in underutilization of capacities.
- **Other difficulties**: A number of other issues also hindered SSIs. These include management deficiencies, old and traditional designs, high degree of obsoleteness and a large number of deceitful firms. Because of all these obstacles, the growth of small businesses has been hampered etc.

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SUGGESTIONS

It will be noted that SSIs experience serious issues by an inequitable allocation system for sparse raw materials, insufficient institutional finance, indigent technical skill and managerial ability, and lack of marketing channels etc. In this connection, the following measures may be suggested:

1. Equitable allocation of raw materials, imported components and equipment.
2. Improvement in production methods and techniques.
3. Provision for adequate finance and market assistance.
4. Provision for industrial education and training to small-scale entrepreneurs.
5. Establishing separate suitable machinery with large powers and initiative to tackle problems of small scale industries in Kerala.
6. Creating and maintaining standards and quality of the output produced by SSIs.
7. Conducting research on the techniques of production.

CONCLUSION

The small scale industries have been playing a very significant role in the growth and development of our economy in terms of employment or in many other related sectors. In spite of having huge potentialities, the SSIs are still not progressing satisfactorily because these industries are facing many challenges and various weaknesses. If the government takes remedial measures to improve the barriers and take an action to utilize huge development potential available in the economy, only then SSI sector runs in a path of progress and they will prove them as one of the most dynamic sectors in the world economy.

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THE EFFECT OF YOGIC EXERCISES ON PERFORMANCE OF COLLEGE FEMALE SOFTBALL PLAYERS

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Abstract

Yoga, an ancient practice renowned for its physical, mental, and emotional benefits, has emerged as a valuable tool for holistic well-being. This 12-week study examines the impact of yoga on performance and mental resilience in softball players. As a sport requiring precision, agility, coordination, and focus, softball provides an ideal context to evaluate the complementary role of yoga in enhancing key performance attributes. Participants were divided into two groups: one incorporating yoga into their training regimen and the other following traditional methods. The study measured flexibility, balance, willpower, and physical metrics such as hitting rate, along with indicators of mental resilience. By integrating yoga into conventional routines, this research explores its potential to complement existing training strategies, fostering resilience, focus, and overall development in players. The findings aim to provide actionable insights for advancing performance in softball through a balanced, integrative approach. Additionally, this study sheds light on the psychological benefits of yoga in sports, particularly in managing stress and enhancing concentration. It underscores the role of controlled breathing and mindfulness in optimizing athletic performance and ensuring overall well-being. Future research can further explore yoga's effectiveness across different sports and performance levels.

Keywords: Yoga, Softball Performance, Flexibility, Willpower, Balance.

1. Introduction

Softball is a physically demanding sport that requires agility, coordination, endurance, and focus. While conventional training methods emphasize

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strength and skill development, integrating complementary practices like yoga can enhance mental resilience, flexibility, and balance. The modern sports environment is becoming increasingly competitive, requiring sportspersons to seek alternative methods of improving performance beyond traditional strength and conditioning programs. Yoga has been widely acknowledged for its ability to improve concentration, reduce stress, and prevent injuries, making it a valuable addition to conventional training. It not only aids in the physical aspects of the game but also contributes to emotional stability and mindfulness, which are crucial for high-pressure sports like softball.

The ability to remain calm and composed under pressure is a key determinant of success in softball. Yoga, with its emphasis on breath control and relaxation techniques, equips players with the necessary tools to manage game-related stress effectively. Moreover, improved flexibility and balance contribute to reducing the risk of injuries, allowing players to perform optimally over longer periods. By incorporating yoga into regular training routines, players can benefit from both physiological and psychological advantages, enhancing their overall game performance.

This study investigates the effectiveness of yoga in improving the overall performance of college female softball players by evaluating both physical and mental aspects, thereby bridging the gap between physical training and mental preparedness.

2. Hypothesis

- H_0 (Null Hypothesis): There is no significant difference in the performance of college female softball players due to the incorporation of yoga in their training regimen.
- H_1 (Flexibility): Yoga training leads to significant improvements in flexibility compared to traditional training alone.
- H_2 (Balance): Yoga training enhances balance significantly in softball players.
- H_3 (Willpower): Regular yoga practice results in a measurable increase in willpower and mental resilience.
- H_4 (Hitting Rate): Incorporating Yoga training improves the hitting rate in softball players complementary to traditional training methods.

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3. Methodology

3.1 Participation

A total of 20 female college softball players participated in this study. They were randomly divided into two groups:

- **Experimental Group (Yoga + Traditional Training) - 10 players**
- **Control Group (Traditional Training Only) - 10 players**

3.2 Duration

The study was conducted over a period of 12 weeks.

3.3 Training Protocol

- The experimental group engaged in yoga sessions for 45 minutes, five times a week, in addition to regular training.
- The control group followed their regular training routine without yoga intervention.
- The yoga sessions included specific asanas targeting the variables assessed in the study:
  - ✓ **Flexibility:** Paschimottanasana (Seated Forward Bend), Padahasthasana (Hand-to-Foot Pose) to enhance lower back and hamstring flexibility.
  - ✓ **Balance:** Virabhadrasana III (Warrior III), Garudasana (Eagle Pose) to improve proprioception and stability.
  - ✓ **Willpower:** Virabhadrasana II (Warrior II), Dhanurasana (Bow Pose) to develop mental endurance and focus.
  - ✓ **Hitting Rate Improvement:** Vrikshasana (Tree Pose), Pranayama (Nadi Shuddhi - Alternate Nostril Breathing) for improving mental focus and coordination.

3.4 Measurement Parameters

The following parameters were measured before and after the intervention:

1. **Flexibility:** Sit and reach test
2. **Balance:** One-leg stance test
3. **Willpower:** Questionnaire-based assessment
4. **Hitting Rate:** Number of successful hits per 30 throws

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By monitoring these factors, the study aimed to provide a comprehensive understanding of the physical and psychological benefits of yoga in a sports training context.

4. Results and Discussion

The performance improvements were assessed using a comparative pre- and post-intervention data analysis. The results are summarized in Table 1 below.

Table 1: Comprehensive Performance Analysis (Mean ± SD and Gain Percent)

Parameter	Experimental Group (Before)	Experimental Group (After)	Gain % (Exp)	Control Group (Before)	Control Group (After)	Gain % (Ctrl)
Flexibility (cm)	24.8 ± 2.2	30.0 ± 2.4	20.9%	24.7 ± 2.1	26.0 ± 2.3	5.3%
Balance (sec)	10.1 ± 1.3	12.4 ± 1.6	22.8%	10.2 ± 1.2	11.5 ± 1.3	12.7%
Willpower Score	5.3 ± 0.7	6.5 ± 0.8	22.6%	5.3 ± 0.8	5.9 ± 0.9	11.3%
Hitting Rate	15.3 ± 2.1	18.8 ± 2.3	22.9%	15.1 ± 2.0	16.9 ± 2.1	11.9%

The findings of this study emphasize the role of yoga as a performance-enhancing tool in competitive sports. The significant improvements observed in flexibility, balance, and willpower highlight its effectiveness in optimizing both physical and mental well-being.

To summarize the findings, a comparative statistical table (Table 2) below presents the average gain percentages and corresponding p-values.

Table 2: Summary of Gain Percentages and Statistical Significance

Parameter	Gain % (Exp)	Gain % (Ctrl)	p-value
Flexibility	20.9%	5.3%	0.012*

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Balance	22.8%	12.7%	0.018*
Willpower	22.6%	11.3%	0.021*
Hitting Rate	22.9%	11.9%	0.015*

Note: p-value < 0.05 indicates statistical significance.

The data indicate a marked improvement in all tested areas for the experimental group, confirming that yoga plays a significant role in enhancing softball performance.

5. Conclusion

The findings of this study highlight the tangible benefits of incorporating yoga into softball training. Participants who practiced yoga demonstrated significant improvements in flexibility, balance, willpower, and overall performance. These results underscore the importance of integrating mind-body techniques into conventional training, not only to enhance physical ability but also to cultivate mental resilience.

The observed improvements in flexibility and balance contribute directly to injury prevention, allowing players to maintain peak performance over extended periods. Enhanced willpower and focus, facilitated by controlled breathing and mindfulness techniques, play a crucial role in managing in-game stress and improving decision-making under pressure. This aligns with broader research suggesting that holistic approaches to training yield both physiological and psychological benefits.

Given the growing demand for performance optimization in competitive sports, yoga presents a practical, cost-effective, and holistic training method. Unlike other intensive strength or endurance programs, yoga offers a balanced approach that complements traditional regimens while addressing both physical and cognitive aspects of sports performance.

Future research should explore the long-term effects of yoga practice and its application across different sports to further validate its efficacy. Expanding studies across diverse training disciplines and larger sample sizes will provide

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deeper insights into yoga's role in enhancing overall athletic performance and psychological well-being.

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A STUDY ON THE ROLE OF REGENERATIVE TOURISM IN EMPOWERING LOCAL COMMUNITY; WITH SPECIAL REFERENCE TO NILAMBUR TEAK MUSEUM

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ABSTRACT

In this 21st century, the tourism industry plays an important role in our society and economy. It has great potential as it bring social, cultural, infrastructural and overall development. It contributes to the economic development all over the world. While focusing on socially responsible travel, personal growth, and environmental sustainability the ecotourism has a dominant role in Kerala. Regenerative tourism is a holistic approach that aims to improve the well-being of local communities and creating the positive impacts. It's achieved through regenerative agriculture, preservation of cultural heritage, empowerment of community, creating education and awareness about the regenerative tourism practices. Regenerative tourism goes beyond sustainable tourism by actively seeking to improve and restore destinations. Sustainable tourism seeks to minimize harm, while regenerative tourism seeks to actively heal and enhance destination. Regenerative tourism prioritizes local communities by involving them in decision-making processes and ensuring they benefit economically and socially from tourism.

Nilambur teak museum provides an outlook to the environment as a potential area of ecotourism and regenerative tourism. The present study focus on the role of regenerative tourism in local community, to understand the benefits of regenerative tourism, and to know the positive impact of Nilambur teak museum.

Hence the study reveals that the local community are benefited in several ways as part of regenerative tourism. Job creation, income generation, environmental benefits, communal involvement, etc.The Nilambur Teak Museum adopted various practices such as sustainable tourism operations, tourism based on community, collaboration with various organizations and government agencies.

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Keywords: Tourism, Regenerative tourism, Ecosystem, Community.

INTRODUCTION

Regenerative tourism is an approach to tourism that focuses on revive and restoring the social, cultural and environmental well being of tourist destination. It is not simply minimizing harm to destinations. Instead, it focuses on actively improving and restoring the local environment, culture, and economy of destinations. The idea is to create positive, long-term effects by creating strong connections between travellers and local communities, encouraging sustainable practices, and benefiting the destination as a whole.

The Nilambur teak museum was established in 1995 on the campus of the centre of Kerala Forest Research Institute, because of the historical significance of teak to the area.

It is the world's first teak museum..The centrepiece of the museum is an impressive 55 year old teak tree. Its extensive root system on full display in the portico, which offering a striking introduction to the world of teak.

This research paper deals with regenerative tourism practices in nilambur teak museum and how the local communities are empowered through this practice.

RESEARCH METHODOLOGY

1. **RESEARCH DESIGN** : The descriptive research is used for study
2. **SAMPLING TECHNIQUE**: CONVENIENT sampling used for the study
3. **SAMPLING SIZE** : collected 60 samples
4. **SOURCES OF DATA**:
    - **Primary data:** Through self structured questionnaire.
    - **secondary data:** from books, websites and articles.
5. **TOOLS USED FOR THE STUDY**:
    - **Data collection tool**: Questionnaire Is used for this purpose
    - **Data Analysis tool**: Simple percentage analysis.
    - **Data Ptesentaion tool**: Tables and diagrams are used for presentation.

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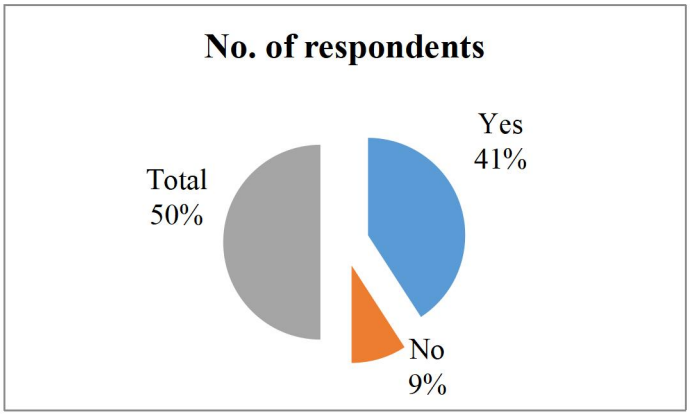
RESULTS AND DISCUSSION

Empowerment through regenerative tourism

options	No. of respondents	percentage
Yes	49	82
No	11	18
Total	**60**	**100**



The majority of the respondents are in the opinion that they are empowered through regenerative tourism in Nilambur Teak Museum.

BENEFITS OF REGENERATIVE TOURISM

option	No. of. respondents	percentage
Economic benefit	28	47
Environmental benefits	17	28
Social benefit	12	20
Cultural benefit	3	5
Total	**60**	**100**

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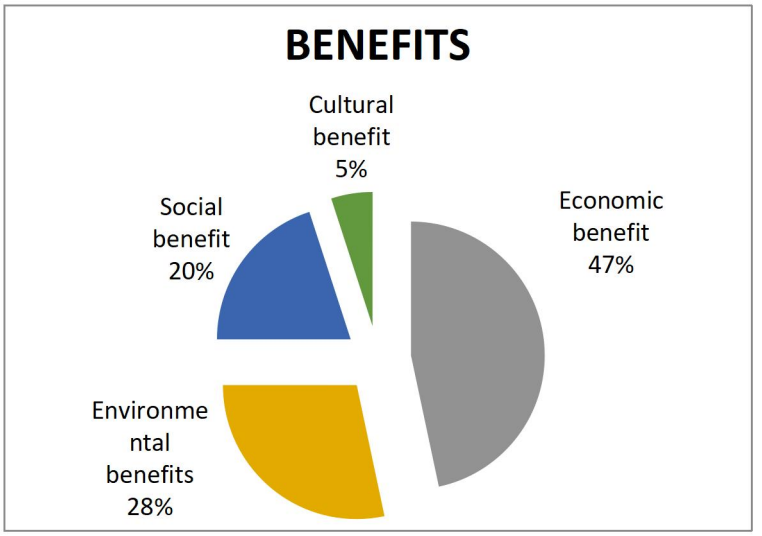

The above analysis shows that more number of respondents are in the opinion that the got economic benefit as part of Regenerative tourism. Very few of them opined that they got cultural benefit.

LIMITED AWARENESS AND EDUCATION IS A MAJOR CHALLENGE

Options	No. of respondents	Percentage
STRONGLY DISAGREE	8	13
DISAGREE	9	15
NEUTRAL	14	23
AGREE	26	44
STRONGLY AGREE	3	5
TOTAL	**60**	**100**

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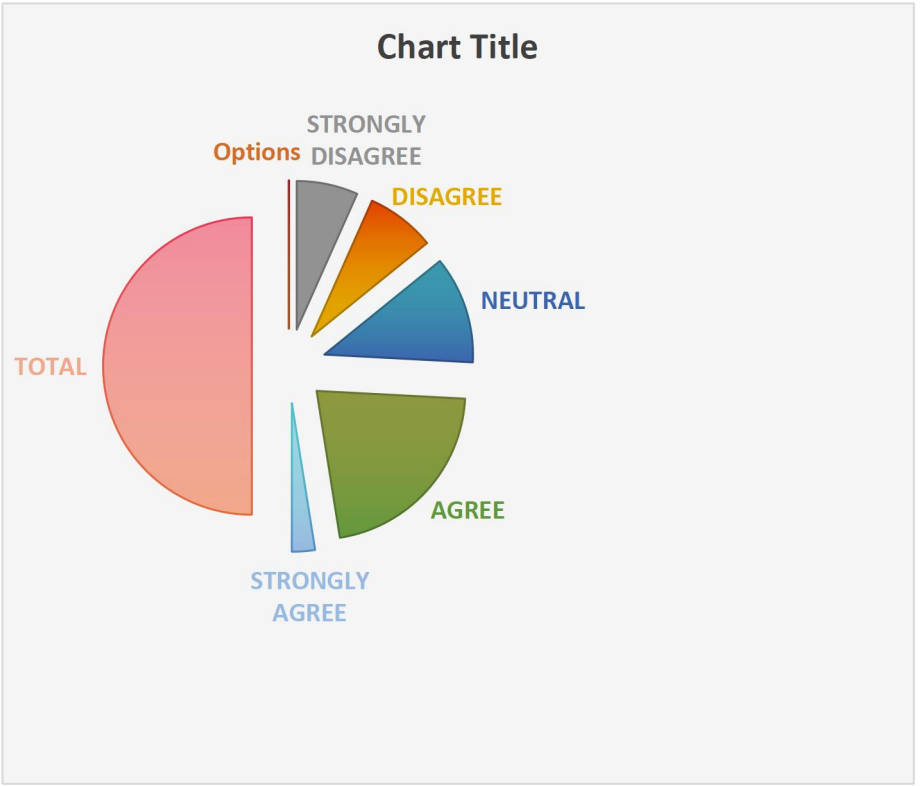

Limited awareness and education are the main problems faced by the respondents

FINDINGS

The study identified that

- The local communities are empowered in the form of employment creation, income generation.
  that leads to their economic well being.
- The regenerative tourism helps to preserve the heritage and history of the Nilambur teak plantation and museum.
- The museum promote sustainable forest management.
- This tourism led to the infrastructure development such as hotels, restaurants andtransportation services.
- Increased tourism and outside influence created social tension and conflicts within community.

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CONCLUSION

The study on the topic "The Role of Regenerative Tourism In Empowering Local Community; with Special Reference To Nilambur Teak Museum" conducted to analyse the empowerment of local communities through regenerative tourism practices in Nilambur teak museum, the benefits and problems of local communities.

The study shows that the local community is empowered in various forms by regenerative tourism. Job creation, income generation, growth of the local economy, social cohesion, and tourism infrastructural development are the major benefits of this practices. But it faces certain limits also; like social conflict, insufficient waste management, limited experience with tourism, and limited awareness and education. The government also initiated certain measures to promote tourism the Nilambur teak museum. The tourism department is going to launch a special promotion program in Nilambur. It covers the beautiful landscapes and monuments including connolly's Plot, Shalimar mukku, adyanpara waterfalls, kozhippara waterfalls, etc.,

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ASSESSMENT OF KERALA TOURISM INDUSTRY – AN ECONOMIC PERSPECTIVE

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ABSTRACT

Kerala plays a significant role in India's economic growth, with its economy being the 11th largest in the country [1]. The state has a high per-capita income, which is 60% higher than India's average, and contributes more than 4% to the country's GDP, despite accounting for only 2.8% of India's population and 1.2% of its land area [1]. Kerala's economy is driven by its service sector, which accounts for around 65% of its revenue, with major contributions from tourism, information technology, and remittances from Non-Resident Indians (NRIs) [2] [1]. The state is also known for its high human development indicators, including literacy rates, life expectancy, and social security, which have earned it the title of "Kerala Phenomenon" or "Kerala Model" of development [1]. However, Kerala's economy also faces challenges, including a high debt-to-GDP ratio, limited revenue sources, and a decline in its agricultural and industrial sectors [3]. To address these challenges, the state government has implemented various initiatives, such as the "Year of Enterprises" program, to promote entrepreneurship and industrial growth [2]. Overall, Kerala's unique economic model, which combines high human development indicators with a strong service sector, makes it an important contributor to India's economic growth.

Introduction

Tourism is an activity when an individual from one Country or region travels to and spend time in another Country or territory. The primary goal is fun. Spending time for recreations has become essential in todays world. Now a days, people budget a portion of their income for recreational activities. It has now become an important aspect of our lives. In Indian contest of tourism, the Country has a great potential for revenue generation. Obviously, the tourist

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Industry is becoming a more significant economics force with the potential to be development. In addition to contributing to economic quality progress, the tourist industry also enhances the quality of people lives through supporting environmental protection promoting diverse cultural heritage and enhancing International peace. Kerala's economy has been progressively transitioning from an agrarian economy to a service based one. Its main source of income are ship building tourism, education and information technology.

In developing countries like India tourism has become one of the major sectors of the economy, contributing to a large portion of the National Income and generating huge employment opportunities. It has become the fastest growing service industry in the Country with great potentials for its further expansion and diversification. How ever, there are pros and cone involved with the development of tourism industry in the Country.

Kerala is a popular tourist destination in India known for its beaches, backwaters, hill stations and wild life sanctuary. It's also known as God's own country. Tourism is a major contributor to Kerala's economy, generating income and employment. Tourism promotes traditional industries and earns foreign exchange for the state.

Objective of the study

1. To analyze the recent trends in Kerala tourism and the cause for increasing economic development.
2. To study the impact of Kerala tourism Industry.
3. To study the relationship between foreign exchange earnings of Kerala tourism and share in Indian GDP.

Scope of the study

The scope of Tourism is broad and encompasses various aspects that contribute to the travel industries over all impact on economics, culture and individuals. Money spend by visitors helps local economics. It bring people together, fostering understandings of different cultures. Tourists can protect cultural and historical sites. It is a broad concept and includes a wide range of activities, services, and destinations. It can be seen as a catalyst for economic growth, job creation, and cultural enrichment. For making the industry more profitable it is important to understand the different aspects of the tourists, and

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for this it is necessary to analyze the purpose of tourist Effective management and planning are crucial to harnessing its benefits while mitigating potential drawbacks.

Methodology

The present study is in analytical and is purely based on Secondary data.

Review of literature

1. Mathew (2021)

He made a study entitled as " Interaction effect of tourism and foreign exchange earning on economic growth in Nigeria. This paper examined the interaction effect of toursim and foreign exchange earnings on economics growth. They also examined the trade balance in tourism on economic growth.

2. Shen & Lai (2022)

Scopus is frequently used in tourism research and provides more articles on virtual technology than Web of Sciences. This study answers the following questions: What is the latest research progress on virtual technology in hospitality and tourism? What are the current research topics in hospitality and tourism research? What are the opportunities for future research in this field?

3. Szromek (2023)

To address open innovation in tourism, demonstrate how open social innovation can solve common problems in tourist destinations, promoting cooperation between the public and private sectors to implement innovative solutions that benefit all stakeholders.

4. Kerala tourism vision (2025)

A strategic plan prepared by the tourism department and authorized by the Kerala goverment in 2002, intends to turn tourism in to private industry in the state, with the state serving as a promotor and mediator. This has been written after much consideration and deliberation, with input from a variety of stake holders. Kerala's tourism vision 2025 intends to transforms the state in to a high end tourist destination.

An overview of tourism development in Kerala and India

Kerala is blessed with varied geographical features that have made it one of the most sought after destinations in Asia. Tourism is the hallmark of Kerala's economic development and a principal contributor to the State's economy.

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Kerala is now recognised internationally as a tourist destination. Tourism enables balanced and sustainable regional growth by generating income and creating employment opportunities especially in trade, transport and hospitality sectors. The sector earns foreign exchange to the State and promotes traditional industries.

The share of tourism in Kerala's Gross State Domestic Product is about 10 per cent. Tourism creates employment, brings in incomes, and opens out cultures to the rest of the country and world. A feature of tourism is its interconnection with other spheres of development. Tourism cannot be successful without concurrent development in health, sanitation, urban and rural planning, transport, connectivity, local self-government and other spheres.

A major contributor to Kerala's economy is the large amount of remittances sent by Malayalee migrants working abroad, particularly in the Gulf region, which significantly boosts the state's purchasing power and investment potential. Kerala boasts high literacy rates and a well-educated population, which provides a skilled workforce across various sectors, contributing to its economic competitiveness. While not the dominant sector, Kerala remains a significant producer of cash crops like rubber, pepper, coconut, cardamom, and tea, contributing to the national agricultural output. Kochi is increasingly recognized as a significant IT hub, attracting investments and generating employment in the technology sector. Kerala's natural beauty, including backwaters, beaches, and hill stations, provides significant potential for tourism revenue generation. Compared to other Indian states, Kerala has a relatively smaller industrial base, which can limit its potential for large-scale manufacturing jobs. While certain areas like Kochi are experiencing rapid development, other regions may lag behind in economic growth. This article examines the complex relationship between migration, remittances, and Kerala's economic development. Provides an overview of Kerala's economic performance and key indicators compared to the rest of India. This article discusses the "Kerala Model" of development, highlighting its achievements in human development while also addressing its economic limitations.

Tourism contributes to India's GDP, and is one of the country's fastest-growing economic sectors Tourism is India's third-largest source of foreign exchange Tourism creates jobs in the hospitality, transportation, and other

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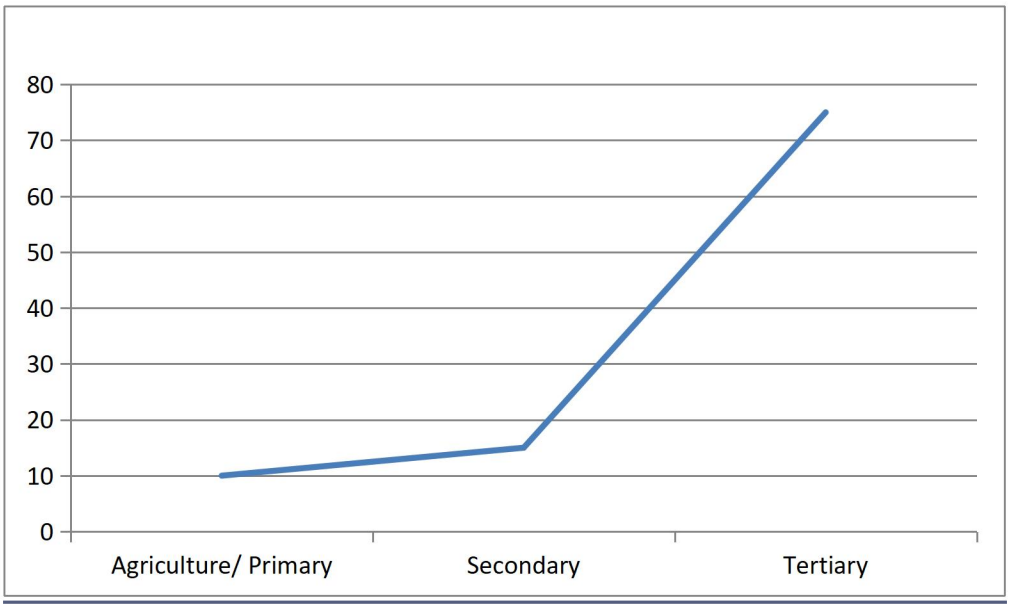
sectors Tourism helps preserve India's cultural heritage and traditionsTourism promotes tolerance and acceptance of diversityTourism helps build social capital in IndiaTourism can help conserve the natural environment and ecological sitesTourism contributes to the development of local infrastructure Tourism can help reduce poverty and inequality Tourism can enhance bilateral relations and people-to-people connections.

Analysis and Interpretation of Data

Table1

The contribution of tourism to overall GDP in different sectors of the economy.

Primary Sector	5-10%
Secondary Sector	10-15%
Tertiary Sector	75-80%



The tertiary sector is the major beneficiant from tourism which contributes approximately 80% towards nation'sGDP.Secondarysector stands the second place and primary sector is the least contributor**.**

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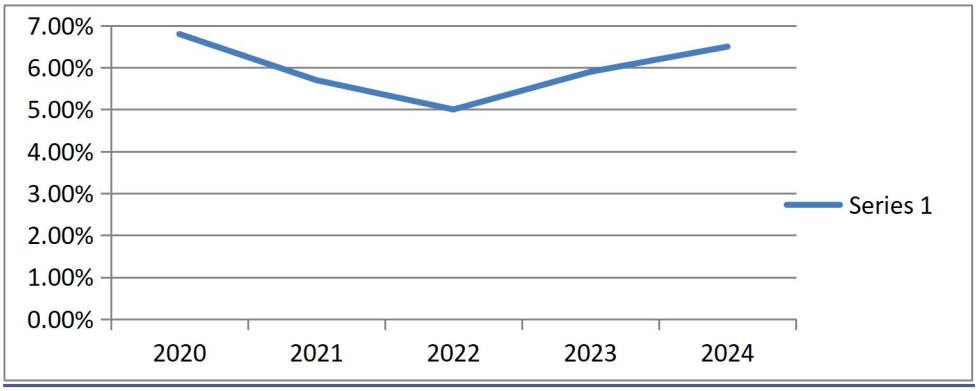
Table 2

The classification of years to the GDP Contribution in India.

2020	6.8%
2021	5.7%
2022	5%
2023	5.9%
2024	6.5%



Among the above years,2020 contributes themajor share of 6.8% towards our GDP.The year 2024 contribution is just close to that of 2020 with an average of 6.5%.We expect a hike in contribution in the year 2025 with not less than 7%.

Table 3

Forex contribution of Tourism to Indian's economic growth.

2020	50%
2021	60.8%
2022	51.3%
2023	16.1%
2024	15.7%

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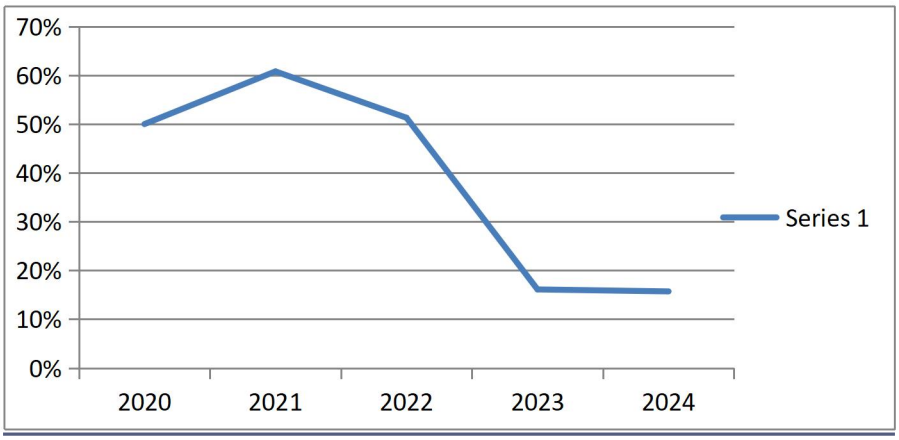
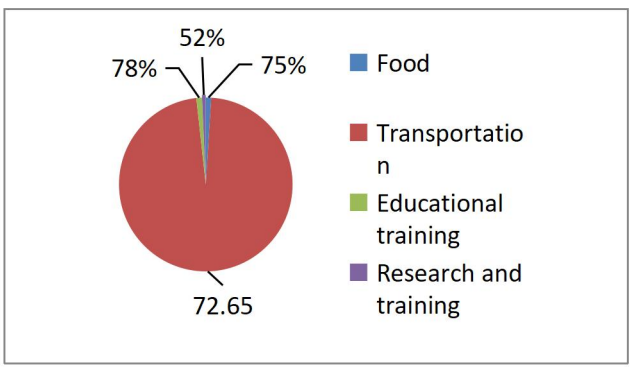


According to our survey,the contribution of tourism towards forex reached its maximum in the year 2021 with a drastic percentage of 60.8%.But the succeeding years showed a downward trend in forex reserve.

Table 4

Benefits of Kerala Tourism to employment sector.

Food	75%
Transportation	72.65%
Educational training	78%
Research and training	52%



The transportation sector has benefited more from the tourism in terms of employment followed by educational training,food, and research study.

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Findings

According to the study, Kerala tourism in India has seen significant growth, particularly in domestic tourist arrivals, with a record-breaking 2.18 crore domestic visitors in 2023, marking a 15.92% increase compared to the previous year; additionally, international tourist arrivals also saw a substantial rise with a growth of 87.83% in 2023 compared to 2022, indicating a strong rebound in the post-pandemic period. The tertiary sector is driven as a predominant force in our economy. Tourism enables a vast space for transportation, research studies, Forex reserves and even mainly to our GDPgrowth.Further more studies are recommended to have a deep knowledge in tourism and its associated sectors.

Conclusion

The present study titled "Assessment of Kerala tourism industry-An economic perspective" provides some insight into how Kerala's tourism industry contributes to Forex earnings, GDP etc., Kerala's tourism industry has significant growth potential. Kerala tourism can make a significantly bigger impact on India's GDP and ultimately on the nations economic development.

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RELATIONSHIP BETWEEN SELECTED LUNG FUNCTION AND PERFORMANCE AMONG SWIMMERS IN PALAKKAD KERALA

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ABSTRACT

This study examines the relationship between selected lung function parameters and swimming performance among 40 competitive junior swimmers in Palakkad, Kerala. The key lung function parameters analyzed include Maximum Voluntary Ventilation, Vital Capacity, and Forced Expiratory Volume in One Second. Performance was assessed across different strokes (freestyle, backstroke, breaststroke, and butterfly) and distances (50m, 100m, and 200m). The results indicate a significant positive correlation between superior lung function and enhanced swimming performance, with Maximum Voluntary Ventilation emerging as the strongest predictor. Freestyle was the most efficient stroke, whereas breaststroke posed the highest resistance. Regression analysis confirmed that swimmers with higher Maximum Voluntary Ventilation, Vital Capacity, and Forced Expiratory Volume achieved faster times, emphasizing the role of respiratory efficiency in competitive swimming. The study highlights the need for lung function training in swimming programs, including breath-hold exercises and aerobic conditioning. Despite limitations such as sample size and regional focus, these findings provide valuable insights for coaches, athletes, and researchers. Future studies should explore additional physiological and psychological factors influencing performance. Overall, this research underscores the importance of targeted respiratory training to enhance competitive success in swimming.

Keywords: Lung Function, Respiratory Efficiency, Maximum Voluntary Ventilation, vital capacity.

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1. Introduction

Swimming is a highly demanding aerobic sport that requires efficient respiratory function to optimize performance. Lung function plays a crucial role in determining an athlete's endurance, stamina, and overall swimming efficiency. Swimmers rely on their respiratory capacity to sustain prolonged activity, control breathing patterns, and enhance oxygen uptake during training and competition. In Kerala, particularly in Palakkad, swimming has gained significant attention, with numerous athletes competing at various levels. However, the relationship between lung function and swimming performance among these athletes remains an area of limited exploration. Understanding this relationship can provide valuable insights into how respiratory parameters such as vital capacity (VC), forced vital capacity (FVC), forced expiratory volume in one second (FEV1), and peak expiratory flow rate (PEFR) influence the performance of competitive swimmers. This study aims to examine the correlation between selected lung function parameters and swimming performance among swimmers in Palakkad, Kerala. By assessing these physiological factors, the research seeks to highlight the importance of respiratory efficiency in competitive swimming and contribute to the development of specialized training techniques that enhance both lung function and overall performance.

References Link:

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2. https://nanoscalereports.com/index.php/nr/article/view/30

2. Materials and Method

2.1. Participants

A descriptive correlational design was used to examine the relationship between lung function and swimming performance in 30 competitive swimmers (aged 13–18 years) from Palakkad, Kerala. Swimmers were selected based on two years of training and participation in at least two competitive events in the past year.

2.2. Measures

The independent variables included lung function parameters: Vital Capacity (VC), Forced Expiratory Volume in One Second (FEV1), and

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Maximum Voluntary Ventilation (MVV), measured with a MIR Spirobank II spirometer. Swimming performance (dependent variable) was assessed by the time taken to complete the 100m Freestyle and 200m Butterfly, recorded using electronic timing systems.

2.3. Procedures

Participants underwent preliminary orientation and informed consent procedures. Spirometry testing was performed in a sports science lab, and swimming performance was assessed through simulated competitive events in a 50m pool.

2.4. Analysis

Data were analyzed using descriptive statistics, Pearson's correlation coefficient to determine relationships, and linear regression to predict performance outcomes.

2.5. Instruments and Software

The MIR Spirobank II spirometer was used for lung function testing. Performance times were recorded with electronic timing systems. Statistical analysis was performed using SPSS (version 28.0).

2.6. Ethical Considerations

The study followed ethical guidelines to ensure participant safety and confidentiality, with informed consent obtained from all participants and approval from the Institutional Ethics Committee.

3. Results and Discussion

The study examined the relationship between lung function and swimming performance in 30 competitive swimmers. Descriptive statistics showed that the mean values for Vital Capacity (VC), Forced Expiratory Volume in One Second (FEV1), and Maximum Voluntary Ventilation (MVV) were within the expected range for trained athletes, with minor variations based on training and physiological differences. Pearson's correlation coefficient revealed a significant negative correlation between lung function and swimming performance times ($p < 0.05$), indicating that swimmers with higher lung function performed better in competitive events.

Among the variables, FEV1 showed the strongest correlation with performance, highlighting the importance of expiratory strength. Regression analysis further confirmed that FEV1 and MVV significantly predicted

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swimming performance. These results align with existing research emphasizing the role of respiratory efficiency in endurance and speed in aquatic sports.

The findings suggest that lung function is a critical factor in swimming performance, as enhanced respiratory capacity allows for more efficient oxygen uptake and ventilation during exertion. The study is consistent with previous research showing that elite swimmers tend to have superior lung function compared to non-athletes.

However, the study's limitations include a small sample size and potential confounding variables such as muscle strength and stroke efficiency. Future research should include a larger sample and additional factors like VO_2 max. Overall, the study highlights the importance of respiratory training in competitive swimming to optimize performance.

Descriptive Statistics of Variables

Parameter	Mean ± SD	Range
Maximum Voluntary Ventilation (L/min)	130 ± 12.5	110 – 150
Vital Capacity (L)	4.5 ± 0.6	3.8 – 5.5
Forced Expiratory Volume (FEV1, L)	3.9 ± 0.4	3.2 – 4.6
Swimming Performance (Seconds)	57.2 ± 4.8	49.0 – 63.0

Correlation Between Lung Function Parameters and Swimming Performance

Variable	Correlation (r)	Significance (p)
Maximum Voluntary Ventilation (MVV)	-0.75	<0.001
Vital Capacity (VC)	-0.70	<0.001
Forced Expiratory Volume (FEV1)	-0.68	<0.001

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Regression Analysis Summary

Predictor Variable	β (Standardized Coefficient)	p-value
Maximum Voluntary Ventilation (MVV)	-0.52	<0.001
Vital Capacity (VC)	-0.40	<0.01
Forced Expiratory Volume (FEV1)	-0.35	<0.05

Conclusion

This study underscores the significant relationship between lung function parameters and swimming performance. Higher values of Vital Capacity (VC), Forced Expiratory Volume in One Second (FEV1), and Maximum Voluntary Ventilation (MVV) were positively correlated with faster swimming times, suggesting that respiratory efficiency is crucial for enhancing endurance and speed in competitive swimming. Among the lung function variables, FEV1 was identified as the strongest predictor of performance, highlighting its importance in sustaining high-intensity efforts during swimming events.

The findings suggest the need for integrating targeted respiratory training into athletes' conditioning programs to improve lung function and, consequently, performance outcomes. Such training could lead to better oxygen uptake, ventilation efficiency, and overall endurance, which are vital for success in swimming.

While the study has limitations, including a small sample size and the potential influence of other physiological and biomechanical factors, the results reinforce the critical role of pulmonary function in swimming. The research provides valuable insights for coaches and athletes, particularly in emphasizing the importance of respiratory training to enhance competitive performance. Future studies should address these limitations by including a larger sample size and additional variables to gain a more comprehensive understanding of the factors influencing swimming performance.

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GENDER DISPARITIES IN LIFE INSURANCE INVESTMENTS: RECENT TRENDS IN INDIA

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ABSTRACT

Gender disparities in financial decision-making are a critical issue in India, particularly in the context of life insurance investments. This paper examines the recent trends of gender differences in terms of investment in life insurance market. The paper also explores initiatives by insurers to bridge the gender gap, such as tailored products, targeted marketing, and inclusive financial literacy programs. Despite increased financial literacy and economic participation among women, their representation in life insurance portfolios remains significantly lower than men's. This disparity is influenced by traditional gender roles, income inequality, and limited financial autonomy. Secondary data collected from IRDA reports are used for the analysis. It emphasizes the need for policy interventions, gender-sensitive insurance products, and awareness campaigns to empower women as independent financial decision-makers. By addressing these disparities, the Indian life insurance industry can not only achieve greater equity but also unlock significant untapped market potential.

Keywords: Gender Disparities, Life Insurance, Investments, Gender Roles, Financial Literacy, Insurance Industry.

1. Introduction

Life insurance plays a pivotal role in financial planning, providing a safety net against unforeseen events and securing the financial well-being of individuals and their dependents. Historically, life insurance policies have often been designed and marketed with a gendered lens, focusing predominantly on the earning male as the primary policyholder. While societal shifts and economic progress have increasingly brought women into the

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financial mainstream, their participation in life insurance investment remains relatively limited. Factors such as wage disparities, lower financial literacy levels, and traditional caregiving roles contribute to this imbalance. Women frequently earn less than men, experience more career interruptions, and often outlive their male counterparts, yet they remain underinsured or Uninsured many cases. Wome who lack adequate life insurance coverage may face greater financial vulnerability in old age or during crises, perpetuating cycles of economic dependency and poverty.

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The financial landscape has undergone significant transformations, leading to the recognition of gender-specific financial strategies. Stephen Diacon (2002) emphasized the need for financial institutions to design offerings that align with the unique financial psychology and needs of women. The role of insurance in women's financial security has been a subject of scholarly interest. Dr. B. M. Ghodeswar (2006) highlighted that insurance serves as a crucial safety net for women, preventing dependence on traditional risk management mechanisms such as selling assets or taking high-interest loans. The globalization of India's life insurance sector has played a pivotal role in shaping financial opportunities for women. Sunil Kumar et al. (2012) pointed out that the entry of 23 private companies alongside a public-sector entity has expanded access to life insurance. This shift has allowed women to use insurance as a tool for financial security, marking a significant step towards gender-inclusive financial planning. Changes in educational systems, economic policies, cultural shifts, and technological advancements have redefined women's roles in society. Priya Vasugadekar (2014) attributed these shifts to the increasing control women have over resources, enabling them to effectively manage both professional and domestic responsibilities. With the availability of extensive data on women's financial behaviour, analysing their perception of life insurance has become imperative. Anuradha (2015) underscored the importance of understanding how women view life insurance as a viable savings and risk management tool. This analysis is crucial in tailoring financial products to meet the specific needs of women. Globalization has further expanded opportunities for women, particularly in education and career advancements. Devi Mohan (2016) discussed how increased awareness of the importance of education has empowered women, leading to significant achievements in various fields. As a result, women have gained greater access to financial resources and investment opportunities. Life insurance plays a crucial role in empowering women by enabling them to manage risks and tackle unforeseen financial challenges. Sandeep Chaudhary (2016) noted that such empowerment extends beyond financial independence to include enhanced family welfare, children's education, and overall confidence in achieving life goals.The shift towards financial freedom is more pronounced in urban areas, where women actively participate in decision-making regarding personal and family investments. Ms. S. Pradeepa and A. Ananth (2017)

observed that this transition marks a significant change in household financial dynamics, reflecting women's growing influence over financial decisions. Investment behaviours among men and women vary significantly, especially in urban settings. Backman and Maurie (2018) found that men tend to be more aggressive in investing in equity shares, real estate, and fixed deposits, while women prefer safer options like gold and jewellery. This preference underscores women's focus on financial security and family protection. The relationship between women's income generation and their participation in financial decision-making has been well established. Smriti Chand (2018) highlighted that as women's financial awareness grows, they explore new investment opportunities while continuing to prioritize safety and security for their families. This shift reflects their increasing confidence in managing financial matters. Historically, women have preferred secure investment options such as gold, post office savings, bank fixed deposits, and precious metals.

Dr. D. Chitra and Mahalaxmi (2020) reiterated that among these, gold has remained the most favoured due to its safety and cultural significance. The tendency to choose secure investments highlights the cautious approach women take towards financial planning, ensuring stability and long-term security for their families.

The existing literature underscores the importance of gender-differentiated financial strategies, the role of insurance in women's financial security, and the evolving nature of women's financial decision-making. This study aims to analyse the existing gender disparities in life insurance investments, explore the underlying socio-economic and cultural factors influencing these differences, and examine the current policies and programs in addressing this issue.This study holds significance in understanding the financial security and economic empowerment of women in India. By identifying key barriers to life insurance adoption among women, this study can help policymakers, financial institutions, and stakeholders design targeted strategies to enhance awareness, accessibility, and affordability of life insurance for women.

2. Materials and Methods

This study is based on secondary data which is sourced from the Annual Reports of the Insurance Regulatory and Development Authority of India

(IRDA) for the financial years 2017- 2018 to 2022-2023. A descriptive and comparative analysis is conducted to examine the trends in gender disparities in life insurance investments. Key indicators such as the percentage of policies owned by men and women and growth patterns are analysed. The study also evaluates policy interventions for reducing gender-based differences in insurance investments. Descriptive statistics such as percentages, mean values, and trend analysis are applied to interpret the data effectively. Comparative graphs and tables are used to present findings in a structured manner.

3. Results and Discussion

1. Recent Trend of Gender Disparities in Life Insurance Investments

a. Proportion of policy holders in life insurance industry

The recent trend of inclusion of women in life insurance policies can be analysed with the proportion of women policy holders in life insurance industry.

Table-1: Proportion of policy holders in life insurance industry

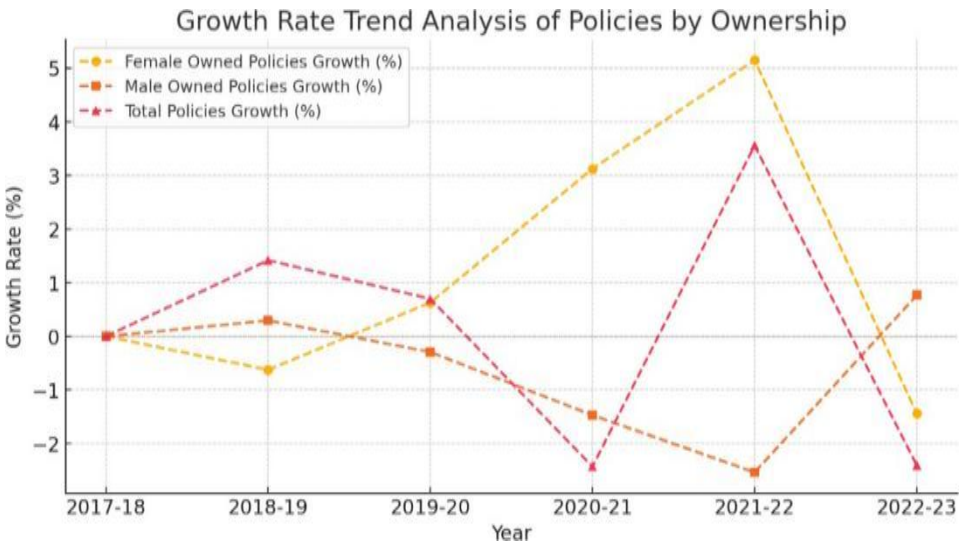
Year	Proportion ofFemale Owned Policies (%)	Proportion of Male Owned Policies (%)	Total No. of Policies(in crores)
2017-18	**32.0**	**68.0**	**2.82**
2018-19	**31.8**	**68.2**	**2.86**
2019-20	**32.0**	**68.0**	**2.88**
2020-21	**33.0**	**67.0**	**2.81**
2021-22	**34.7**	**65.3**	**2.91**
2022-23	**34.2**	**65.8**	**2.84**

Source : Annual Reports of IRDA

The steady rise in female participation reflects growing awareness and targeted efforts to involve women in financial planning. However, the overall representation of female policyholders still falls short of parity with

male policyholders. The growth trend of the policy holders over the years reveals the trend of gender wise differences.

Figure: 1 .Growth rate Trend of Policies by Ownership



Source: Annual Report IRDA

b. Gender wise distribution of policy holders in LIC and private insurance companies

The gender-wise distribution of policyholders in LIC (Life Insurance Corporation of India) and private insurance companies also reflects the differences in life insurance ownership between men and women in India.

Table-2: Gender wise distribution of policy holders in LIC and private insurance companies

Year	LIC		Private Insurer	
	Female	Male	Female	Male
2017-18	38%	6%	29%	71%
2018-19	36%	64%	30%	70%
2019-20	36%	64%	29%	71%

2020-21	**35%**	**65%**	**27%**	**73%**
2021-22	**34%**	**66%**	**27%**	**73%**
2022-23	**33%**	**67%**	**27%**	**73%**

Source : Annual Reports of IRDA

LIC demonstrates higher female inclusion compared to private insurers, with female policyholders. Over time, female participation has declined in both segments, with LIC showing a drop from 36% to 33% and private insurers declining from 30% in the first year to 27% from the third year onwards.

2. Proportion of Policies Bought by Women in States/UTs

The proportion of insurance policies purchased by women across various States and Union Territories (UTs) reveals the gender difference in life insurance investments across states.

Table-3 Proportion of Policies Bought by Women in States/UTs (2017-18 to 2022-23)

Year	Top5 States/UTs (Highest Proportion of Policies Bought by Women)	Share (%)	Bottom 5 States/UTs (Lowest Proportion of Policies Bought by Women)	Share (%)	All-India Average (%)	States/UTs AboveAll India Average
2022-23	Karnataka	44	Ladakh	23	34.2	15
	Kerala	44	Haryana	27		
	Mizoram	43	Jammu & Kashmir	28		
	Sikkim	43	Uttar Pradesh	30		

Year	Top 5States/UTs (Highest Proportion of Policies Bought by Women)	Share (%)	Bottom 5 States/UTs (Lowest Proportion of Policies Bought by Women)	Share (%)	All-India Average (%)	States/UTs Above All India Average
	Meghalaya	42	Gujarat	30		
2021-22	Karnataka	45	Jammu & Kashmir	26	34.7	16
	Kerala	44	Ladakh	26		
	Sikkim	42	Haryana	27		
	Goa	42	Rajasthan	30		
	Arunachal Pradesh	41	Uttar Pradesh	30		
2020-21	Kerala	43	Haryana	27	33.0	19
	Sikkim	41	Jammu &Kashmir	27		
	Andra Pradesh	40	Gujarat	28		
	Lakshadweep	40	Uttar Pradesh	29		
	Puducherry	40	Rajasthan	30		
2019-20	Kerala	43	Diu-Daman-Dadra & Nagar Haveli	19	32.0	18
	Andhra Pradesh	40	Ladakh	22		
	Mizoram	40	Haryana	27		
	Puducherry	39	Gujarat	27		
	Tamil Nadu	38	Jammu & Kashmir	27		
2018-19	West Bengal,	59	Sikkim	11	36.0	17
	Meghalaya	49	Dadar & Nagar Haveli,	19		
	Manipur	46	Punjab	22		
	Assam	46	Gujarat,	23		
	Arunachal Pradesh	44	Tamil Nadu	27		
	Lakshadweep	55	Jammu & Kashmir	24		

2017-18	**Puducherry**	**43**	**Haryana**	**27**	**32.0**	**19**
	Kerala	**43**	**Gujarat**	**27**		
	Mizoram	**41**	**Uttar Pradesh**	**28**		
	Sikkim	**40**	**Jharkhand**	**28**		

Source: IRDAI Annual Reports 2017-18 to 2022-23

Kerala consistently leads among states with strong female policyholder engagement, driven by high literacy and progressive gender norms. Sikkim has made remarkable progress, moving from the lowest rank in 2018-19 to a top performer, while Karnataka and Mizoram also show strong outcomes, reflecting successful outreach efforts. In contrast, states like Jammu & Kashmir, Haryana, Gujarat, and Uttar Pradesh consistently underperform due to barriers such as patriarchalnorms, lower literacy, and limited financial access. Challenges in low-performing states stem from socio-economic and cultural barriers, highlighting the need for tailored strategies.

3. Factors affecting gender differences in life insurance ownership and investment

Various economical, social and cultural factors leading to the gender disparities in life insurance investments.

Table -4 Factors affecting gender differences in life insurance ownership and investment.

Category	Factors	Details
Economic Factors	**Income Disparities**	**Women earn less due to the gender wage gap, reducing disposable income for life insurance.**
		Participation in the informal economy limits access to financial benefits like insurance.
	Financial Independence	**Men are often considered primary breadwinners,**

		prioritizing their insurance over women's.
	Employment Patterns	**Women dominate part-time or low-paying jobs, restricting access to employer-sponsored plans.**
		Careers interrupted by caregiving reduce women's financial contributions to life insurance.
	Access to Financial Literacy	**Limited access to financial education affects women's informed decisions on investments.**
Social Factors	**Traditional Gender Roles**	**Societal norms assign men as providers and women as caregivers, deprioritizing women's insurance.**
		Unpaid care giving reduces the perceived value of insuring women.
	Dependence on Spousal Coverage	**Women often rely on their spouse's life insurance policies, creating a gender gap.**
	Risk Aversion	**Women's higher risk aversion influences investment decisions, reducing life insurance uptake.**
	Family Dynamics	**Joint household decisions often reflect male dominance, affecting women's insurance coverage.**
Cultural Factors	**Patriarchal Norms**	**Assets and investments are commonly held in men's names, reinforcing inequality in ownership.**
	Perception of Women's Economic Value	**Women's contributions are undervalued, leading to lower prioritization of their insurance.**

	Marriage and	**Cultures focused on marriage and childbearing de-emphasize women's financial independence.**
	Religious Beliefs	**Certain ideologies discourage women's involvement in financial decisions, including insurance.**

Source : Annual Report , IRDA

Economic factors such as income disparities from the gender wage gap and women's participation in the informal economy limit their ability to invest in life insurance. Additionally, limited financial literacy reduces women's ability to make informed investment decisions. Many women rely on spousal coverage and are influenced by family dynamics where joint decisions often favour male dominance. Women's higher risk aversion also impacts their willingness to invest in life insurance. Assets and investments are typically held in men's names, and cultural practices emphasizing marriage and childbearing de-emphasize women's financial independence. Religious beliefs in some communities further discourage women's involvement in financial decision- making, including life insurance.

4. Existing Policies and Programs to Reduce Gender Disparities in Life Insurance Investments

Governments, insurers, and financial institutions are implementing various initiatives to address gender disparities in life insurance ownership and investment. These efforts focus on economic empowerment, awareness, and accessibility for women. Below is an overview of such policies and programs.

Table -6: Initiatives Supporting Women's Investment in Life Insurance

Category	Subcategory	Details
1.Government Initiatives	**Women-Centric**	**Pradhan Mantri Jeevan Jyoti Bima Yojana (PMJJBY): Affordable**

	Subsidies and Schemes	**insurance targeting rural and low-income women.**
		SEWA Insurance (India): Tailored for women in informal sectors to ensure family security.
	Financial Inclusion Policies	**Jan Dhan Yojana (India): Promotes financial literacy and access to insurance and savings.**
		Microinsurance Schemes: Government partnerships to provide affordable insurance for marginalized women.
	Tax Benefits	**Women-specific tax incentives on life insurance premiums to encourage investment.**
	IRDAI'sBima Vahak Initiative	**Women-centric distribution channel in every Gram Panchayat by Dec 31, 2024.**
		Expanded role for Bima Vahaks: Proposal collection, KYC management,and claims coordination.
		Removed restrictions on partnerships with insurers for greater flexibility.
		Promotion of electronic payments for seamless premium remittance.
	IRDAI's Bima Vistaar Initiative	**Comprehensive, affordable insurance products covering life, health, and property.**
		Focused on rural households, encouraging women to adopt social security measures.
		Aimed at achieving universal insurance coverage by 2047.
2.Insurer-	**Women-**	**Policies tailored to women's needs,**

Driven Programs	**Focused Insurance Products**	**including maternity benefits and child-related savings. Examples: LIC Jeevan Bharati II (India).**
	Microinsurance for Low-Income Women	**Collaboration with NGOs and MFIs to offer affordable life insurance in underserved areas.**
	Customized Coverage Plans	**Policies addressing women-specific risks (e.g., health concerns, maternity costs).**
	Marketing and Outreach	**Campaigns and partnerships with self-help groups to raise awareness and simplify processes.**
3.Financial Literacy Programs	**Educational Workshops**	**Conducted by public and private organizations to improve women's financial planning knowledge. Example: RBI's Financial Literacy Centers (India).**
	Digital Tools	**Mobile apps, chatbots, and helplines providing easy access to insurance information.**
	Inclusion in School Curricula	**Financial literacy education with a focus on empowering young girls.**
4.Microfinance andCommunity-Based Efforts	**MicrofinanceInstitutions (MFIs)**	**Bundling microloans with life insurance for women entrepreneurs.**
	CommunityInsurance Groups	**Grassroots programs encouraging collective investment in group insurance plans.**
	Gender-Specific Insurance Agents	**Hiring female agents to overcome cultural barriers and improve trust in rural areas.**

Source: Annual Report IRDA

Government initiatives play a crucial role in promoting women's inclusion in life insurance. Programs like Pradhan Mantri Jeevan Jyoti Bima Yojana and SEWA Insurance offer affordable coverage tailored to rural and low-income women, while financial inclusion policies like Jan Dhan Yojana enhance access to insurance and savings. Micro insurance schemes target marginalized women, and tax incentives encourage investment. Insurers also contribute through specialized products addressing women's needs, such as maternity benefits and child-related savings. Financial literacy programs, including workshops and digital tools, enhance women's understanding of financial planning. Community-based efforts, such as microfinance institutions bundling loans with insurance and grassroots programs promoting group investments, further enhance accessibility. Hiring female insurance agents in rural areas helps overcome cultural barriers and builds trust, ensuring more inclusive insurance adoption for women.

4. Conclusion

In India, stark gender disparities persist in life insurance investments, driven by a complex interplay of social, economic, and cultural factors that influence how men and women perceive, access, and prioritize life insurance coverage. Women appear to have a stronger presence as policyholders in the Life Insurance Corporation of India (LIC) compared to private insurers. This suggests that private insurance companies could benefit from adopting LIC's best practices to enhance female representation in their customer base.

By addressing existing challenges and scaling up effective initiatives, the gender gap in life insurance ownership and investment can be significantly reduced. To fully unlock this potential, policymakers and insurance companies must design products and strategies tailored to the specific needs and preferences of female policyholders. This approach will not only foster greater participation but also empower women to take charge of their financial security with confidence, ensuring their active and sustained engagement in the insurance sector.

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VAKKAM ABDUL KHADAR MOULAVI : "A PILLAR OF RELIGIOUS AND CULTURAL RENAISSANCE IN KERALA"

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ABSTRACT

This paper explores the life and legacy of Vakkam Abdulkhadar Moulavi , A pillar of Religious and cultural renaissance in kerala. Renaissance has been one of the most significant discussion in the study of Kerala. Vakkam Moulaviis known to the Keralites as an enterpriser owning the swadeshabhimani press having swadeshabhimani Ramakrishna Pillai as its editor, Abdul Khadar Moulavi of Vakkam a leader of the muslim community. This piece of work traces the origin, development and results of the Socio-religious movements which have changed muslim society in kerala in 19th and 20th century.

Vakkom Abdul Khader Moulavi is known as the father of the Kerala Renaissance. He is a prominent spokesperson who worked for the upliftment of Muslims in Kerala. The educational backwardness of the Muslim community led Moulavi to the public sphere and revivalist activities. Following the example of Narayana Guru, he urged Muslims to study and become independent and to organise and become strong. He has advocated and worked for the advancement of education for Muslim girls. He served as the chairman of the Muslim Board of the Travancore government. The Arabic and English languages were spread among all peoples. He wrote many works in Malayalam, Arabic, and Arabic-Malayalam languages. The first magazine was launched in 1906 under the name Muslim. Vakkom Moulavi said, "The rich should bear the cost of educating the poor and help them get higher education."At a time when many in the Muslim community were opposed to modern education, the Moulavi exerted strong influence on the government to establish Malayalam and English medium schools in Muslim settlements. VakkomMoulavi, who led the Kerala Muslim community, which

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was mired in ignorance, superstitions and immorality, by shedding the light of knowledge through his writings and lectures, is also known as the leader of the Islamic movement in Kerala.

Vakkom Abdul Khadar Moulavi (1873-1932) was a visionary Islamic scholar, social reformer, journalist, and freedom fighter from Kerala, India. His tireless efforts to promote Islamic education, social reform, and cultural revival have left an indelible mark on Kerala's history. This essay explores Moulavi's life, contributions, and legacy, highlighting his pivotal role in shaping Kerala's religious and cultural landscape.

Key words: Renaissance, religion, Muslim community, education.

1. Indroduction

Vakkom Moulavi, a prominent leader of the Kerala Revival, was known to Keralites as the owner of the Swadeshabhimani Press, a well-known orator in Travancore, and an architect of radical political ideas. The socio-religious movements in Kerala were not confined to the Hindu community. Educationally backward and affected by the winds of change, one of the best contributions of the British rule in India was the introduction of modern and secular education. For various reasons, the Muslim community in India had distanced itself from the British. The Islamic revival reached Kerala in the last quarter of the 19th century through the hard work of enlightened scholars and reformers like Makthi Thangal, Hamadani Thangal, and Vakkom Moulavi, the religious organizations formed in the later period.

Vakkom Abdul Moulavi was one of the best social reformers among Muslims. He encouraged Muslims to get English education and to actively participate in modern progressive movements. He published two magazines, “Muslim” and “Deepika” under his own editorship. On January 19, 1905, he started a weekly newspaper, “Swadeshabhimani”, from Anjuthengu. “A nation will not be developed by the greed of the fearful” was the motto of the Swadeshabhimani newspaper. Since education is essential for human progress and to overcome social backwardness, he devoted his life to it. Abdul Khadar Moulavi became proficient in Arabic within a short time. He acquired deep knowledge in the Quran, Sunnah, logic, Islamic jurisprudence and Islamic history, and he is a magnificent and powerful writer in Malayalam.

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He analysed the problems intelligently and correctly diagnosed the disease affecting his community. He founded several organizations. Many schools were established on his model. VakkomMoulavi, who was a wealthy man, devoted his wealth, health and time entirely to this. Books and newspaper publications were the main areas of his interest. The home environment played a decisive role in shaping his tastes and personality. 'Al-Islam', which started publication in Arabic and Malayalam in 1918, was also short-lived. Although these publications caused heavy financial losses, he was not ready to compromise on any ideals. Moulavi formed the 'Akhila Travancore Muslim Mahajana Sabha' to maintain unity in the Muslim community. The community organization called 'Nishpaksha Sangham' formed in Kodungallur became the 'Muslim Aikya Sangham' in 1932 under his leadership.

Gandhiji's life and methods of work influenced him. He also attended the Congress session held at Ottapalam in 1921. Moulavi met Gandhiji when he came to Kerala following the Vaikom Satyagraha. Vakkom Moulavi also had to face opposition from conservatives in his own community during his social reform activities. In 1931, he started a publishing house called 'Islamia Publishing House'.

2. Early Life

Moulavi was born in 1873 in Vakkom, Chirayinkil Taluk, Thiruvananthapuram. His family had ancestral roots to Madurai and Hyderabad, and many of his relatives had worked for the military of the state government. Moulavi as proficient in many languages including Arabic, Hindusthani, Persian, Tamil, Sanskrit and English.

His father, a prominent merchant, engaged a number of scholars from distant places, including an itinerant Arab savant, to teach him every subject he wished to learn. Moulavi made such rapid progress, that some of his teachers soon found that their stock of knowledge was exhausted and at least one of them admitted that had learnt from his student more than he could teach him.

In 1901, Vakkom Moulavi married Halima, a member of a wealthy family in Kayalpuram, Ayrur, near Varkala. With the death of his father in 1902, the entire burden of the family fell on Moulavi's shoulders. Not long after, Moulavi Sahib's wife died prematurely. Later, he married Amina, the younger sister of his first wife.

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Moulavi's son Abdul Khadar(Junior) was a writer, and another son, Mohammed Eeza was a writer and scholar of Islamic studies. One of his nephews, Vakkom Majeed, was an Indian freedom fighter and a former member of Travancore-Cochin State Assembly and another nephew, P.Habeeb Mohamed, was the first Muslim judge of the Travancore High Court of Kerala.

His wide reading and quest for knowledge helped him shape a national outlook and realise the importance of education for social development. Through foreign publications and books, he was in touch with what was happening around the world, be it matters to do with Islam, science or geopolitics.

Before the age of 30, he had a patriotic heart beating fervently within him. He believed in the critical role of media in social reformation and in achieving and protecting civil rights and liberty. He questioned the ‘divinity’ of the royal and stood up for the rights of the people as citizens and not as mere ‘subjects’ of a king.

In 1905, at the young age of 32, he launched Swadeshabhimani (ThePatriot) as a weekly newspaper. It was not to uplift the Muslim community in and around him but to empower the citizens of Travancore, to make them aware of their rights to freedom and liberty, and to remind the royal rulers and the dewans appointed by the British that the people of the land were not ‘subjects’. He was championing the democratic rights at a time when civil rights movement had not gained any momentum across India.

Abdul Khader had a close relationship with his father's friend Sree Narayana Guru. The educational backwardness of the Muslim community made him a social worker. He called for independence through education and organizing and becoming strong, following the example of Sree Narayana Guru. By this time, he had come to be known as VakkomMoulavi. The Moulavi , who discovered that inculcating the habit of reading was the way to acquire knowledge, decided to publish newspapers, magazines, etc. On January 19, 1905, he started a weekly newspaper called 'Swadeshabhimani' from Anjuthengu. He bought the best paper from abroad and brought it by ship. C.P. Govinda Pillai was the first editor. In 1906, the newspaper was shifted to Vakkom. K. Ramakrishna Pillai took over as the editor. In 1907, the publication was shifted to Thiruvananthapuram. 'Swadeshabhimani' railed against the misdeeds of the Travancore government. It had to pay a heavy

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price for this. The newspaper was banned on September 26, 1910, by order of Diwan P. Rajagopalachari. The press was confiscated and the editor K. Ramakrishna Pillai was exiled. If there had not been a newspaper owner like VakkomMoulavi, it would have been difficult for an editor like Ramakrishna Pillai to emerge.

3. Kerala Renaissance

As power has always been in the hands of the upper caste, a section of the population has always been made untouchable. The upper caste feared that if the minority community achieved educational and social advancement, they would quickly reach the mainstream and that would destroy their very existence. This strategy of denying the rights of the basic classes and not allowing them to grow has been used by the upper caste for centuries.

Since even the kings of Kerala lived under the Brahmins, economic, social and administrative power was vested in the Brahmins, and a person from the lower caste who had obtained higher education from outside Kerala could not get a job according to his qualifications. The elite classes prepared the laws and convinced the lower class that only that was the right religion. Social reform movements were formed by creating a strong resistance against untouchability and immorality, which were the consequences of the upper caste-centered power system. The word 'renaissance' became popular in the early 1970s. The term 'Renaissance' was coined by Canadian missionary Roland Miller to replace the term 'Renaissance', in reference to the rebellion of Protestant groups against the Christian priesthood in Europe and many parts of America. Religious reform movements emerged as a way of escaping the mental and physical hardships caused by the British invasion. Most historical records suggest that the Muslim renaissance in Kerala was inspired by the Islamic reform movements that emerged in the Arab world in the late 19th and early 20th centuries.

4. The Religion Reform

Like all other religious communities, 19th century marked the beginning of reform initiatives and movements within the Islam as well. This was a time when some concerned personalities of Muslim community started raising their voices against certain so called `unIslamic' practices which were inflicted into

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the religion by the Ulema of vested interests over a period of time. The early reform movements were both reformist as well as revivalist. On the one hand they tried to purify Islam from all later accretions, which run contrary to its original teachings, on the other, they tried to uplift the community through secular education, stressing even on the education of women. The reform movements contributed much to strengthen the community identity as these reforms were directed against un-Islamic practices and customs. But neither the early reformers, nor the later reformers were against the tenets of the texts of Islam, Quran and Hadith. Veliyankot Umar Qazi, Sayyid Sanaullah Makthi Thangal, Chalilakat Kunhamad Haji, Sheikh Muhammad.

Hamadani Thangal, E.K. Moulavi, Vakkom Abdul Khadar Moulavi were prominent personalities associated with the socio-religious reform movements of Muslims in Kerala.

The Muslims of Kerala had been completing their religious education in a traditional way. The Arabic Alphabet, reading the Holy Quran and some Baith or Moulids or Malapattu their curricula in their primary education. Moulavi started a movement that provided proper religious education, based on the Quran and Sunna of the prophet (s) to eradicate all the superstitious beliefs and practices of the Muslims. Moulavi eleased a journal, Al Muslim and published article on the title Islahu Diniya, which advised his followers to wage a struggle to revive pristine Islam.

Moulavi soon felt that, Al-Muslim, published in Malayalam language, was not useful to majority of Muslims, especially to women. He therefore started another journal entitled Al-Islam in Arabic-Malayalam in 1918, the popular language of Muslim Community. He also conducted public lectures and distributed pamphlets among Muslim explaining Shirk and Tauhid. Moreover he started an organization called Islam Darma Paripalana Sangam at Nilakkal Mukku in 1918 for the same. He wrote an introduction to Holy Quran to emphasis on the reading of the Quran with the translation. Apart from these he translated Kimiya e sa'adat written by Imam Al-Ghazali to Malayalam language. All these helped to create a renaissance in the Muslim community.

5. Social Reformation

Moulavi is considered as one of the greatest reformers in Kerala Muslim community and is referred to as the "Father of Muslim renaissance".He

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emphasised the religious and socio economics aspects much more than the ritualistic aspects of religion. He also campaigned for the need for modern education, the education of women and the elimination of potentially bad customs among the Muslim community. Influenced by the writings of Muhammed Abdah of Egypt and his reform movement, Moulavi started journals in Arabi-Malayalam and in Malayalam modelled on Al-Manar.

The 'Muslims' was launched in January 1906 and was followed by Al-Islam and Deepika. Through these publications, he tried to teach the Muslim community the basic tenants of Islam. Al-Islam began publishing in April 1918 and played a pivotal role in Muslim renaissance in Kerala. It opposed Nerchas and Uroos festivals among the Muslim community, thereby attracting opposition from the orthodox ulema to the extent that they issued a fatwa declaring the reading of it as sacrilege. Financial troubles and lack of leadership led to the closure of the journal within five issues, but it is regarded as the pioneer journal that attempted religious reform amongst Mappilas of Kerala.While it was published in Malayalam language using Arabi-Malayalam script, Muslim and Deepika used Malayalam in script also.

As a result of the continuous campaigning of Moulavi throughout the state, the Maharaja's Government introduced the teaching of Arabic in all state schools where there were Muslim pupils, and offered them fee concessions and scholarships. Girls were totally exempted from payment of fees. Moulavi wrote text books for children to learn Arabic, and a manual for training Arabic instructors for primary schools. At the instance of Moulavi Abdul Kader the state Government soon instituted qualifying examinations for Arabic teachers of which he was made the chief examiner.

6. Vakkam Moulavi’s Activities For Education

Vakkam Abdul Kadar Moulavi was one of those rare men whose greatness was recognized while he was alive, being the chief architect and a towering leaders of Muslim revivalism. His unparalleled intellectual approach towards the milieu of Muslims in Kerala made an enormous impetus in the socio-educational arena. Moulavi imbibed religious as well as general education ideas from various scholars of the world and he endeavoured to disseminate the light of knowledge across the State. In order to overcome the distressing backwardness of the Muslims in the state, he forecasted a definite and realistic

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groundwork for the social and educational upliftment of the community. Studious and intelligent Abdul Khader soon became proficient in different languages like English, Persian, Urdu, Hindi, Sanskrit, as well as Arabic. He acquired immense knowledge through his untiring efforts and became a master of a wide variety of subjects.On finding that most of the Muslim masses were illiterate in their mother-tongue Malayalam, Moulavi resorted to the use of Arabi-Malayalam, it was written in Arabic script, adapted to suit the Malayalam alphabet. It was an attempt to provide for the Muslim common folks a special medium for their religious literature.

The government appointed Vakkam Moulavi as the Inspector of Muhammadan Schools. He had been entrusted to prepare a curriculum for the scientific execution of secondary education under this board. For the promotion of Muslim education, the Maharajas of Travancore extended very much assistance to the Muslim pupils. Special fee concession was granted to Muslim children, Arabic Munshis were appointed in elementary schools from the year 1915 - 1916, Arabic has been announced as a second language, six Muslim vernacular schools were opened in 1918 - 1919 and a number of these schools were extended in 1923 - 1924.

In order to further the expansion of Muslim education in the State an Arabic Examination Board was constituted; Vakkam Moulavi was made the president and Member of the board. It was this board that drafted the syllabi and the text books for the different classes.

Moulavi prepared curriculum for Arabic teaching in the State. He prepared a few books like Ta'leemul Quran and Adduroosul Adabiya for Primary and secondary classes respectively. His work Ahkamut Tajweed was exclusively written for the Quran teachers.*ii During the academic year 1946-47 the total number of enrolment was 46,261, out of which around one third of the students were girls. It was one of the most remarkable achievements ever witnessed in the educational history of Muslims in Travancore. This huge jump of the community in the sphere of modern female education was the outcome of relentless work rendered by moulavi. . Moulavi had given the lead to educational efforts in Travancore and Cochin. Under his inspiring leadership several local organization like Lajnathul Muhammaduya Sangham of Alappuzha, Lajannathul Hamdaniof Azhikkode and several others interested themselves in education. An Arabic teacher was also appointed to teach Arabic

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in the school. In April, 1915 when Maharaja Srimulam Thirunal visited Alleppey, the LajnattulMuhammadiyaSangham submitted a memorandum detailing the difficulties experienced by the community in the field of education. In response to this petition, the Government took the following steps. Moulavi was unlike other reformers of the community, not only was he sitting somewhere and writing some meaningful articles but also he maintained a close association with government authorities, thereby he could bring to their notice, the distressing matters of Muslims.

7. Swadeshabhimani

Swadeshabhimani was a newspaper published in Travancore, which was banned and confiscated by the Government of Travancore in 1910 due to its criticisms against the government and the Diwan of Travancore, P Rajagopalajari. Vakkom Muhammed Abdul Khadar Moulavi alias Vakkom Moulavi founded the weekly newspaper on January 19, 1905, to spearhead the fight against corruption and to struggle for the democratic rights of the people in Travancore. He managed to import, directly from England, an automatic flatbed printing press, the latest type then available. The press operated from Anjuthengu (Anglican: Anjengo), a British colony at the time directly ruled by British East India Company.

C P Govinda Pillai was the editor of before Ramakrishna Pillai took over as the editor in January 1906.Ramakrishna Pillai and his family had to shift to Vakkom in Chirayinkil Taluk where the newspaper office and the printing press were located.

In July 1907, both the newspaper office and the family moved to Thiruvananthapuram. Though Vakkom Moulavi was still the proprietor, Ramakrishna had been given total freedom in the running of the newspaper by Moulavi. Although there were never any legal or financial contracts between the two, Moulavi provided all the financial aid to set up the press.

On 26 September 1910, the newspaper and the printing press were sealed and confiscated by the British Police. Ramakrishna Pillai was arrested and banished from Travancore to Tirunelveli in Madras Province of British Raj.
In 1957, after the Independence of India, the Government of Kerala returned the press to Moulavi's family and son Abdul Khadar. On 26 January 1968, the then Chief Minister of Kerala, E M S Namboothiripad, presented it to the legal heirs of Moulavi Abdul Khadar at a public meeting, 36 years after his death.

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8. Conclusion

Vakkom Abdul Khadar Moulavi was a visionary leader who played a pivotal role in shaping Kerala's religious and cultural landscape. Through his tireless efforts to promote Islamic education, social reform, and cultural revival, Moulavi inspired a generation of scholars, reformers, and community leaders. His legacy continues to inspire and influence contemporary Kerala society, politics, and culture, cementing his place as a pillar of Kerala's religious and cultural renaissance.

Moulavi initiated press for making Muslim community in its modern fashion. However, efforts were not limited to that of his own community. The attempt was to envisage larger civil communities were within every Muslim individual who could have his role as citizens for a responsible government. Moulavi known to the general Kerala society as the entrepreneur behind 'Swadeshabhimani' press had been involved in the modernization efforts that were initiated by other social reformers. Moulavi tried to combine both the Arab world's Islamic ideas along with native Muslim's view for achieving the desired levels of mobility.

He championed the cause of modern education for Muslims with due emphasis on having its reach to the women among the community. He also pioneered the cause of press for addressing the general issues applicable to everyone. His activities were not limited to the Muslims of Kerala but were for the whole people of Kerala. Moulavi got influence by the reformist efforts of Sir Syed Ahmad Khan and Shah Waliullah of Delhi. He fought against corruption and to fight for the democratic rights of the people. He modernise Islam and also to avail the positive results of modern education to the new generation of Islamic.

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A COMPARATIVE ANALYSIS OF PHYSICAL ACTIVITY AND EATING ATTITUDES BETWEEN SPORTS HOSTEL ATHLETES AND DAY SCHOLAR ATHLETES IN KERALA

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ABSTRACT

This study explores the physical activity attitudes and eating behaviors of sports hostel athletes and day scholar-athletes, with a focus on the impact of living arrangements. The physical activity and dietary habits of athletes play a critical role in their overall performance and health. Sports hostel athletes benefit from a structured environment, which provides consistent access to training facilities, nutritious meals, and professional coaching, promoting positive attitudes towards physical activity and diet. In contrast, day scholar-athletes face challenges such as irregular access to training facilities, time constraints, and unstructured meal plans. The study gathered data from 50 sports hostel athletes and 50 day scholar-athletes, aged 18 to 25, using validated Physical Activity and Eating Attitude Scales. The results indicated significant differences between the two groups, with sports hostel athletes scoring higher on both scales. Statistical analysis revealed a p-value of < 0.00001, signifying the importance of structured living arrangements for fostering positive physical activity and eating habits. The findings underscore the need for targeted interventions to support day scholar-athletes in improving their physical activity attitudes and dietary behaviors.

Keywords: Physical Activity Attitudes, Eating Behaviors, Sports Hostel Athletes

1. Introduction

The study examines the physical activity attitudes and eating behaviors of sports hostel athletes and day scholar-athletes, highlighting the impact of

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living arrangements on these crucial aspects. Athletes' physical activity and dietary habits are essential determinants of their overall performance and health. Sports hostel athletes benefit from a structured environment with access to training facilities, nutritious meals, and professional coaching, fostering positive attitudes. Conversely, day scholar athletes face challenges such as inconsistent access to training grounds, time constraints, and unstructured meal plans, which may affect their attitudes and behaviors. By analyzing and comparing these two groups, the study aims to identify the differences in their attitudes and explore potential areas for improvement.

Reference Link:
https://www.mdpi.com/1660-4601/16/6/919

2. Materials and methods

2.1. Participants

The study included 50 sports hostel athletes and 50 day scholar-athletes, aged 18 to 25, from colleges affiliated with the Kerala State Sports Council.

2.2. Measures

Data were collected using two main validated instruments:

- Physical Activity Attitude Scale
- Eating Attitude Scale

Both scales consist of Likert-type items to assess athletes' attitudes toward physical activity and eating behaviors.

2.3. Procedures

Participants were asked to complete the scales voluntarily in controlled settings. This procedure ensured accurate responses regarding their physical activity attitudes and eating behaviors.

2.4. Analysis

Statistical analysis was performed using t-tests to compare the mean scores between sports hostel athletes and day scholar-athletes. The analysis showed that sports hostel athletes had higher scores on both the Physical Activity Attitude Scale and the Eating Attitude Scale, with a p-value of < 0.00001, confirming statistical significance.

2.5. Instruments

Physical Activity Attitude Scale: A validated instrument to assess attitudes toward physical activity.

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Eating Attitude Scale: A validated tool to evaluate eating behaviors and attitudes.

2.6. Software

SPSS software was used to perform the statistical analysis. The t-test results confirmed significant differences between the two groups, with a p-value of 0.00001, indicating meaningful disparities in physical activity and eating attitudes.

Results and Discussion

The analysis revealed that sports hostel athletes scored significantly higher on both the Physical Activity Attitude Scale (mean = 294.44) and the Eating Attitude Scale (mean = 294.44) when compared to day scholar-athletes (Physical Activity mean = 277.5; Eating Attitude mean = 277.5). The standard deviations indicated greater variance among sports hostel athletes, with a standard deviation of 16.73, suggesting a wider range of responses but consistently higher scores compared to their day scholar counterparts (standard deviation = 11.80). The difference between the two groups was statistically significant, with a p-value of < 0.00001, much smaller than the standard significance level of 0.05. This confirmed that the difference in physical activity attitudes between sports hostel athletes and day scholar-athletes was unlikely to have occurred by chance, highlighting a meaningful disparity in their physical activity and eating behaviors.

TOTAL RESPONSES IN EACH CATEGORY

Sl No	Group	Variable	Total Response					
			Strongly Disagree	Disagree	Mildly Disagree	Mildly Agree	Agree	Strongly Agree
1	Physical Activity Attitude	Sports Hostel Athletes	122	566	532	630	1056	594

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		Day Scholar Athletes	62	668	598	615	1258	299
			Never	**Rarely**	**Sometime**	**Often**	**Usually**	**Always**
2	Eating Attitude	Sports Hostel Athletes	448	68	28	106	260	140
		Day Scholar Athletes	372	288	320	138	170	12

TOTAL SCALE POINTS SCORED BY RESPONDENTS

Items	**Total Scores**		**Total Scores**	
	Physical Activity Attitude		**Eating Attitude**	
	Sports Hostel Athletes	**Day Scholar Athletes**		**Sports Hostel Athletes**
Mean	294.44	277.5	Mean	294.44
SD	16.73218	11.79632	7.354022	6.848089
T value	5.851		11.08991	
P value	.00001		.00001	

The findings of the study emphasize the critical role of boarding facilities in shaping athletes' habits. Sports hostel athletes benefit from structured environments, providing consistent access to training facilities, professional coaching, and nutritious meals, which foster more favorable physical activity and eating attitudes. On the other hand, day scholar athletes face logistical challenges such as inconsistent access to training grounds, time constraints, and unstructured meal plans. These challenges likely contribute to their comparatively less favorable attitudes toward physical activity and diet.

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The analysis stresses that sports hostels offer a supportive ecosystem that enhances focus and discipline, leading to better management of both physical activity and eating habits. In contrast, day scholar athletes need targeted interventions, including reliable transportation, structured training schedules, and access to balanced meals, to bridge the gap in their athletic and nutritional attitudes. These findings underscore the importance of equitable resource allocation and the development of strategic support systems for day scholars, ensuring parity in athletic and nutritional attitudes, which would promote holistic development and better performance across all athletes.

Conclusion and Recommendations

The study underscores the significant role of structured environments in shaping athletes' attitudes toward physical activity and eating behaviors. Sports hostel athletes consistently exhibited superior attitudes compared to day scholar athletes, primarily due to access to regular training facilities, nutritious meals, and a conducive living environment. In contrast, day scholar athletes faced logistical challenges, such as irregular training schedules and limited access to facilities and balanced meals, which contributed to less favorable attitudes.

The findings suggest that addressing these disparities by providing day scholar-athletes with reliable transportation, organized training schedules, and access to nutritious food is crucial in bridging the gap. Such measures can foster positive changes in attitudes similar to those observed in sports hostel athletes, ultimately enhancing athletic performance and overall well-being.

To improve the physical activity and eating attitudes of day scholar-athletes, it is essential to implement structured support systems. Providing consistent access to facilities, transportation, and well-planned nutrition would create an environment that nurtures athletes' holistic development. This approach would ensure more equitable opportunities for all athletes, leading to improved athletic outcomes and promoting well-being in both sports hostel and day scholar athletes alike.

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ANALYSIS OF ENDOPHYTIC BACTERIA IN SELECTED MEDICINAL PLANTS: *PIPER LONGUM* L. AND *PIPER CHABA* HUNTER

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ABSTRACT

This project aims to analyze the endophytic bacteria present in two selected medicinal adulterant plants, *Piper longum* and *Piper chaba.*The samples are collected from Kottakkal Arya Vaidya shala. The objectives involve estimating the endophyte bacteria present in the piper sp. that have been used as adulterant in medicinal plants and assess the diversity and composition of Endophyte bacteria in these plants and compare them with those in authentic medicinal plants.The research explores molecular methods like 16S rRNA gene sequencing.The findings of this study will shed light on the endophytic bacterial population associated with these therapeutic plants and their possible applications in the agricultural and pharmaceutical Certain endophytic bacteria identified in the study are known to have beneficial effects on plant development and health. Research on *Piper longum* revealed that endophytic bacteria from the *Bacillus* genus can produce antibiotic substances that inhibit harmful bacteria. Similarly, research on *Piper chaba* identified endophytic bacteria that produce antioxidant compounds with potential pharmaceutical applications.

Keywords : *Piper longum*, *Piper chaba*, Endophytic Bacteria, 16S rRNA

1. Introduction

An endophyte is an endosymbiont, typically a bacterium or fungus, Endophytes are non-pathogenic organisms that live within plant tissues for a portion of their life cycle (Rosenblueth & Martínez-Romero. (2006).

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Endophytic bacteria, which interact closely with their host, are an essential part of the plant microbiome, These interactions enhance plant tolerance to environmental changes as well as promote plant growth, thus they have become attractive targets for increasing crop production (Pinski, A., Betekhtin, A., Hupert-Kocurek, K., Mur, L. A. J., & Hasterok, R. (2019).Some endophytes may promote host development and nutrient acquisition while also improving the plant's ability to handle abiotic conditions such as drought and reducing biotic stresses by increasing plant resistance to insects, diseases, and herbivores.Although endophytic bacteria and fungi are well studied, endophytic archaea are increasingly being investigated for their function in plant growth promotion as part of a plant's core microbiome(chow et al.(2022).Endophytic bacteria colonize the interior tissues of all plants investigated. Endophytic bacteria, unlike phytopathogens, do not harm the host. Instead, they can benefit the plant by providing defense against pests. infections and enhanced growth and development by the generation of plant growth-promoting chemicals and/or nitrogen fixation from the atmosphere (Glick, 2012; Mercado Blanco &Lugtenberg,2014).

Medicinal plants and their associated endophytic bacteria were collected. Our study and analysis revealed mutually beneficial connections between bacterial endophytes. The collected plant samples included members from piperaceae family, piper longum & piper chaba. P. longum, a member of the Piperaceae family, is a popular medicinal plant in India. The smooth, hairless, scrambling shrub known as Piper chaba Hunter is found in India. (Kirtikar K.R & Basu B.D.,(1987). piper longum is used as an adulterant instead of piper chaba (Kumar P.S (2014).

Adulterants are similar to the original medicine in terms of morphology, chemical composition, and therapeutic properties, but are of lower quality and less expensive. This is the most prevalent sort of adulteration (Kokate et al., 2007; Dubey et al., 2004).The adulterated drugs is found to that there are adverse event reports , that are present due to the usage of adulterant herbs (De S et al., 1992).In such cases it is essential to sensitize the masses of the plant based medicine systems helps to identify the plant properly (Thakur R,et al .,2018).

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The study is relevant as endophytic bacteria plays a crucial role in growth and development of medicinal plants, by understanding the diversity and function of Endophyte bacteria in these plants can provide valuable insight into their potential medicinal properties and help in development of new drugs. It is also relevant in context of the increasing use of medicinal plants as alternative medicine,it can ensure the quality and authenticity of these plants by identifying potential adulterants.

Reference Link:

https://doi.org/10.1094/MPMI-19-0827
https://doi.org/10.1016/j.jep.2006.03.013

2. Materials and Methods

2.1. Measures

Sodium hypochlorite 1.5% ,Nuclear free wate r ,70% Ethanol ,4-5 unfrozen leaf samples,
PBS buffer , XBA 1, XBA 2, XBA 3, XBA 4, XBA 5, XBA 6, XBA 7 (buffer), 1X dsDNA HS buffer, TaKaRa Ex Taq Hot Start Version(RR006A)kit, ExoSap -IT reagent.

2.2. Procedures

1. **Sample collection:**

Plant sampling was carried out from a selected site of kottakkal Arya Vaidya shala herbal garden.

3. Isolation of Endophytes:

3.1 Surface sterilization:

Collect 4-5 unfrozen leaf samples were surface sterilized to isolate and identify bacteria based on culture (Correa-Galeote et al. (2018). In Culture-dependent identification of microbial-community samples were completely washed with distilled water, blot dried, and submerged in 1.5% sodium hypochlorite for 10 minutes,wash in nucleus free water (NFW),treat in 70% ethanol (v/v) for one minute.Secondly, repeat the same process followed by four consecutive washes with sterilized distilled water for surface sterilization

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and Use 100 µl of the fourth washing nucleus free water to plate on NA (nutrient agar) plates. To check sterilization efficacy, these plates were incubated for 10-15 days at 28-30°C (M. Ali et al. (2021).

3.2 Preparation of leaf Extraction:

The surface sterilized plant material, leaves are grinded into fine extract using mortar & pestle, add few drops of buffer PBS.

4. Isolation of pure culture of Endophyte bacteria:

Endophytic bacteria are isolated, purified, and subcultured after the surface sterilization of plant material is done in this method.70 µl of the leaf extract were placed on a nutritional agar medium plate enriched with agents,the drop placed in plate is spread using L-rod in spread plate methodology.The control that washed the leaf sample in Nucleus free water is also plated.The plates were wrapped in clean wrap cling film and incubated at 22∘C with 12 h light and dark cycles for up to 6 to 8 weeks (Nalini.S M et al.(2014).Bacteria growing in striation were moved to new plates with Luria broth medium (LB) and agar to begin the purification process. The bacteria in the stock remained in LB at 4°C until DNA extraction.(S.A. Rhoden et al.(2015).

5. DNA Extraction:

Bacterial DNA isolation was carried out using column based DNA extraction. (XploregenTM Bacterial Extraction kit, Cat. no. XPBAD22-50).

5.1 Bacterial broth

DNA extraction is followed by the Xploregen kit method; Take 1 ml of sample in a 1.5 ml tube and centrifuge at 10,000 rpm for 5 minutes. Discard supernatants. Add 1 ml of XBA 1 to the pellet and pipette mix, then add the whole solution to the beaded vial. Horizontal vortex the vial at maximum speed for 10 minutes, Add about 300 µl of XBA 2 to the viala and Horizontal vortex the vial at maximum speed for 7 minutes. Centrifuge the tube at 10,000 rpm for 2 minutes at room temperature (RT).Transfer 950 µl of supernatant to a sterile 2 ml vial and Add 200 µl of XBA 3 solution and vortex for 5 seconds. Centrifuge at 10,000 rpm for 2 minutes, Transfer 800 µl Supernatant to a clean

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sterile 2ml vial, Continue Adding 700 µl XBA 4 solution to the supernatant and vortex for 5 Seconds and Transfer 700 µl of Lysate to the spin column and Centrifuge at 10,000 rpm about 2 minutes and Discard the flow through .Repeat the above steps to collect all the Lysate. Add 600 µl of XBA 5 to the spin column and Centrifuge at 10,000 rpm for 2 minutes, Discard the flow through and Add 600 µl of XBA 6 to the spin column Centrifuge at 10,000 rpm for 2 minutes and discard the flow through. Centrifuge the empty spin column for 5 minutes at 10,000 rpm and Place the spin column into a sterile 1.5 ml vial and incubate for 2 minutes. Add 30 µl XBA 7 to the center area of spin column and centrifuge for 5 minutes at 10,000 rpm, Place the spin column to a new sterile 1.5 ml vial. Discard the spin column and store both elution tubes for further processing.

5.2 DNA quantity analysis:

The concentration of DNA is checked using a qubit fluorometer, adding drops of 1X dsDNA HS buffer into isolated DNA for the concentration analysis.

6. DNA amplification using polymerase chain reaction (PCR):

6.1 DNA Amplification:

Total 50µl of general reaction mixture is required, PCR was done in a solution containing 5 µL buffer (20 mM Tris-HCl, pH 8.0, 100 mM KCI), 4 µL 2.5 mM dNTPs, 0.2-1 µM 10-50 Pmol of each primer (Primer 1&2): (As most PCR products amplified with TaKaRa Ex Taq HS have one A at the 3'-termini, the obtained PCR products can be directly cloned into a T-vector.), 0.25 µL 5 U/µL of TaKaRa Ex Taq HS. Add Taq DNA polymerase, 4µL 2.5mM dNTP mixture, up to 50µL sterile purified water, and 2 µL of previously extracted sample DNA (10-20 ng/µl),under common PCR conditions .

6.2 Agarose Gel Electrophoresis:

After amplification, PCR products and 100bp DNA ladder(solution composed of DNA molecules of varying lengths) were loaded in 2% agarose gel for electrophoresis at 150 V.

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6. Purification and sequencing of 16S rRNA:

6.1 Purification of PCR Products:

6.2 Sanger Sequencing :

The sequencing was done by using Bigdye x Terminator V3.1 kit ,sample DNA is used as a template in a polymerase chain reaction (PCR).A mix of normal bases (dNTPs) and chain terminating bases (ddNTPs) is used in the PCR reaction,This will generate DNA fragments of different lengths.The DNA fragments are then separated by size using Capillary Electrophoresis was done by Applied Biosystems 3730 Genetic Analyser.A laser is used to excite these fluorescently labeled bases at the end of each fragment.In the sequence, shorter fragments appear first, then progressively longer fragments. A chromatograph indicating which base is present at each place along the DNA fragment is created by recording the fluorescence of the base that ended each length of the segment.

7. Phylogenetic Analysis:

After the sequencing, the FASTA sequence of the samples were analyzed in the Nucleotide Blast programme of NCBI(www.ncbi.nlm.nih.gov).

7.1. Analysis

The obtained bacterial species were isolated on the basis of the unique features of colonies.A prominent bacterial colony from leaf tissue bacterial endophytic species were isolated.Endophytic bacteria are isolated, purified, and subcultured after the surface sterilization of plant material is done.Band was observed at 1500 bp.The analysis shows the concentration of DNA extracted in Piper chaba is 3.6 & as for the Piper longum is 3.7.

Instruments and Software

Autoclave, Laminar air flow, sterile plate, beaker with several measurements, Inoculation loop, L-rod, Micropipette, mortar & pestle, Burner, extraction tubes, sterile cotton, Incubator, XploregenTM Bacterial Extraction kit, qubit fluorometer, PCR VERITI THERMO SCIENTIFIC, Applied Biosystems 3730 Genetic Analyser, NCBI(www.ncbi.nlm.nih.gov).

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8. Results and Discussion

Isolation of Endophytes From Pure culture:

Bacterial endophytes were isolated using fresh plant material (leaf) from the medicinal plants Piper longum and Piper chaba. Sterilisation of the surface was an essential step in eliminating epiphytic bacteria from the explant samples. Our analysis found that this step was satisfactory because the control plate (Fig.1) did not exhibit any development. As illustrated in (Fig. 2), an adequate number of colonies were found in the explants extraction (leaf) on the medium. These isolates were regarded as bacterial endophytes of the plant because there was no growth on the control plate. Endophytic bacteria are isolated, purified, and subcultured after the surface sterilization of plant material is done. The findings showed that the two piper species' isolated bacterial species were distinct from one another.The culturing is continued until we reach a pure culture of Endophyte bacteria is illustrated in (Fig.3) of each plant species.

9. DNA Extraction:

Bacterial DNA isolation was carried out using column based DNA extraction. Cultured Endophytic bacteria isolates were used to take the DNA extraction. Extracted DNA using XBA 1,2,3,4,5,6 & 7 reagents and stored the elution tubes for the further analysis. DNA quantification is a crucial step in many processes where knowing the amount of DNA present is required, the analysis shows the concentration of DNA extracted in Piper chaba is 3.6 & as for the Piper longum is 3.7.

DNA amplification using polymerase chain reaction (PCR):

previously extracted sample DNA (10-20 ng/µl),under PCR conditions mentioned in Table.1 ,PCR is done by the universal primer 16s rRNA. After amplification PCR, PCR products and 100bp ladder were loaded in
2% agarose gel for electrophoresis at 150 V. Band was observed at 1500 bp as illustrated in (Fig.4).

Sequencing & Molecular identification of Endophytic bacteria:

The strain was identified by phylogenetic association using the PCR-amplified 16s rRNA gene .By measuring the fluorescence of the base that ends

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each length of the segment, a chromatograph is constructed that shows which base is present at each location along the DNA fragment is illustrated in (Fig.5).There are two Sanger processes involved in sequencing a DNA region: forward and reverse for each piper species.The sequencing result is Illustrated in Table 1.The amplified 16s rRNA gene was sequenced using the chromatogram illustrated in Fig .4 as mentioned above and matched using BLAST search with strain sequences that were similar and found in the NCBI database.Several similarly resembling sequences were produced by the multiple sequence alignment process that was received from the NCBI database. The findings show the similarity of isolated endophyte bacteria in sample 1 ,piper chaba is 99.89**%** Identical to *Bacillus Pumilus* and Sample 2 *Piper longum* is 99.89**%** Identical to *Bacillus Aerius*. Using the basic local alignment search tool (BLAST) search, the nucleotide sequences with the closest identities were obtained from the NCBI database for analysis.The sequences that shared the most similarities with each other were chosen for phylogenetic analysis after the 16S rRNA gene sequence underwent filter search. The dendrogram was generated in accordance with the similarities within the species as illustrated in Fig.6 & 7.

Table 1

Sample name	**Primer name**	**Raw length (bp)**	**Trimmed length (bp)**	**Trim start**	**Trim end**	**Averag QV score**
Piper chaba	Forward	1191	901	17	918	51
Piper chaba	Reverse	1155	867	18	885	50
Piper longum	Forward	1187	885	22	907	49
Piper longum	Reverse	1178	881	17	898	50

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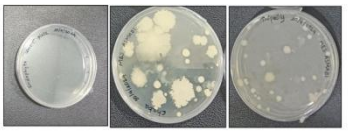

Fig.1 control plate **Fig. 2** colony of multiple endophytic bacteria in culture plate **(a)** *piper chaba* & **(b)** *piper longum*

Fig.3 pure cultured endophyte bacteria in medium **(a)** *piper chaba* & **(b)** *piper longum*

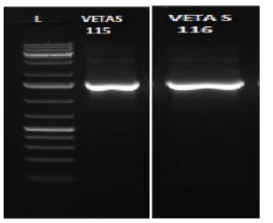

Fig.4 Agarose gel electrophoresis image of isolated gDNA (genomic DNA) of different bacterial isolates on 2% (w/v) agarose gel band appears to be 1500 bp.

VETAS : Endophytic bacterial isolates.**LAD:** Marker (100 base pair DNA ladder).

VETAS 115 - *Piper chaba*, **VETAS 116 -** *Piper longum*.

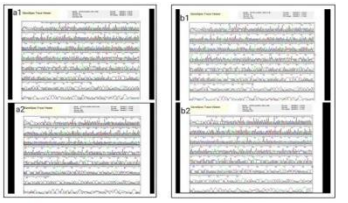

Fig 5 Chromatogram of DNA fragments isolated from *Piper chaba* and *piper longum* respectively.

(a1.) Forward of *piper chaba*, **(a2.)** Reverse of *piper chaba*. & **(b1.)** Forward of *piper longum*, **(b2.)** Reverse of *piper longum* .

Fig.6 Dendrogram representing *piper chaba*. Phylogenetic tree retrieved from BLAST analysis showing the evolutionary relationship of *Bacillus pumilus* with its closest BLAST hits based on multiple sequence alignment.

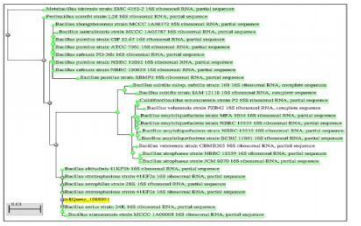

Fig.7 Dendrogram representing *piper longum* Phylogenetic tree retrieved from BLAST analysis showing the evolutionary relationship of *Bacillus aerius* with its closest BLAST hits based on multiple sequence alignment.

10. Conclusion

This study Identified multiple bacterial endophytes from the selected medicinal plants *Piper longum* and *Piper chaba*. Endophyte was extracted from plant samples by culture dependent method, followed by sanger sequencing using 16sr RNA. The 16S rRNA gene is a prime candidate for phylogenetic analysis because of its high degree of conservation among bacterial species. The evolutionary links between various bacterial strains and species can be ascertained using the sequencing of the 16S rRNA gene. For 16S rRNA sequencing, there are defined techniques and databases that facilitate findings comparison with other studies and allow for the expansion

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of current knowledge in the field. The dendrogram was created by nucleotide database BLAST. By analyzing the dendrogram, it is identified that endophytes as *Bacillus pumilus* and *Bacillus aerius* from p. *chaba* and P. *longum* respectively. B. *pumilus* shows about 99.89% similar to isolated endophyte and B. aerius shows 99.89% similarity.Both Bacillus pumilus and Bacillus aerius are recognised for their possible therapeutic uses.

Our examination of the endophytic bacteria and medicinal plants has yielded important insights into the possible advantages of these partnerships.Intended to carry out more research in the future on the processes by which these bacteria communicate with their host plants and any possible health benefits.This project has led the foundation for future research in this area, and we are excited to continue our investigation of endophytic bacteria in medicinal plants to gain a more profound understanding of their role in plant health and therapeutic properties.

Acknowledgment:

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DESCRIPTIVE STUDY ON IMPORTANCE OF INSECTS FOR PROVING RAPE CASES THROUGH SEMEN EXTRACTED FROM THEIR BODY

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ABSTRACT

In criminal investigations, the study of insects and other arthropods is known as forensic entomology. From the very beginning, insects are drawn to the decaying carcass and may deposit their eggs there. The post-mortem index, any changes in the corpse's posture, and the cause of death can all be estimated by forensic experts by examining the insect population and the growing larval stages. The post-mortem index, any changes in the corpse's posture, and the cause of death can all be estimated by forensic experts by examining the insect population and the growing larval stages. Professional forensic scientists and entomologists use their vast expertise and state-of-the-art methods to analyse insect evidence in a quick, accurate, and trustworthy manner.

Forensic Entomology studies insects and other arthropods that can be used in the expert analysis of various types of crimes. Even though forensic entomology can be utilised to determine the period since death in death investigations, blowflies' gut contents can yield male criminal DNA that is thought to be derived from sperm cells. The results of the study suggest that insect samples may be able to increase the time frame for detecting sexual activity prior to homicide. Through more researches related to this study will help to rectify all the limitations now it has.

Keywords: Forensic Entomology, DNA Profiling, Y- STR, Insects, Rape Case.

Introduction

The application of scientific techniques or knowledge to criminal investigations or the analysis of evidence that may be offered in court is

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known as forensic science. From anthropology and wildlife forensics to fingerprint and DNA analysis, forensic science encompasses a wide range of fields. Since practically any science can aid in the investigation of a crime or the assessment of civil harm, practically any science might be a forensic science. Forensic sciences actually examine the same things as traditional sciences, with very few exceptions.

A decaying vertebrate carcass or carrion contains insects or arthropods. The mobility of the corpse, the manner and cause of death, the association of suspects at the death scene, and the time of death—also known as the post mortem index, or PMI—can all be estimated using these insect colonisers. The researchers discovered in a short pilot investigation that human DNA from semen could be successfully detected in carrion fly larvae for up to some days after the larvae started consuming living material.

Review of Literature

1. Forensic Entomology: The utility of Arthropods in Legal Investigations Authors: Goff, M. L. Journal: *Annual Review of Entomology* (2000), The use of insects in forensic investigations, particularly in estimating the post-mortem interval (PMI), is explored in this review. To build a foundation, it describes the history of forensic entomology, advances and limitations of methodology with an emphasis on the identification of arthropods and their wave of succession on cadavers. It outlines both challenges, such as environmental conditions and species-specific differences, that affect decomposition rates.
2. Forensic Entomology in Criminal Investigations, Author(s): Byrd, J.H., & Castner, J.L. (2001), Provides a foundational understanding of forensic entomology as a discipline and its application in criminal investigations. It discusses the various functions related to entomological species that can be used to estimate post-mortem intervals (PMI), whether the body has been moved post-mortem, and lethality of chemical agents. Byrd and Castner emphasize the relationship of forensic entomology with other forensic disciplines, with illustrative case histories.

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3. The Role of Blowflies in Forensic Entomology, Author(s): Amendt, J., Richards, C.S., & Zehner, R. (2011), The most common colonisers of decaying remains discussed in this review are the blowflies (family Calliphoridae). It explores their biology, life cycles and the role of these insects in estimating PMI. Authors underscore the importance of regional databases of blowflies for forensic applications, including the developments of genetic approaches for species identification.
4. Advances in Molecular Techniques for Forensic Entomology, Author(s): Wells, J.D., & Stevens, J.R. (2008), The paper discusses the use of molecular biology in forensic entomology, including DNA methods for identifying insect species and determining their geographic range. It covers topics including next-generation sequencing, polymerase chain reaction, and mitochondrial DNA. The authors investigate examples where the current morphological identification methods were insufficient and where advanced molecular approaches greatly aided in the resolution of challenging cases.

Significance of the study

Given how common insects are in the wild, it is quite likely that they will be connected to a crime scene, either because it is a part of their natural habitat or because they have been drawn to or brought to it. According to Sung Tzu's book The Washing Away of Wrongs, the earliest known instance of insects being utilised in a criminal investigation occurred in 13th-century China. All of the suspects were instructed to put their sickles on the ground after a farmer was discovered dead in a field with a sharp object.

The study of insects and other arthropods in criminal investigations is known as forensic entomology. Insects are drawn to the decaying carcass from the very beginning and may deposit their eggs there. Forensic scientists can determine the cause of death, any changes in the corpse's location, and the post mortem index by examining the insect population and the growing larval stages.

The murderer confessed because only one sickle attracted blow flies to the minuscule amount of blood that was concealed from view. In 18th-century France, forensic entomology was first used in a modern courtroom when

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entomological evidence was permitted as evidence to exonerate the current inhabitants of the house where a child's skeletonised bones were discovered. The field of forensic entomology was founded in the 18th century by Yovanovich and Megnin, who assessed the insect succession on dead bodies.

The sole distinction is that forensic scientists apply proven scientific methodologies and approaches to legal issues. The discipline of forensic science is broad and multidisciplinary. It's not limited to labs; it's also present in actual crime scenes. This field's main goals are to present evidence that may be used in court, bring the real criminals to justice, and deliver justice to the innocent.

According to scientists, blowfly eggs and larvae can carry important evidence, like sperm, that could aid in investigations into sexual assault. According to research, blowflies have the potential to be an effective forensic investigative tool because they may unintentionally gather and preserve DNA evidence from sexual assault case scenes. The capacity of forensic entomology to determine the time of death and other specifics by examining insect activity is already well-established.

Although forensic entomology can be utilised in death investigations to determine time since death, retrieving male criminal DNA, attributable to sperm cells, from the gut material of blowflies is very new, and this is the first-time research in England has looked specifically at sperm cells. The research team designed an experiment to mimic real-world forensic scenarios. To mimic evidence occasionally found at major and intricate crime scenes, a tiny bit of boar semen was placed to pig skins. Blowflies were attracted to the decomposing remains and lay hundreds of eggs and larvae. After collecting some of the blowfly eggs and young larvae, the researchers cleaned and frozen them. Before they pupated, the intestinal contents of other larvae were analysed after they had been allowed to grow larger.

A specialised method known as "differential extraction" was employed to remove the sperm from the cells of the piglet's skin. After that, the samples were examined under a microscope to look for intact sperm. There were sperm cells in at least 50 percent of the samples. This is a fascinating discovery since it demonstrates how blowfly eggs and larvae can preserve evidence, even sperm, which may be used to connect criminals to crime sites.

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According to Dr. Magni, a forensic entomologist with experience in criminal investigations, insects can be used for genetic and toxicological analysis as well as to determine how long it has been since a person died.

Due to the rapid deterioration of semen evidence and the body's decomposition caused by the activity of the vaginal microenvironment and carrion insects, investigations into sexual assault instances that result in homicide can be very difficult. For the investigation, chicken liver combined with donated human semen was given to the larvae of Lucilia sericata, a major coloniser of human remains worldwide. Swabs of larvae and semen were taken throughout a 12-day period, and the forensic DNA quantification kit was used to evaluate the extracted DNA. Additionally, the human DNA in the larvae can be recognised for a longer duration.

Conclusion

Forensic Entomology is one of the most important tools for solving many criminal cases and it helps to determine PMI (Post-Mortem Interval). Insects' life cycle plays an important role in the determination of PMI. Through proper collection, preservation and analysis of this help to solve the crime. In some recent studies it shows that presence of drugs can be isolated from the digestive system of insects.

This study soberingly shows that insects can play a positive role in forensic science and investigations, especially in rape cases, where certain types of DNA might be obtained from insect bodies. Insects can be collected from crime scenes and examined by forensic scientists to obtain biological material, even in cases with poor or degraded evidence, to aid in identifying the perpetrators. The information obtained emphasizes the importance of using entomological skills in forensic practice in order to facilitate the criminal justice system more effectively and accurately.

Though this study shows that how insects are how important with the retention of biological evidence through age and time. Insects like flies and beetles often found at crime scenes which remain missing or contaminated, have DNA traces in the digestive systems.

This unlocks exciting prospecting information for forensic examinations. Such evidence shedding technique plays a crucial role in the forensic entomology field, while simultaneously unveiling how interdisciplinary

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cooperation can solve challenging cases. Moreover, the legal system would benefit, and victims of sexual offenses would be avenged in a way through the intricate details hidden in the externally focused and biological friendly proving the word of memory depleting techniques, as well insect mediated evidence.

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GREEN SYNTHESIS OF 2 –HYDROXY -1-NAPHTHALDEHYDE BASED BARBITURATES AND THEIR MOLECULAR DOCKING STUDIES

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ABSTRACT

An ecofriendly green approach was used to synthesize 2 –Hydroxy -1-Naphthaldehyde based barbiturates with three different barbituric acid derivatives (1, 3-dimethylbarbituric acid, barbituric acid, thiobarbituric acid) in presence of biodegradable and biocompatible green catalyst Chitosan-SO_3H.The use of solvent less method make this present protocol more relevant to green chemistry in terms of admirable yield, reduced reaction time, eviction of hazardous solvents etc. The chemical structures of the synthesized compounds were characterized by various spectral techniques like ^{1}H NMR, ^{13}C NMR, IR and mass spectrometry. Molecular docking studies was performed in order to evaluate the binding mode of action for the synthesized compounds. It is a powerful tool used to position the computer generated 3D structure of small ligands into a receptor in a variety of conformations, orientations and positions. The synthesized barbiturates were docked with human 3-alpha-hydroxysteriod dehydrogenase type 3 (PDB ID: 4XO6) and E.coli DNA gyrase A (PDB ID: 6F86) utilizing AutoDock.

Keywords: Green synthesis, Barbiturates, Solvent less method, Molecular docking.

Introduction

Growing concerns about the safety and environment attained worldwide initiatives to create green ecofriendly practices. The principles of green chemistry promotes the synthetic route by the design and development of biodegradable and biocompatible catalysts, that consider environmental safety

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[1].For the recent years , scientists have devoted a great effort to replace chemical synthesis from hazardous solvents to solvent free green method[2]. Solvent free methods replaces classical procedures such as harsh reaction conditions making them more profitable, cleaner and operationally easier [3]. Barbituric acid is a pyrimidine derivative with extensive pharmacological applications like antimicrobials, antifungal, anticancer agents anesthetics and so on that are evident from various reactions [4].These derivatives has been investigated for its antimicrobial activity which may contribute to the development of novel antimicrobial agents that may lead to the antimicrobial drug discovery. The anti-cancerous properties of this derivatives are also available from the literature such as they are used as effective therapeutic agent for lung cancer. They work by enhancing the chemical therapeutic agent capacity to penetrate the microorganisms cell wall [5].Chitosan is an easily available, biodegradable, and renewable green material with diverse applications in catalysis, adsorption, therapeutic agents and so on. It has abundant applications in biomedical area due to its easy transformation to varied physical forms [6,7].Chitosan act as a good support material, it can be easily functionalized to chitosan-SO_3H by sulfonation reaction due to their availability with free amino and hydroxyl group.Chitosan-SO_3H has been reported as a good green catalyst for few organic transformations only[8].The reaction between aldehydes and active methylene compounds by knoevenagel condensation is a fascinating area of study with wide applications in the field of medicinal chemistry, drug development, and chemical synthesis .Knoevenagel condensation reaction is also employed to access the catalytic performance of various solid acid catalysts [9,10].Molecular docking is a powerful tool used to position the computer generated 3D structure of small ligands into a receptor in a variety of conformations, orientations and positions. Docking provides information about drug receptor interactions which is useful to predict how small molecule drug candidates bind to their protein targets which in turn tell us about the affinity and activity of the small molecule [11].In this work, Green synthesis of 2 –Hydroxy -1-Naphthaldehyde based barbiturates with three different barbituric acid derivatives in presence of biodegradable and biocompatible green catalyst Chitosan-SO_3H was carried out [12]. The chemical structures of the synthesized compounds were characterized by various spectral techniques like ^{1}H NMR, ^{13}C NMR, IR and

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mass spectrometry. Molecular docking studies of the synthesized barbiturates were carried out with human 3-alpha-hydroxysteriod dehydrogenase type 3 (4XO6) and E.coli DNA gyrase A (6F86) utilizing AutoDock.

1. Experimental

1.1. General:

All reagents, solvents and starting materials (compounds 1, 2, 3 and 4) were purchased from commercial sources and of AR grade and used as such. The reaction progress was monitored by thin layer chromatography on glass plates coated with silica gel G254 (E. Merck) using chloroform-methanol mixture as mobile phase and visualized by iodine vapors.

1.2. Preparation of chitosan-SO_3H catalyst:

Chitosan (3.704 g) and anhydrous dichloromethane (20 mL) was added in to a RB flask fixed in an ice bath at 0^0C. Chlorosulphonic acid (2.330 g) was added as drop by drop using a constant pressure funnel in 30 min by slow stirring at the same temperature. After complete addition of chlorosulphonic acid the reaction mixture was heated to room temperature and stirred for another 2.5 h. The solid obtained was filtered, washed with water and then with diethyl ether. It was then dried under vacuum to obtain as a cream colored solid [12, 13].

1.3. Solvent free green method of synthesis of 2-hydroxy-1-naphthaldehyde based barbiturates:

To the equimolar mixture of 2-hydroxy-1-naphthaldehyde (250 mg, 1.45 mmol) and active methylene compound (2–4), (1, 3-dimethylbarbituric acid (226.71 mg, 1.45 mmol), barbituric acid (185.98 mg, 1.45 mmol), thiobarbituric acid (209.30 mg, 1.45 mmol), and chitosan-SO_3H catalyst (100 mg) was added. The reaction mixture was grinded uniformly with a mortar and pestle and transferred in to a 50 mL RB Flask. Heated at 60^0C over a magnetic stirrer with a hot plate. Completion of reaction was checked by TLC (chloroform-methanol) in every frequent interval. The product was isolated by adding 10 mL ethanol to the reaction mixture. The catalyst, which is insoluble was separated by filtration, washed, dried and reused. The filtrate was concentrated and recrystallized from chloroform-methanol mixture (9:1) to get pure products.

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1.4. Recycling and reuse of chitosan-SO_3H catalyst for the synthesis of 2-hydroxy-1-naphthaldehyde based barbiturates under solvent-free green condition:

To the reaction mixture of 2-hydroxy-1-naphthaldehyde (1) (250 mg, 1.45 mmol) and 1, 3-dimethylbarbituric acid (2) (226.71 mg, 1.45 mmol) and Chitosan-SO_3H catalyst (100 mg) was added. The reaction mixture was grinded uniformly with a mortar and pestle and transferred in to a 50 mL RB flask. Heated at 60^0C over a magnetic stirrer with a hot plate. Reaction progress was monitored by TLC (chloroform-methanol) at every frequent interval of time. Product was isolated from the reaction mixture by adding 10 mL ethanol to the reaction mixture. The catalyst which is insoluble in ethanol was removed by filtration, washed and dried. The recovered catalyst was further used for next cycles. Filtrate was concentrated and recrystallized from chloroform-methanol mixture (9:1) to get pure products.

1.5. Molecular docking studies:

The molecular docking studies have been performed by using Autodock Vina version 1.5.6. This software is an interactive molecular graphics tool for calculating and presenting possible docking modes of a pharmacophore scaffold with biological targets such as protein, DNA, RNA and enzyme. The 2 –Hydroxy -1-Naphthaldehyde based barbiturates were docked with human 3-alpha-hydroxysteriod dehydrogenase type 3 and E.coli DNA gyrase A. The structure of these proteins was retrieved from the RCSB Protein Data Bank (PDB ID: 4XO6) and (PDB ID: 6F86) respectively. Chem 3D software was used to stimulate the structures of all the tested substances. The docked attitude was visualized with the help of Discovery Studio 2016.

2. Results and Discussion

Chitosan is a green catalyst which possess -OH and –NH groups due to which there is an extensive intramolecular /intermolecular H-bonding. This results in the formation of a helical structure of chitosan making it capable for various chemical modifications. The catalyst was synthesized according to the following scheme (Scheme 1) as reported in the literature [12,13].

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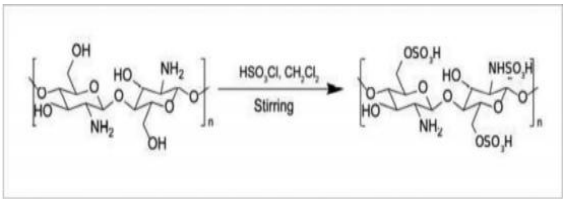
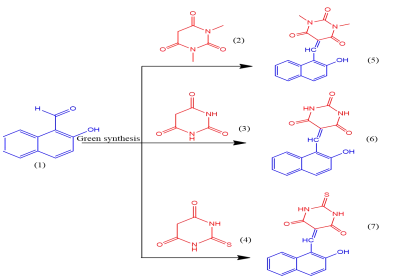


Scheme 1: Synthesis of chitosan-SO_3H from chitosan.

The synthesis of 2 –Hydroxy -1-Naphthaldehyde based barbiturates were carried out in green condition in order to develop an eco-friendly approach. we explored the efficiency of chitosan modified sulfuric acid as catalyst to execute the reaction of 2-hydroxy-1-naphthaldehyd (250 mg, 1.45 mmol) separately with 1,3-dimethylbarbituric acid (226.71 mg, 1.45 mmol), barbituric acid (185.98 mg, 1.45 mmol), and thiobarbituric acid (209.30 mg, 1.45 mmol) in molar ratios under solvent-free heating condition at 60 ^{0}C (Scheme 2). All the reactions were found to proceed very easily in high yields (80%–96%) within a short period of 20–27 min (Table 1).

Sl.No	Product	Time(min)	Yield (%)
1	Compound 5	20	96
2	Compound 6	27	84
3	Compound 7	22	80

Table 1: Solvent free synthesis of 2-hydroxy-1-naphthaldehyde based barbiturates using Chitosan-SO_3Hcatalyticsystem.



Scheme 2: Green Synthesis of 2-hydroxy-1-naphthaldehyde based barbiturates.

Recyclability of a catalyst is an important requirement in satisfying green chemistry criteria. Recyclability of chitosan-SO_3H was carried out by

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the model reaction of 2- hydroxy-1-naphthaldehyde (250 mg, 1.45 mmol) with 1, 3-dimethylbarbituric acid (226.71 mg, 1.45 mmol) in molar ratio. At the end of reaction, the product was extracted using ethanol (10 mL) in which catalyst was insoluble. The catalyst left after the extraction was washed with methanol, dried in air and used for the subsequent cycles (Table 2). There was no significant change in reaction yield and time up to five catalytic cycles showing the efficiency of chitosan-SO_3H as a good catalyst.

Entry	Catalyst recycle	Time (min)	Yield (%)
1	I	20	96
2	II	20	96
3	III	20	96
4	IV	20	96
5	V	20	96
6	VI	22	90

Table 2: Recyclability data of chitosan-SO_3H.\

The software AutoDock 1.5.6 was used to conduct docking studies on all the targets.All the target protein had polar hydrogen atoms and Kollman unified charges added to them. The final file was saved in the pdbqt extension. The crystal structure of human 3-alpha-hydroxysteriod dehydrogenase type 3 and E.coli DNA gyrase A. was retrieved from the RCSB Protein Data Bank (PDB ID: 4XO6) and (PDB ID: 6F86) respectively. The structures of all the tested substances were simulated using Chem 3D software. Discovery studio visualizer was used to taken out the water and heteroatoms of the proteins throughout the preparation process. For the docking computation, a grid box measuring 404040 in x,yand z dimensions was made to encompass the active site of the targets human 3-alpha-hydroxysteriod dehydrogenase type 3(12.95, 13.08,-11.34) and E.coli DNA gyrase A(64.39,30.89,61.08).Grid point spacing was set by default 0.500. The binding affinity of the ligands (**5, 6, and 7**) with these proteins were depicted in Table 3.

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Ligand	Protein binding affinity (kcal/mol)	
	Human 3-alpha-hydroxysteriod dehydrogenase type 3	E.coli DNA gyrase A
COMPOUND 5	-9.2	-8.9
COMPOUND 6	-10.1	-7.8
COMPOUND 7	-9.6	-8.6

Table 3: The binding affinity of the ligands (**5, 6, and 7**) with the proteins human 3-alpha-hydroxysteriod dehydrogenase type 3 and E.coli DNA gyrase A.

All the molecules were carried out docking. The processes of the receptor preparation included removing heteroatoms (water and ions), assigning charges, and adding polar hydrogen. The docking study's visualization was carried out using Autodock Vina and Discovery studio. Molecular docking is a powerful tool used to provide information regarding drug receptor interactions. It is used to analyze the binding orientation of small molecules to their protein targets in order to predict the affinity and activity of the small molecules. The results of the molecular docking studies showed that using the protein human 3-alpha-hydroxysteriod dehydrogenase type 3 **compound 6** had the best binding energy at -10.1kcal/mol ,followed by **compound 7** (-9.6kcal/mol) and **compound 5** (-9.2 kcal/mol) .**Compound 6** established two hydrogen bonds with the residues GLNA:6 and LEUB:261.Additionally it formed four pi-alkyl bonds with VALB:8, VALB:18, LEUA:261,VALA:8, one pi-sigma bond with VALA:18 and numerous van der Waals interactions with neighboring residues. Similarly, **compound 7** has two hydrogen bonds with the residues LEUA:261 and GLNB:6, one pi-sigma bond with VALB:18,three pi-alkyl bonds with VALA:18, LEUB:261,VALB:8 and many van der Waals interactions. In contrast the compound with lowest binding affinity **compound 5** showed numerous van der Waals interactions and an unfavorable acceptor-acceptor bond with the residueLEUB: 261.

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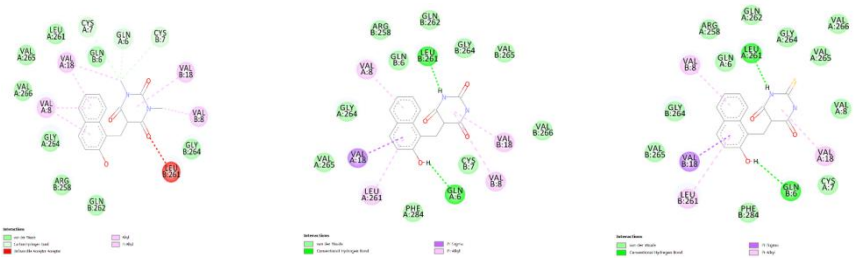
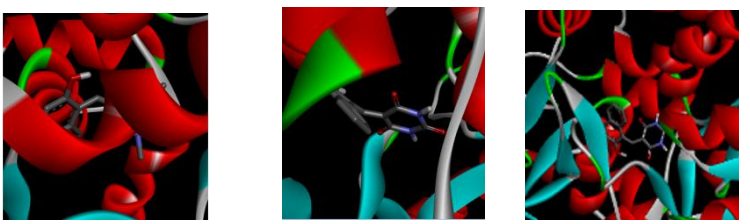


(a) (b) (c)

Fig: 1: A 2D representation of various interactions observed between the ligands and the protein human 3-alpha-hydroxysteriod dehydrogenase type 3 after docking.(a)compound **5**, (b) Compound **6**, and (c) compound **7**.



(a) (b) (c)

Fig: 2: A 3D representation of various interactions observed between the ligands and the protein human 3-alpha-hydroxysteriod dehydrogenase type 3 after docking.(a)compound **5**, (b) Compound **6**, and (c) compound **7**.

Further, evaluation of the compounds were also carried by docking with E.coli DNA gyrase A. In this, **compound 5** showed the best docking results (-8.9kcal/mol). It established two hydrogen bonds with the residues GLUA: 50 and GLYA: 77, one Pi-alkyl bond with ILEA: 78, one Pi cation bond with ARGA:76, one pi anion with GLUA:50 and numerous van der Waals interactions. **Compound 7** showed good but a lower docking result (-8.6kcal/mol) than **compound 5**, it has one hydrogen bond residue with GLUA: 50, one Pi-alkyl bond with ILEA: 78 one Pi cation ARGA:76,one pianion bond with GLUA:50 and so many van der Waals interactions. The lowest interaction was exhibited by the **compound 6** (-7.8kcal/mol) which showed four hydrogen bond with the residues ASPA:73, THRA:165,GLYA:77 and GLUA:50, one Pi-anion bond with GLUA:50, two pi-alkyl bond with ILEA: 78 and ILEA:94 Along with vander waals interactions.

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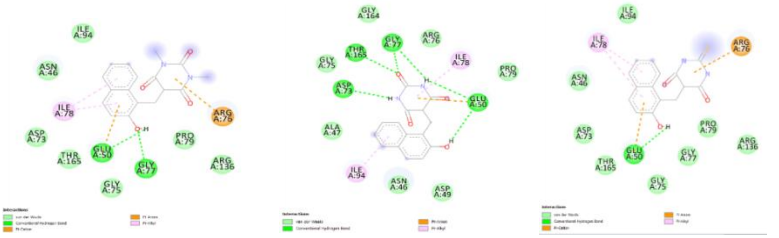
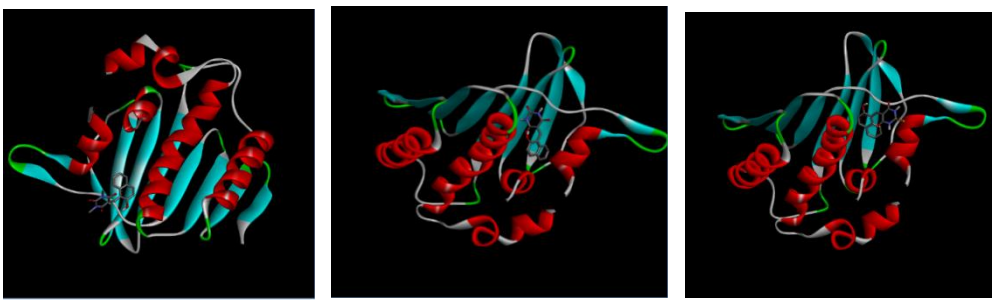


(a) (b) (c)

Fig: 3: A 2D representation of various interactions observed between the ligands and the protein E.coli DNA gyrase A after docking. a) compound **5**, (b) Compound **6**, and (c) compound **7**.



(a) (b) (c)

Fig: 4: A 3D representation of various interactions observed between the ligands and the protein E.coli DNA gyrase A after docking.(a)compound **5**, (b) Compound **6**, and (c) compound **7**.

3. Conclusion

In conclusion, the green synthesis of 2 –Hydroxy -1-Naphthaldehyde based barbiturates with three different barbituric acid derivatives in presence of biodegradable and biocompatible green catalyst Chitosan-SO_3H was carried out. The chemical structures of the synthesized compounds were characterized by various spectral techniques like ^{1}H NMR, ^{13}C NMR, IR and mass spectrometry. The catalyst used here is easily recoverable and recyclable upto five catalytic cycles. Now a days computational techniques received much attention in chemical research Molecular docking is a powerful tool used to provide information regarding drug receptor interactions. It is used to analyze the binding orientation of small molecules to their protein targets in order to predict the affinity and activity of the small molecules. The synthesized

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barbiturates were docked with human 3-alpha-hydroxysteriod dehydrogenase type 3 (4XO6) and E.coli DNA gyrase A (6F86) utilizing AutoDock. The results of the molecular docking studies showed that using the protein human 3-alpha-hydroxysteriod dehydrogenase type 3 **compound 6** had the best binding energy at -10.1kcal/mol which shows the anticancerous behavior of the **compound 6**.Similarly the antibacterial properties of the compounds were evaluated using the docking of the synthesized compounds with E.coli DNA gyrase A and the results showed that **compound 5** showed the best binding affinity (-8.9kcal/mol).Overall the present protocol explains the importance of ecofriendly green synthesis of compounds and the molecular docking results showed the restriction in functioning human cancerous cell and bacterial DNA there by satisfying crucial feature of the molecules to behave like an anticancerous and antimicrobial agents.

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TEMPERATURE DEPENDED PHASE TRANSITION STUDIES OF AG / TIO_2 MODIFIED MCM-48 MESOPOROUS MATERIALS

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ABSTRACT

This work reports the phase transition studies of Ag modified TiO_2 -MCM 48 material synthesized through sol-gel method followed by calcination at various temperature. The calcined materials were well characterized by Powder X-ray Diffraction (PXRD), diffuse reflectance Ultraviolet-Visible Absorption (UV-Vis), FT-IR spectroscopy and Transmission Electron Microscopy (TEM). From Powder X-ray Diffraction (P XRD), we get to know that Ag modification of Ti MCM 48 at certain temperature of 800℃ results in a characteristic phase transformation. From UV visible absorption spectroscopic measurement, we noticed a characteristic band around 450-550 nm region. From FT-IR analysis, noticed the broadening of spectral lines after modification with Ag. From TEM analysis we noticed the formation of silver nanoparticle along with Ti-MCM 48, the TiO_2 particles are randomly distributed with a pore size of 10-15 nm. This work provides an opportunity to explore various method of synthesis of metal modified mesoporous material and their effects on the physico-chemical properties of mesoporous materials.

Keywords: sol- gel method, mesoporous material, Ti MCM -48, Ag modification.

1. Introduction

The development of ordered mesoporous materials containing some transition metal ions in the pore walls has opened new possibilities in the fields of photochemical solar energy conversion and of catalysis [1-4]. These

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materials are characterized by quite narrow pore size distributions in the mesoporous region, long range order, high surface area, and high thermal stability. Less research has been carried out on MCM-48, probably due to the difficulty of its reliable synthesis compared with the extensively studied MCM-41. Earlier studies showed that MCM-48 materials can achieve stable photo induced charge separation. Further, incorporation of reducible transition metal ions into nano porous materials impedes back electron transfer by acting as more stable electron acceptors. Pure Ti MCM-48 showed very limited catalytic activity due to the lack of lattice defect, Modification of TiMCM-48 nano pore materials was found to improve the catalyst activity because it would provide an effective environment for increasing the number of active surface sites for molecular interaction. Silver was recognized to be poorly active as a catalyst; however, when Ag nanoparticles are highly dispersed on semiconductor metal oxides or hydroxides, they exhibit good catalytic activity. Such unusually high activity of gold strongly interacting with the support has later been confirmed by many research groups [5–9]. Further, it is expected that the encapsulation of silver nanoparticles into the MCM-48/TiMCM-48 surface can tailor the photo responsiveness into the visible region (< 400 nm).

2. Experimental

2.1. Chemicals required

Cetyl trimethyl ammonium bromide (CTAB) (Labochemie), Titanium isopropoxide (Aldrich 98 %), Tetra ethyl ortho silicate (TEOS) (Aldrich), Aqueous ammonia, Isopropyl alcohol, Silver nitrate and Sodium borohydride (Nice chemicals), Deionised water.

2.2. Preparation of Ti MCM 48

0.75g CTAB was added to 15 ml deionised water under vigorous stirring. After CTAB was completely dissolved 22.8 ml isopropyl alcohol was poured into the clear solution.17.5 ml aqueous NH_3 was added to the surfactant solution under vigorous stirring. After stirring for 30 minutes, 3 ml TEOS was added. Then it is kept stirring at 600 rpm for 4 hours. The resulting gel was kept for drying at room temperature. The obtained sample was labelled as MCM 48. To the 500 mg of above prepared uncalcinated MCM-48 add 2 ml isopropyl alcohol under vigorous stirring. And then add 2 ml titanium

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isopropoxide. Then it is kept stirring at 600 rpm for 32 hours. The resulting gel was kept for drying at room temperature. Calcination was done at 600^0C 6 hours in a static air environment. The obtained material was labelled as Ti MCM 48.

2.3. Preparation of Ag Ti MCM 48

Take 1g of calcinated Ti MCM 48, 10 ml isopropyl alcohol was added to it under vigorous stirring. A pinch of $AgNO_3$ is added. $NaBH_4$ is added till yellow colour is imparted. Then it is kept stirring for 600rpm 16 hours. The resulting gel was kept for drying at room temperature. Filtered and dried. It is divided into three portions and calcination is done at three different temperatures of 400℃, 600℃, 800℃. The obtained samples are labelled as Ag-Ti MCM48-400, Ag-Ti MCM48-600, Ag-Ti MCM48-800 respectively.

2.4 Characterization

The XRD measurements were performed at room temperature using a Rigaku Ultima IV X-ray diffractometer with Cu Kα radiation. The diffractometer was operated at 40 kV, and 44 mA, scanned with a step size of 0.02°, and a count time of 1°/min in the range of 2θ angle 10 to 80. The FT-IR analysis were carried out using a Bruker ALPHA instrument with ATR Pt diamond holder and the spectra were acquired in the range 4000 cm^{-1} to 500 cm^{-1} with a resolution of 4cm^{-1}. The TEM images were recorded on a HRTEM Jeol/JEM 2100 instrument operating at 200 kV. Prior to TEM analysis, the sample was dispersed in ethanol and the suspension was sonicated for 1h. For each material, one drop of suspension was placed on a copper grid coated with carbon film, and allowed to dry overnight. The UV-Vis diffuse spectra were recorded by a JascoV-550 UV-Visible spectrophotometer with Jasco model ISV 469 reflection accessory.

3. Results and Discussion

3.1. Powder XRD Analysis

The XRD pattern of the Ag Ti MCM48 and Ti-MCM48 at different temperatures were shown in Fig .1. The material Ti-MCM48 showed a characteristic plane of diffraction corresponding to TiO_2 anatase phase [10]. The XRD patterns of Ag Ti-MCM -48 400 and Ag Ti-MCM48 600 exhibit

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similar diffraction peaks as that of Ti MCM-48 at 25º, 38º, 48º,54º, 62º, 69º(characteristic peaks of anatase phase). But the diffraction pattern of Ag Ti MCM 48 800 shows a huge change from others. It shows characteristic peaks of rutile phase [11] at 27º, 36º,41º,54º,55º. The diffraction pattern of Ti MCM 48 800 shows higher proportions of anatase phase. Ag Ti MCM- 48 400, Ag Ti MCM- 48 600, Ag Ti MCM -48 800 shows a diffraction peak at 46º due to the presence of silver. This indicate that Ag modification of Ti MCM 48 at certain temperature of 800℃ results in characteristic phase transformation [12].

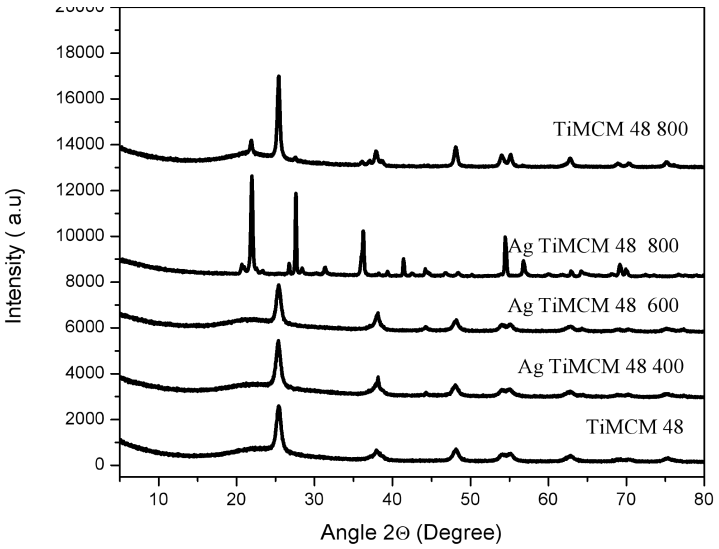

Fig .1. XRD Patterns of Ti MCM 48, Ag Ti MCM 48 -400, Ag Ti MCM 48 -600, Ag Ti MCM 48 -800, Ti MCM 48-800 respectively

3.2. UV-Visible DRS Analysis

To determine the absorption properties of the materials, UV-Visible absorption spectroscopic analysis [13] was carried out. The UV-Visible absorption spectra of Ag Ti MCM-48 and Ti MCM-48 are shown in Fig .2. All samples showed maximum intense bands at around 300 nm corresponding to band gap absorption of TiO_2. Intensity of Ti MCM 48 is less than that of modified Ti MCM 48. Broadening of peak is observed at 600℃. At 400℃ and 800℃ intensity of peak is almost similar.

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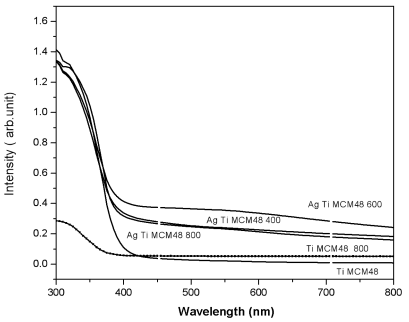

Fig .2 UV-Vis spectra of Ti MCM-48, Ti MCM- 48 800, Ag Ti MCM- 48 800, Ag Ti MCM- 48 400, Ag Ti MCM- 48 600 respectively.

3.3. ATR-FT-IR Spectroscopy

In order to acquire information about the different functional groups[14], the materials were further characterized by using FT-IR analysis. The FT-IR analysis spectra[15] of TiMCM48 and AgTiMCM48 calcinated at 400℃,600℃ and 800℃ are shown in Figure 5.3.Characteristic absorption peaks differ only in the intensity of peaks.The FTIR spectrum shows a broad, intense bands around 667,685and 691cm^{-1} corresponding toTi-O-Ti[16] It is reported that the characteristic broad peak for Si-O-Si observed in between 900-1200 cm^{-1} [17],this peak also generally observed for metal oxygen bonding. While the peak observed at 870 cm^{-1} is due to Si-O-Si symmetric stretching [18]. The broad peak observed at 1600 cm^{-1} is due to OH bending vibrations and is attributed to chemisorbed water molecules vibrations. All the samples showed typical IR spectra of TiO_2 -SiO_2 as reported earlier.

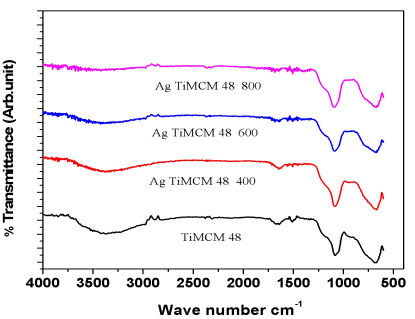

Fig.3. ATR FT-IR spectra of Ti MCM 48, Ag Ti MCM -48 400 , Ag Ti MCM -48 600, Ag Ti MCM -48 800 respectively .

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3.4. TEM Analysis

Fig.4. Displays various internal structures resulted from parallel and perpendicular penetration of electron beam in the hexagonally arrange channels of mesoporous silicate structures of Ag Ti-MCM 48. TEM images of Ag Ti-MCM-48 showed that pores of material were approximately hexagonal rather than circular, thus providing structural information especially important for application of MCM-48 [19]. Honeycomb structure of the mesoporous materials can be observed. The TiO_2 particles are randomly distributed with a pore size of 10-15 nm. TEM images and SAED pattern of silver modified Ti-MCM48 sample is given below.

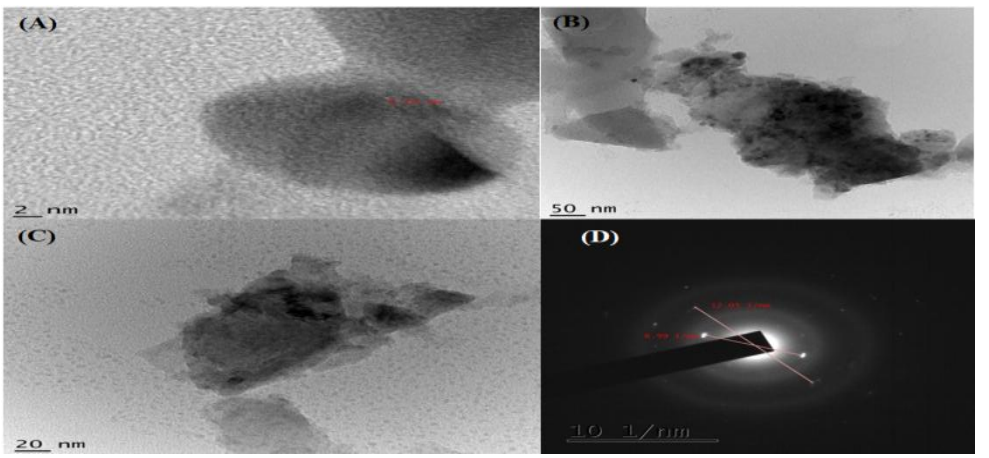

Fig.4. TEM images and SAED pattern of silver modified Ti-MCM48

4. Conclusion

By using the Sol-Gel method, mesoporous Ti-MCM48 and Ag-Ti-MCM48 are effectively synthesised. X-ray diffraction examination shows that the synthesise materials exhibit diffraction patterns of amorphous SiO_2, consisting of a tiny quantity of TiO_2 anatase phase. This work presents a straightforward synthesis of TiO_2 material modified mesoporous Ti-MCM-48 material. The material exhibits anatase phase and a little quantity of rutile phase after being modified by Ag ions. The UV-Vis absorption spectra of the synthesized material indicate that after the modification with Ag particle, band gap energy reduced. From the TEM images, we can find that the silver nanoparticles are randomly distributed with a particle size of 10-15 mm.

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GREEN SYNTHESIS OF HETEROCYCLIC ALKENES USING MCM 41 SUPPORTED PERCHLORIC ACID CATALYTIC SYSTEM: CHARACTERIZATION AND MOLECULAR DOCKING STUDIES

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ABSTRACT

Heterocyclic compounds are the basic scaffolds for majority of commercial medicines, but their classical synthetic strategies are not sustainable or eco friendly. Abundant strategies and technologies rose to meet green and sustainable synthesis of various pharmaceutical and medicinally important heterocyclics in last few years. Herein, a series of heterocyclic alkenes were prepared by the reaction of the 2- hydroxy-1-naphthaldehyde with different heterocyclic active methylene compounds via Knoevenangel condensation reaction using mesoporous silica, MCM 41 supported perchloric acid as a prominent green catalytic system under solvent free conditions. A comparative study of the conventional and green strategies was also carried out using the same materials. The synthesized compounds were characterized using ^{1}HNMR, ^{13}CNMR and IR spectroscopic techniques. The molecular docking study of the newly prepared compounds with the target enzymes COX-1 and oncogenic tyrosine kinase bcr/abl was undertaken to explore their potential inhibitory activities as COX-1 inhibitor and anti cancer agents.

Keywords: Green synthesis, molecular docking, heterocyclic alkenes, MCM 41.

1. Introduction

Heterocyclic compounds are most relevant division of organic chemistry as they have widespread applications in pharmaceutical, anti microbial and industrial applications [1]. Heterocyclic compounds both naturally and industrially generated often execute vital biological activities [2]. They also found utilization as sentizers, developers, anti-oxidants, corrosion inhibitors,

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copolymers, dye stuff etc. [3]. Because of their widespread uses the generation of heterocyclic compounds has become a vital point in organic synthesis. In earlier decades many systematic strategies were adopted for the synthesis of different heterocyclic compounds [4].

On agreement to the principles of green chemistry several novel eco friendly techniques have been developed which includes micro wave assisted synthesis, nanoparticles catalyzed reactions, solvent free reactions etc [5]. Since nanocatalysts offers advantages such as selectivity, reusability, high activity, selectivity they are placed in the border between homogeneous and heterogeneous catalysts [6]. Comparing with other microporous materials, MCM-41 exhibits large pore volume, narrow pore size distributions, ordered pore arrangement and large surface area, these are very vital to catalytic activity [7]. Due to these reason, lot of MCM 41 supported catalysts have been reported recently in the research studies. Similarly, perchloric acid supported on MCM 41 catalysts has been widely used for a vast range of organic transformations. Perhaps the function of perchloric acid supported on MCM 41 catalyst in the Knoevenagel condensation reaction has not been studied in detail as of yet [8].

In present scenario molecular docking has been widely utilized in drug research field [9]. Non steroidal anti inflammatory drugs (NSAIDs) have been used for their anti inflammatory, analgesic and anti pyretic effects which they achieve by inhibiting the cyclooxygenase(COX) enzyme.

Here, we report the synthesis of a series of heterocyclic alkene from 2-hydroxy-naphthaldehyde and active methylene compounds such as Meldrum's acid, 3-methyl-1-phenyl-2-pyrazoline-5-one, and dimedone via Knoevenangel condensation under solvent free conditions using perchloric acid supported on MCM 41 eco friendly catalyst [8], along with their molecular docking studies as COX 1 inhibitors and anti cancer activities against human breast cancer (MCF7) [10].

2. Experimental

All the chemicals were purchased from commercial sources and used as such. In order to monitor the reaction we used TLC on glass plates coated with silica gel G254 utilizing chloroform- methanol mixture as mobile phase and visualized via iodine chamber.

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2.1. Preparation of catalyst

The MCM 41 and MSP (perchloric acid was supported on MCM 41) catalyst were prepared according to the literature reports. Cetyltrimethylammonium bromide (CTAB-2.50 g, 0.0068mol) was dissolved in de-ionized water (50 mL) by heating with constant stirring. After cooling to room temperature, aqueous ammonia (14.61 mL, 0.25mol) and ethanol (76.02 mL, 1.3 mol) were added and the mixture was stirred for 15 min at 250 rpm. Tetraethyl orthosilicate (TEOS-5.02 mL, 0.024 mol) was added rapidly while stirring was continued. After an additional 2 h stirring, the precipitate was filtered with suction and washed with 100 mL ethanol and 100 mL de-ionized water. The precipitate was dried overnight at 90 °C and calcinated for a period of 5 h at 550 °C to get MCM 41. Perchloric acid was supported on MCM 41 by the wet impregnation technique. A suspension of MCM 41 (2 g) in 10 mL of diethyl ether was prepared. An ice-cold aqueous solution of perchloric acid (70%, 10 mmol) was added to the suspension of MCM 41 and placed in an ice bath with constant stirring. The mixture was concentrated in air and the scum was then heated at 100 °C for 4 h under a vacuum to afford MCM 41-supported perchloric acid catalyst (MSP) as a free-flowing powder.

2.2. Methods for synthesis heterocyclic alkenes (1–3) from 2- hydroxy- 1- naphthaldehyde

2.2.1. Conventional method

To the dissolved solution of 2-hydroxy-1-naphthaldehyde (250 mg, 1.45 mmol) in 10 mL ethanol, an equimolar amount of heterocyclic active methylene compounds [Meldrum's acid (209.27 mg, 1.45 mmol), 3-methyl-1-phenyl2-pyrazoline-5-one (252.93 mg, 1.45 mmol), and dimedone (203.54 mg, 1.45 mmol)] was added by taking in a 100 mL RB flask. The reaction mixture was allowed to reflux after the addition of five drops of pyridine as a catalyst. The reaction completion was checked by TLC (chloroform-methanol mixture) at regular intervals. When the reaction has completed, the crude product obtained was filtered and recrystallized from the chloroform-methanol mixture.

2.2.2. Solvent- free method using MSP catalyst

The catalyst perchloric acid supported on MCM 41 (50 mg) was ground uniformly with the equimolar mixture of 2-hydroxy-1-naphthaldehyde (250

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mg, 1.45 mmol) and the heterocyclic active methylene compounds [Meldrum's acid (209.27 mg, 1.45 mmol), 3-methyl-1-phenyl-2-pyrazoline-5-one (252.93 mg, 1.45 mmol), dimedone (203.54 mg, 1.45 mmol)] in a mortar using a pestle. Transferred the reaction mixture into a 100 mL beaker and heated at 60 °C over a magnetic stirrer with a hot plate. Completion of the reaction was checked by TLC (chloroform-methanol mixture) in regular intervals. The product was separated by adding hot ethyl acetate. The insoluble catalyst was separated by filtration and the filtrate was concentrated and recrystallized (chloroform-methanol mixture) to afford products in pure form.

2.2. Method for recycling and reuse of MSP catalyst

The catalyst perchloric acid supported on MCM 41 (50 mg) was ground uniformly with the equimolar mixture of 2-hydroxy-1-naphthaldehyde (250 mg, 1.45 mmol) and the heterocyclic active methylene compound Meldrum's acid (209.27 mg, 1.45 mmol) in a mortar. Transferred the reaction mixture into a 100 mL beaker and heated it at 60 °C over a magnetic stirrer with a hot plate. Progress of the reaction was regularly checked by TLC in the chloroformmethanol mixture. After completion of the reaction, product was separated from the mixture by adding hot ethyl acetate. The catalyst which is insoluble in hot ethyl acetate was separated by filtration. The filtered catalyst was washed with ethyl acetate and methanol, dried in an oven at 80 °C, and was further used for the next cycle of reaction. Concentrated filtrate was recrystallized using the chloroform-methanol mixture to afford the product in pure form.

2.3. Molecular docking studies

An in silico molecular docking study was conducted to evaluate the potential of the three synthesized compounds **1, 2, 3** in inhibiting the COX 1 and bcr/abl tyrosine kinase enzymes. Their crystal structures were obtained from protein data bank (PDB identifier 1EQG, 1IEP) in PDB format respectively. The stimulation box (40x40x40 A^0) used was sufficiently large to cover the entire region of interaction between the ligand and the enzyme. The target active site of the of COX 1 was in the x= 47.58, y= 30.38, z=190.49 and that of bcr/abl tyrosine kinase was x= 18.12, y= 52.86, z= 17.41 dimensions. Grid point spacing was set by default as 0.500. Following the completion of

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docking, the blind conformations of the ligand were ranked based on their binding energies. The visualization of docking result was carried out using BIOVIA Discovery Studio as 2-D and 3- D diagrams.

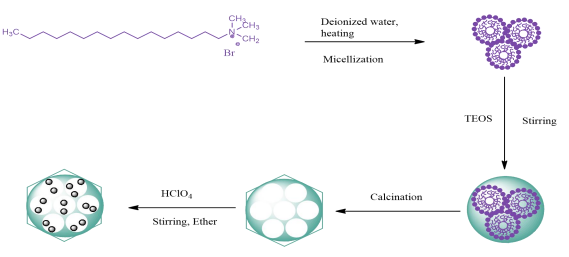
3. Results and Discussion

3.1. Chemistry

The present study details the conventional as well as solventfree methods for synthesizing the new heterocyclic alkenes from 2-hydroxy-1-naphthaldehyde and different heterocyclic active methylene compounds (Scheme 2). The synthesized compounds were obtained by conventional refluxing of an equimolar mixture of different active methylene compounds and 2-hydroxy-1-naphthaldehyde in ethanol using pyridine as a catalyst. The reactions proceeded for a prolonged time (3–5 h) and the yield was also not satisfactory (42–58%). While the same substrates under solvent-free green condition using mesoporous silica, MCM 41 supported perchloric acid as a catalyst resulted in a much better yield (85–94%) within a shorter time 20–25 min (Table 1). MCM 41 supported perchloric acid catalyst was prepared according to Scheme 1. A direct comparison of the green methodology with the conventional method was also examined. The result as obtained is given in Table 1 (Scheme 2).

Compounds	Conventional synthesis		Solvent Free synthesis	
	Time(h/min)	Yield (%)	Time(h/min)	Yield (%)
1	5h	58	20 min	94
2	3.5h	42	20 min	85
3	3h	45	20 min	93

Table 1: Comparison of conventional and solvent free synthesis



Scheme 1: Synthesis of MCM 41 supported perchloric acid catalyst

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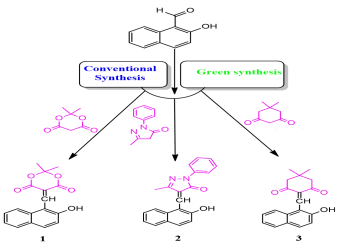

Scheme 2: Synthetic route for synthesis of compounds 1–3.

According to the green chemistry principles, the reusability of catalysts is a vital standard for the process of catalysis. Thus recyclability and reusability of the MCM 41-HClO4 (MSP) catalyst were also tested for the model reaction. After completion of the reaction, the product was separated from the reaction mixture by adding hot ethyl acetate. The catalyst which is insoluble in hot ethyl acetate was separated by filtration. The filtered catalyst was washed with ethyl acetate and then with methanol, dried in an oven at 80 °C, and was further used for the next cycle of reaction. There was no remarkable reduction in catalytic activity up to four cycles as demonstrated in Table 2.

Entry	**Catalytic cycles**	**Time(min)**	**Yield (%)**
1	I	20	**94**
2	II	20	94
3	III	20	94
4	IV	20	94
5	V	20	89

Table 2: Recyclability study of MCM 41-$HClO_4$ catalyst.

Based on the revealed results of optimization conditions, the scope of MCM 41-HClO4 catalyst in Knoevenagel condensation was further extended by the reaction of 2-hydroxy1-naphthaldehyde with active methylene compounds such as 3-methyl-1-phenyl-2-pyrazoline-5-one, and dimedone under solvent-free condition. All the reactions were preceded efficiently and provided excellent yields as shown in Table 1. Thus, the present study revealed that solvent-free heating condition with MCM 41-HClO4 catalyst is the best condition for the synthesis of The good dispersion of active reagent sites, which might facilitate better contact between reactant molecules and

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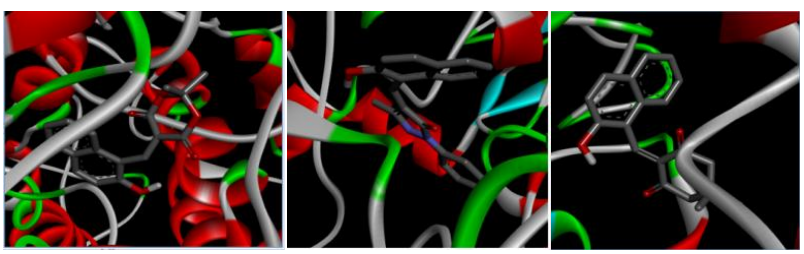
catalyst, may be the reason for improved catalytic activity under solvent-free conditions. The absence of solvents in solvent-free reactions may help to eliminate the dilution effect due to the solvent and the heat required as activation energy was directly made available to the reactant molecules. Also, it prevents the chance of high collisions to form more than one product and wastage of energy by heating the solvents, thereby resulting in products in excellent yields in a shorter period of time.

3.2. Molecular docking studies

The results of molecular docking studies showed that **2** has best binding energy at – 9.9kcal/mol, followed by **1**(-9.6kcal/mol), **3**(-9.1kcal/mol) in the interactions with the enzyme COX-1 among different orientations. Figure 1 and 2 respectively shows the docking results of the synthesized compounds **1-3** with COX 1 as 3-D and 2 D diagrams. Compound **1** established three hydrogen bonds with the residues ARGA376, ARGA374 and ASNA375. It forms alkyl bond with ARGA374, VALB145, and PHEB142 and one pi sigma bond with VALA145 and numerous van der Waals interactions with neighboring residues. Compound **2**, that is with highest binding affinity established pi pi T shaped bond with the residue PHB142 and pi sigma bond with VALA145. It also formed four alkyl bonding with ARGA374, LEUA224, VALA 145, VALB145 and numerous van der Waals interactions with neighboring residues. Compound **3** established three hydrogen bonds with the residues ARGA376, ARGB374 and ASNA375. . It forms alkyl bond with VALB145 and pi cation with ARGB374. It also created numerous van der Waals interactions with neighboring residues. All the three compounds established an unfavorable donor donor bond with ARG residues.



1 2 3

Figure 1: 3D docked structures of 1-3 with the active site of COX-1

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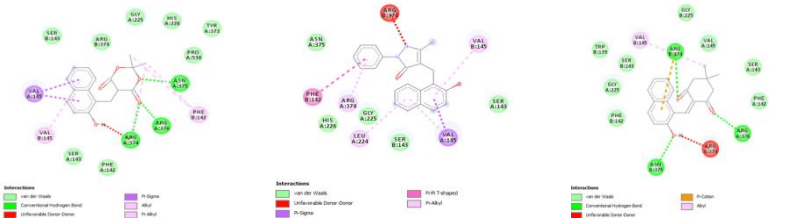
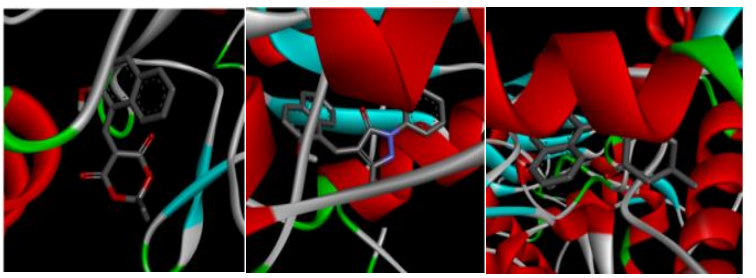


1 2 3

Figure 2: 2D docked structures of 1-3 with the active site of COX-1

In the molecular docking studies of compound **1-3** with tyrosine kinase bcr/abl shows that **2** has better binding affinity of -9.2 kcal/mol followed by **1**(-9.1 kcal/mol and **3**(-8.7 kcal/mol) among different orientations. Figure 3 and 4 respectively shows the docking results of the synthesized compounds **1-3** with tyrosine kinase bcr/abl. Compound **1** established five alkyl bonds with VALA289, LEUA354, ILEA293, LEUA298, and META290 and one pi anion bond with ASPA381 and numerous van der Waals interactions with neighboring residues. Compound **2** that is with highest binding affinity established one hydrogen bond with ILEA293, pi anion bond with ASPA381, pi sigma bond with VALA289. It also formed pi sulfur bond with META290 and amide pi stacked interaction with LYSA285 and pi alkyl bond with LEUA354 and numerous van der Waals interactions with neighboring residues. Compound **1** established six alkyl bonds with VALA289, LEUA354, ILEA293, LYSA285, PHEA359 and HISA361and one hydrogen bond ASPA381. It also established pi anion bond with GLUA289 and numerous van der Waals interactions with neighboring residues.



1 2 3

Figure 3: 3D docked structures of 1-3 with the active site of tyrosine kinase bcr/abl

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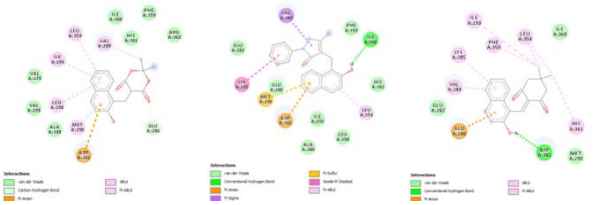

1 2 3

Figure 4: 2D docked structures of 1-3 with the active site of tyrosine kinase bcr/abl

4. Conclusion

In conclusion, the MCM 41-$HClO_4$ catalyzed green synthesis of 2-hydroxy-1-naphthaldehyde based heterocyclic alkenes found to have the better yield of the products and decreased reaction times disclosed that solvent-free condition is much more favorable reaction condition over the conventional method. The maximum catalytic activity under solvent-free conditions may be owing to the good availability and scattering of active reagent sites assisting better contact between substrate compounds and catalyst. Furthermore, because of the absence of any solvent (as the medium), there is no dilution effect as well as the heat required for the energy of activation is directly available to the reactants also helps to improve the yield and reduce the reaction time. Therefore, this methodology becomes greener with attractive features like eco-friendly, mild reaction conditions, shorter period of reaction time, excellent yield, recyclability of catalyst, etc. The molecular docking studies showed that the compound 2 exhibits significant binding affinity towards both COX1 and oncogenic tyrosine kinase bcr/abl. It exhibits high inhibition potency towards COX1 and oncogenic tyrosine kinase bcr/abl.

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CADMIUM ACCUMULATION AND STRUCTURAL DAMAGE IN PLANTS: MECHANISMS OF TOXICITY AND MITIGATION STRATEGIES

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ABSTRACT

Cadmium (Cd) contamination is a significant environmental challenge that severely disrupts plant structure and function. This review examines the structural modifications induced by Cd stress, focusing on biomass reduction, root–shoot growth dynamics, and tissue-level alterations. Root growth is particularly affected, with Cd accumulation triggering morphological changes such as browning, necrosis, and reduced elongation, ultimately impairing water and nutrient uptake. These structural injuries extend beyond individual plant health, posing serious threats to food safety and agricultural sustainability, particularly in the presence of co-contaminants like microplastics.

Mechanistically, Cd enters plant tissues through nutrient mimicry and specific transporter systems, including NRAMP and ZIP family proteins. Once inside, Cd is sequestered in root vacuoles or bound to cell walls to limit translocation to aerial parts. Soil factors such as pH, redox potential, and organic amendments significantly influence Cd bioavailability, shaping its toxic effects. Current remediation strategies—including soil amendments, microbial inoculants, and biochar applications—show potential in mitigating structural damage by modulating Cd uptake and improving plant resilience. However, long-term field studies are necessary to validate their effectiveness under real-world conditions.

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By integrating high-resolution imaging, molecular genetics, and field-scale experiments, future research can refine our understanding of Cd-induced structural injuries and develop targeted interventions. A holistic approach combining plant physiology, soil science, and agronomic management is essential to mitigate Cd toxicity, enhance crop resilience, and safeguard environmental and food security in contaminated agroecosystems.

Keywords: Cadmium toxicity, structural modifications, biomass reduction, root–shoot growth, cadmium uptake, root morphology, stomatal closure, phytoremediation.

1. Introduction

Cadmium (Cd) is a globally pervasive environmental contaminant with profound implications for plant health, agricultural sustainability, and food security. As a non-essential and highly toxic heavy metal, Cd contamination originates primarily from anthropogenic activities, including industrial emissions, mining operations, and the excessive use of phosphate fertilizers [1-2]. Once introduced into the soil, Cd persists due to its long biological half-life and mobility, leading to its accumulation in plant tissues, where it disrupts fundamental physiological and structural processes.

At the cellular level, Cd toxicity interferes with photosynthetic efficiency, nutrient homeostasis, and oxidative balance, thereby compromising plant growth and development [3-4]. Disruptions in chlorophyll biosynthesis and Rubisco activity impair carbon assimilation, while Cd-induced stomatal closure further constrains photosynthetic performance. Concurrently, Cd triggers excessive reactive oxygen species (ROS) accumulation, leading to oxidative stress, lipid peroxidation, and irreversible cellular damage[5]. These biochemical and physiological perturbations manifest as visible structural modifications, including reduced biomass, root browning, foliar chlorosis, and necrosis—hallmarks of Cd-induced stress that undermine crop productivity and quality [6].

Beyond its direct impact on plant physiology, Cd contamination poses a significant risk to human health through trophic transfer. Edible plant tissues often serve as reservoirs for Cd accumulation, exacerbating dietary exposure and raising concerns over food safety [7]. Moreover, emerging evidence

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suggests that Cd interacts with co-contaminants, such as microplastics and other heavy metals, intensifying its toxicity by altering bioavailability and exacerbating structural damage in plant tissues [8]. These multifaceted interactions underscore the urgency of developing targeted remediation strategies to mitigate Cd uptake and its deleterious effects on plant morphology and function.

Despite substantial research on Cd toxicity, gaps remain in understanding the intricate structural and morphological alterations it induces in plants. Investigating the interplay between Cd accumulation, root–shoot growth dynamics, and environmental co-contaminants is essential for developing effective mitigation approaches. This review synthesizes recent advances in structural modifications under Cd stress, root and shoot morphological responses, and tissue-level alterations. By elucidating these changes, we aim to provide a framework for enhancing plant resilience in contaminated environments, with implications for soil remediation.

2. Methodology

This review focuses exclusively on **structural modifications** in plants subjected to cadmium (Cd) stress. A **systematic literature search** was conducted using PubMed, Scopus, Web of Science, and Google Scholar, employing the keywords *"cadmium toxicity"* and *"structural modifications in plants."* Articles published between **2008 and 2023** were prioritized to reflect recent advances, while seminal works predating this period were included for historical context. Non-peer-reviewed sources and research lacking clear experimental evidence were excluded.

To align with the review's scope, studies were selected only if they **explicitly addressed structural changes**—such as biomass alterations, root and shoot morphological responses, and tissue-level modifications (e.g., necrosis, chlorosis)—in plants under Cd stress. Relevant data were categorized into **biomass reduction**, **root–shoot growth dynamics**, and **root-specific characteristics**, including their interactions with other pollutants (e.g., microplastics). By synthesizing this focused body of research, the review highlights key structural disruptions triggered by Cd and underscores their implications for plant productivity, food safety, and remediation practices.

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3. Structural Modifications Under Cadmium Stress

3.1. Root and Shoot Growth

3.1.1. Growth Inhibition Under Cd Stress

Cadmium (Cd) toxicity is well-documented to **inhibit both root and shoot growth** across a variety of crop species, including wheat (*Triticum aestivum*), sugar beet (*Beta vulgaris*), tomato (*Solanum lycopersicum*), and mung bean (*Vigna radiata*) [9]. In wheat, for instance, elevated Cd concentrations in the rooting medium result in **reduced root elongation**, limiting the plant's capacity for water and nutrient uptake [7]. Similar effects have been observed in tomato and sugar beet, where **stunted shoot growth** and foliar development reflect the plant's compromised energy production due to impaired photosynthesis and disrupted metabolic pathways [2]. The inhibition of meristematic activity within both roots and shoots appears to be a central mechanism, driven in part by Cd's interactions with essential nutrients (e.g., Fe, Zn), leading to **nutrient imbalances** and further constraining overall plant vigor [5].

3.1.2. Morphological Alterations

In addition to quantifiable reductions in root and shoot length, Cd exposure is frequently accompanied by **morphological modifications** such as root browning, necrosis, and foliar chlorosis [3,10-11]. Root browning, often linked to **oxidative stress**, signifies cellular damage that can impede water and nutrient uptake. Meanwhile, **chlorosis** in leaves reflects the degradation of photosynthetic pigments, reducing the plant's light-harvesting ability [12]. In severe cases, necrotic lesions manifest in both root and shoot tissues, indicating cell death and loss of tissue functionality [6]. These morphological symptoms generally correlate with the severity of Cd toxicity, serving as visual indicators of the internal disruptions affecting the plant's physiology and metabolism.

3.1.3. Ameliorative Interventions

Despite the severity of Cd's effects, several interventions have shown promise in **mitigating** its impact on root and shoot growth. A notable example is the **combined application of zeolite and beneficial bacterial inoculants**, such as *Enterobacter sp.* MN17 [2-3]. Zeolite, a naturally occurring

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aluminosilicate, possesses high cation-exchange capacity, enabling it to **immobilize Cd** in the soil matrix and reduce its bioavailability to plant roots. Concurrently, the bacterial inoculant enhances nutrient uptake efficiency and stimulates root growth through the production of phytohormones and other growth-promoting metabolites. When used together, these treatments can **significantly alleviate Cd-induced reductions** in plant height, root length, and overall biomass [6,13]. Other strategies—such as **supplementary silicon (Si), selenium (Se), and biochar amendments**—also exhibit potential in sustaining root and shoot development under Cd stress, often by bolstering antioxidative defenses and modulating nutrient homeostasis [1,14-16].

3.2. Root Characteristics

3.2.1. Cadmium Accumulation in Roots

Roots often serve as the **primary site** for Cd accumulation, acting as a first-line barrier that restricts heavy metal translocation to aerial tissues [3-4,6,16]. Several studies have documented **preferential Cd binding** to the cell walls and extracellular spaces of root epidermal and cortical cells, facilitated by carboxyl and hydroxyl functional groups [5,17]. This binding capacity may be further enhanced by the production of **phytochelatins and metallothioneins**, which sequester Cd ions within root cells and vacuoles [1,18]. While this accumulation can protect the photosynthetic apparatus in leaves, it also **impedes root function**; high Cd concentrations in root tissues can trigger oxidative stress, leading to lipid peroxidation and cellular damage. The resultant **root browning and necrosis** impair water and nutrient uptake, ultimately undermining overall plant vigor and yield potential [10].

3.2.2. Interaction with Other Pollutants

The complexity of root responses to Cd is amplified when **multiple pollutants** are present in the rhizosphere. Recent research highlights the **synergistic impact** of Cd with microplastics, which can alter root morphology and **increase Cd bioavailability** [6]. Microplastics—fragments typically derived from polyethylene, polypropylene, or polystyrene—can **adsorb metal ions** on their surfaces, creating hotspots of Cd concentration in the soil. These hotspots can come into direct contact with root surfaces, exacerbating **metal uptake** and intensifying Cd toxicity. Additionally, microplastics may influence the

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rhizosphere microbiome, altering root exudation patterns and microbial community structures that further modulate Cd mobility [8]. In such cases, plants often exhibit **more pronounced morphological distortions**—including shortened, thickened roots—and experience greater oxidative stress, highlighting the multifaceted challenges posed by co-contaminants in agricultural ecosystems.

4. Mechanisms of Cadmium Uptake, Transport, and Toxicity

4.1. Uptake and Transport Pathways

4.1.1. Mimicry of Essential Nutrients

A critical strategy by which cadmium (Cd) enters plant tissues is **mimicry** of essential micronutrients, particularly iron (Fe), manganese (Mn), and zinc (Zn) [3,10]. Because Cd shares certain physicochemical properties with these divalent cations, it can **hijack their transport pathways** in root cells, thereby circumventing intrinsic selectivity mechanisms [5]. For example, when Fe availability is low in the soil, plants often upregulate Fe acquisition systems—such as **Strategy I** in dicots (enzymatic reduction of Fe^{3+} to Fe^{2+}) or **Strategy II** in grasses (release of phytosiderophores)—which can inadvertently facilitate **Cd uptake**. This **nutrient mimicry** intensifies under conditions of nutrient deficiency or soil imbalances, leading to accelerated Cd accumulation in root cells [1].

4.1.2. Transporter Genes

Beyond nutrient mimicry, **specific transporter genes** have been shown to play pivotal roles in Cd uptake and translocation. In rice (*Oryza sativa*), for instance, **OsNramp5** encodes a member of the Natural Resistance-Associated Macrophage Protein (NRAMP) family that is **crucial for Cd influx** into root cells [3,14,19]. Similarly, **OsIRT1**, primarily involved in Fe transport, can also facilitate Cd entry in Fe-deficient conditions [2]. Genomic and transcriptomic studies in other species have identified additional **ZIP (ZRT/IRT-like Protein) transporters** with broad substrate specificity, implicating them in Cd mobilization across **root cortical and vascular tissues** [6]. The **tissue-specific expression** and regulation of these transporters—often influenced by metal homeostasis pathways—highlight the **complexity and redundancy** of metal uptake systems in plants [11].

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4.1.3. Subcellular Sequestration

Once inside the root cells, plants can **sequester Cd** at the subcellular level to **limit its translocation** to the shoots and minimize cytosolic damage (1). This sequestration often involves binding Cd to **phytochelatins (PCs)** and **metallothioneins (MTs)**—thiol-rich peptides and proteins that chelate heavy metals and facilitate their compartmentalization into **vacuoles** [3,20-22]. By confining Cd within vacuolar compartments, the plant effectively **restricts the metal's interaction** with vital biochemical processes in the cytoplasm, chloroplasts, and nucleus. Additionally, **cell wall components**, such as pectins and hemicelluloses, can **retain Cd ions** in the apoplast, acting as a secondary barrier to upward metal movement [6,23]. These mechanisms collectively **mitigate systemic toxicity**, protect photosynthetic tissues, and are a fundamental element of plant defense against Cd.

4.2. Root-to-Shoot Translocation

4.2.1. Cell Wall Binding

A critical determinant of cadmium (Cd) mobility within plant tissues lies in the **cell wall composition** of root cells. Cell walls rich in **pectin, hemicellulose, and lignin** can **bind and immobilize** Cd ions, thereby reducing their availability for translocation to aerial tissues [1,3,24] . This **cation-exchange capacity** stems from the negatively charged carboxyl and hydroxyl groups found in pectin and other polysaccharides, which can form stable complexes with positively charged Cd ions [6,25]. As a result, an increase in such **cell wall components** effectively **localizes Cd** within the apoplast of root tissues, preventing or delaying its entry into the xylem. This **passive retention** mechanism is particularly pronounced in hyperaccumulator species, where **upregulated pectin synthesis** contributes to both Cd tolerance and reduced Cd flux toward shoots [11,26].

4.2.2. Vacuolar Sequestration

Once Cd enters the root symplast, **vacuolar compartmentalization** serves as an additional mechanism to curtail systemic metal movement. In many plant species, Cd is chelated by **phytochelatins (PCs)** and **metallothioneins (MTs)**, which facilitate the transfer of Cd-PC or Cd-MT complexes into **vacuoles** [10,11,14]. This **vacuolar sequestration** not only **shield**s critical cytoplasmic and

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organellar functions from Cd toxicity, but it also **lowers the likelihood** of Cd reaching the xylem stream and, consequently, the leaves [5,27-28]. Genes encoding **tonoplast-localized transporters**, such as members of the ABC (ATP-Binding Cassette) and CAX (Cation/H^+ Exchanger) families, are often **upregulated** under Cd stress, highlighting their role in **active vacuolar transport** [3,29-30]. By restricting Cd primarily to root tissues, this mechanism substantially **diminishes leaf damage**, preserving photosynthetic capacity and overall plant productivity.

4.3. Soil Factors Influencing Cd Availability

4.3.1. Soil pH and Redox Potential

The **chemical speciation and mobility** of cadmium (Cd) in soils are strongly dependent on **pH** and **redox potential**. Under **acidic conditions**, increased H^+ activity can lead to **greater Cd solubility**, thereby elevating the concentration of Cd^{2+} ions available for root uptake [1,9]. Conversely, **liming acidic soils** often raises pH, promoting the formation of **less soluble Cd complexes** with hydroxides, carbonates, and phosphates [2,31-32]. Although liming generally **reduces bioavailable Cd**, its **efficacy** can be **site-specific**, depending on factors such as initial soil composition, buffer capacity, and the presence of competing ions [5,33]. In waterlogged or anaerobic soils, shifts in **redox potential** further alter Cd speciation—**reductive dissolution** of iron and manganese oxides can release adsorbed Cd, increasing its availability [3,34]. As a result, strategies to **manage soil pH** and **control redox fluctuations** are integral to reducing Cd uptake, yet must be finely tailored to local soil chemistry and cropping systems.

4.3.2. Organic Amendments and Fertilizers

Soil amendments such as **biochar**, **manure**, and **compost** can profoundly affect Cd **speciation**, **distribution**, and **bioavailability** within soil aggregates. **Biochar**—a carbon-rich product derived from the pyrolysis of organic waste—exhibits high **cation-exchange capacity** and **surface area**, enabling it to **adsorb Cd^{2+} ions** and reduce their mobility [7,35]. Similarly, the addition of **manure** or **compost** can facilitate **metal complexation** with humic and fulvic acids, thereby **immobilizing Cd** in more stable organic fractions [1]. However, when overapplied or imbalanced, certain fertilizers—particularly those rich in

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phosphate—can introduce **trace levels of Cd** and unintentionally exacerbate the problem [3,36]. The **net effect** of organic amendments and fertilizers on Cd availability thus hinges on multiple variables, including **application rate**, **soil texture**, and **existing mineralogical composition** [10,37]. Properly **calibrated application** of these amendments can **enhance soil fertility**, **improve soil structure**, and **decrease Cd bioavailability**, but mismanagement may counteract these benefits or introduce new contamination risks.

5. Challenges and Future Perspectives

Despite advances in our understanding of cadmium (Cd)-induced structural injuries in plants—manifested through root browning, stunted shoots, and leaf chlorosis—numerous knowledge gaps persist, warranting focused future research. High-resolution imaging techniques (e.g., confocal microscopy, synchrotron-based X-ray fluorescence) and time-lapse observation methods remain underutilized in depicting how Cd infiltrates specific cell layers and initiates morphological damage at subcellular levels. Likewise, genetic determinants of structural resilience, including cell wall composition and antioxidative capabilities, call for integrated genome-wide association studies (GWAS) or quantitative trait loci (QTL) mapping linked to detailed phenotypic evaluations. Such mechanistic work can reveal how co-contaminants—like microplastics or other heavy metals—amplify Cd toxicity by aggravating cellular disruptions, indicating that real-world contamination scenarios must be modeled more comprehensively to capture synergistic effects on plant architecture.

Moreover, to translate these discoveries into practical outcomes, field-scale validation of remediation strategies remains paramount. While soil amendments, microbial inoculants, and biostimulants have shown promise in controlled conditions, their long-term influence on root morphology, biomass allocation, and overall plant architecture under fluctuating environmental factors has yet to be firmly established. Investigations linking the degree of morphological impairment to agronomic yield or crop quality would strengthen the predictive value of these structural parameters, guiding the development of cultivars and cropping systems better adapted to contaminated soils. By integrating high-resolution imaging, genomics, multi-pollutant studies, and long-term field trials, future research can refine our mechanistic

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understanding of Cd's structural impacts, ultimately informing breeding programs and precision management practices that safeguard plant form and function in Cd-contaminated agroecosystems.

6. Conclusions

Cadmium (Cd) imposes severe structural disruptions in plants, from degrading essential photosynthetic machinery to altering root and shoot morphology. These damages hamper growth, reduce yields, and undermine food security, a concern amplified by co-contaminants such as microplastics. At the crux of these responses lies the root system, which both accumulates Cd and interacts synergistically with other pollutants. Understanding how Cd triggers nutrient imbalances and oxidative stress—ultimately impairing root integrity—provides the foundation for developing more effective remediation strategies.

Addressing this challenge demands an **integrated approach** that spans soil amendments, targeted nutrient supplementation, and microbial inoculations to restore root function and reduce metal bioavailability. Crucially, interventions must be tailored to **site-specific conditions** while leveraging molecular insights into plant defense pathways. By uniting **fundamental plant physiology** with **innovative agricultural practices**, researchers and stakeholders can mitigate Cd toxicity at its structural origins, enhancing crop resilience and safeguarding environmental health in contaminated agroecosystems.

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EFFETIVENESS OF PROMOTIONAL STRATEGIES ADOPTED BY FOOD AND GROCERY ORGANIZED RETAILERS IN KERALA

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ABSTRACT

India lately joined the retail revolution that is rapidly transforming the economies in other Asian countries. The food and grocery retail is in its nascent stage with many international retailers waiting for ventures in India. This was largely due to the excellent food retailing system that was established by the traditional stores that continue to meet with all the requirements of daily needs without the convenience of the shopping as provided by the retail chains; and also due to the highly fragmented food supply chain that is cloaked with several intermediaries (from farm-processor-distributor-retailer) resulting in huge value loss and high costs. Organized retailing is spreading and making its presence felt in different parts of the country((1)Gupta A. K, 2005). The present study attempts to study about the effectiveness of promotional strategies adopted by organized retailers. For this purpose, data have been collected from largest three cities (Kozhikode, Trivandrum and Ernakulam) in Kerala. In the present study organized retailers are chain stores that situated in each sample cities. In the case of organized retailers, researcher selected whole population as the sample for this study.

Keywords: Organized retailers, Promotional strategy, Facility, Services, Communication**.**

1. Introduction

Indian Retail Industry is highly fragmented and unorganised. The modern organised retailing is considered to be efficient and apt to cater the changing consumers' demands in growing economies like India. Unorganised retail sector has been facing a stiff competition from the organised sector. Now it is

worthwhile to examine effectiveness of promotional strategies adopted by organized retailers. Similarly, it is relevant to analyze the behavioral factors of organized retail customers. The chapter is divided into three sections for the proper arrangement. Section A deals with profile of organized retailers, section B cover profile of customer and Section C deals with promotional strategies

Section A

1. Profile of Organized Retailers

The sample size of this study is 127 organized retailers from largest three cities in Kerala.

Retail Formats of Organized Retailers

Three types of retail formats are selected as sample. These are Discount stores, Super market and Hypermarket.

1.1. Retail Format

Retail Format	Number	Percent
Hyper /Super Market	55	43.3
Discount stores	72	56.7
Total	127	100.0

Source: Survey Data

Section B

2. Profile of Customers

2.1. Age Group of Customers

The age group of the majority customers of Hyper/Super market is 26-30 but in the case of Discount stores, age group is 31-45.

2.2. Socio-Economic Profile of Customers

The socioeconomic profile of most of the Hyper /Super market and Discount stores customers are middle class and upper middle class always prefer Hyper /Super market for their shopping.

2.3. Number of Customers

The table 2.3.1 shows the average number of customers per day of Hyper /Super market and Discount stores.

2.3.1. Average Number of Customers per Day (Now)

Type of Outlets	N	Mean	SD	t-value
Hyper /Super market	55	1570.00	1746.33	6.208 (0.000**)
Discount stores	72	282.67	203.16	

Source: Survey Data *Significant at 1% level*

It is clear that the average number of customers per day is high in Hyper/Super market than Discount stores.

2.3.2. Average Number of Customers per Day before Five Years

Type of Outlets	N	Mean	SD	t-value
Hyper /Super market	55	826.91	1238.59	4.745 (0.000**)
Discount stores	72	132.35	97.47	

*Source: Survey Data **Significant at 1% level*

It is clear that there is significant increase in the number of customers for both Hyper/Super market and Discount stores. The percentage of increase in the number of customers of Hyper /Super market and Discount stores is presented in table 2.3.3.

2.3.3. Percentage of Increase in the Number of Customers

Type of Outlets	N	Mean (%)	SD	t-value
Hyper /Super market	55	136.72	92.11	1.251(0.213)
Discount stores	72	118.75	69.84	

Source: Survey Data

For Hyper /Super market, percentage of increase in the number of customers for the last five years is 136.72 with SD 92.11 and for Discount stores is 118.75 with SD 69.84. As per the p value is greater than .05 , it is clear that there is no significant difference between the Hyper/ Super market and Discount stores with regard to increase in the average number of customers.

Section C

3. Promotional Strategies

This section discussed about facilities, services, method of contact and promotional strategies adopted by organized retailers.

3.1. Facilities and Services

The table 3.1.1 shows the facilities and services provided by organized retailers on the basis of type of organized retail formats.

3.1.1. Facilities and Services Provided to Customers

Facilities and Services	Hyper /Super market		Discount stores		Chi square value	p value
	Yes	No	Yes	No		
Facilities						
ERP System	43 (78.2%)	12 (21.8%)	20 (27.8%)	52 (72.2%)	31.689	.000**
CRM System	55 (100%)	-	45 (62.5%)	27 (37.5%)	26.194	.000**
Bar coding & Scanner	55 (100%)	-	45 (62.5%)	27 (37.5%)	26.194	.000**
SAP/Tally	55 (100%)	-	72 (100%)	-	-	-
Information/Automated Security	55 (100%)	-	24 (33.3%)	48 (66.7%)	58.945	.000**
Services						
Free Home Delivery	55 (100%)	-	-	72 (100%)	127.000	.000**
Warranty	55	-	72	-	-	-

	(100%)		(100%)			
Payment by Credit Card	55 (100%)	-	48 (66.7%)	24 (33.3%)	22.605	.000**
Credit facilities	-	55 (100%)	-	72 (100%)	-	-
Repairs/Exchange facilities	55 (100%)	-	72 (100%)	-	-	-

*Source: Survey Data**Significant at 1% level*

In the case of facilities, There is significant difference between Hyper/Super market and Discount stores with regard to ERP System, CRM, Bar coding and Scanning and Information/Automated Security. All Hyper/Super market stores and Discount stores provide SAP/Tally. In the case of services, There is significant difference between Hyper/Super market stores and Discount stores about Home Delivery and Payment by Credit Card. All types of organized retailers provide Warranty, Repairs/Exchange Facilities and none of them provide Credit Facilities.

3.2. Methods to Contact and Follow up Customers

The tables3.2 show the methods to contact and follow up customers on regular bases developed by Hyper/Super market stores and Discount stores. . All Hyper/ Super market stores developed methods to contact and follow up customers on regular bases but only 29.2 percent of Discount stores develop these methods.

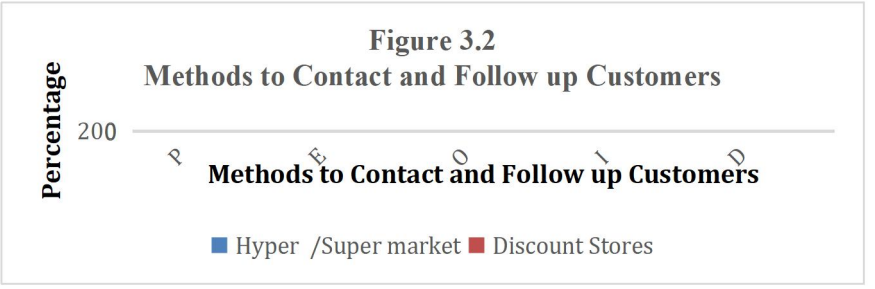
3.2.1 Methods to Contact and Follow up Customers

Methods to contact and follow up	**Hyper /Super market**		**Discount stores**		**Chi square value**	**p value**
	Yes	No	Yes	No		
Print media	55 (100%)	-	-	72 (100%)	127.000	.000**

Electronic media	55 (100%)	-	21 (29.2%)	51 (70.8%)	65.101	.000**
Outdoor advertising	18 (32.7%)	37 (67.3%)	-	72 (100%)	27.455	.000**
Internet	30 (54.5%)	25 (45.5%)	-	72 (100%)	51.419	.000**
Distribution of pamphlets	18 (32.7%)	37 (67.3%)	-	72 (100%)	27.455	.000**

*Source: Survey Data**Significant at 1% level*

There is significant difference between Hyper/Super market stores and Discount stores with regard to methods to contact and follow up customers on regular bases. The diagrammatical representation of methods to contact and follow up customers based on organized retail format is presented in the below Figure .



3.2.2.Communication with Customers

The tables 3.2.1shows the mode of communication developed to communicate with customers of organized retailers.

3.2.3.Communication with Customers

Communication with customers	Type Store		Total
	Hyper / Super market	Discount stores	
Yes	55 (100.0%)	45 (62.5%)	100 (78.7%)
No	0 (0.0%)	27 (37.5%)	27 (21.3%)
Total	55	72	127

	(100.0%)	(100.0%)	(100.0%)
Chi square value = 26.194, df=1, p value= .000			

Source: Survey Data

It is very clear from the table 5.15 that 100 percent of Hyper /Super market stores and 62.5 percent of Discount stores are communicate with their customers.

3.2.3. Mode of Communication

Mode of communication	**Hyper /Super market**		**Discount stores**		**Chi square value**	**Pvalue**
	Yes	No	Yes	No		
SMS	55 (100%)	-	21 (29.2%)	51 (70.8%)	65.101	.000**
E mail	18 (32.7%)	37 (67.3%)	-	72 (100%)	27.455	.000**
Website	55 (100%)	-	24 (33.3%)	48 (66.7%)	58.945	.000**

*Source: Survey Data **Significant at 1% level*

There is significant difference between Hyper/ Super market stores and Discount stores with regard to mode of communication. Majority of the Hyper/ Super markets developed methods to communicate with customers but majority of the Discount stores don't develop methods to communication.

3.3. Promotional Strategies

Promotional strategies means some methods of communication including advertising, digital marketing, sales promotions, and public relations. The below table discussed about promotional schemes offered by organized retailers.

Promotional	**Hyper /Super**	**Discount stores**	**Chi**	**p**

Strategies	**market**				**square value**	**value**
	Yes	No	Yes	No		
Coupons / Discounts	55 (100%)	-	27 (37.5%)	45 (62.5%)	53.239	.000**
Good Bargains	-	55 (100%)	-	72 (100%)	-	-
Special Exhibits	18 (32.7%)	37 (67.3%)	24 (33.3%)	48 (66.7%)	.005	.548
Pleasant Sales People	55 (100%)	-	51 (70.8%)	21 (29.2%)	19.220	.000**
Store Schedule Information	55 (100%)	-	72 (100%)	-	-	-
Customer Service Centre	55 (100%)	-	45 (62.5%)	27 (37.5%)	26.194	.000**
Regular Event	43 (78.2%)	12 (21.8%)	24 (33.3%)	48 (66.7%)	25.163	.000**
Loyalty Schemes	55 (100%)	-	24 (33.3%)	48 (66.7%)	58.945	.000**
Frequent Storeper Card	55 (100%)	-	-	72 (100%)	127.000	.000**
Credit Cards	55 (100%)	-	45 (62.5%)	27 (37.5%)	26.194	.000**
No Hassle Return Policy	55 (100%)	-	72 (100%)	-	-	-
Gift Vouchers	55 (100%)	-	-	72 (100%)	127.000	.000**
Coupon Payment	55 (100%)	-	-	72 (100%)	127.000	.000**
Sim Application	40 (72.7%)	15 (27.3%)	-	72 (100%)	76.439	.000**

*Source: Survey Data **Significant at 1% level*

It is clear that there is significant difference between Hyper /Super market and Discount stores with regard to these strategies. In the case of special exhibits p value is greater than .05 and null hypothesis accepted. There is no significant difference between Hyper /Super market and Discount stores with regard to special exhibits. All of them are provide store schedule information and good return policy and none of them offer bargain.

3.4. Effectiveness of Promotional Strategies

The result shows that 100% of organized retailers agree with the statements "Promotional strategies play a significant role in purchase decision making", "The store personnel should be skill trained by an expert, on tips on promotional strategies and tools", and "Discounts / Price cuts influence the footfalls in this shop". Hence it is concluded that promotional strategies adopted by organized retailers are effective.

Hypotheses Testing: Food and Grocery Organized Retailers

To conclude, the hypothesis formulated and tested in connection with food and grocery organized retailers are shown in the precise form in the following table:

Result of Hypotheses Testing: Food and Grocery Organized Retailers

Sl No.		Hypotheses	Result
1	**A**	There is no significant association between the age group of customers of organized retailers and their format type.	**Reject H0**
	B	There is no significant association between the socioeconomic profile of customers of organized retailers and their format type.	**Reject H0**
	C	There is no significant association between the shopping companion of customers of organized retailers and their format type.	**Reject H0**
2	**A**	There is no significant association between the organized retailers and their format type with regard to the change in average number of customers for the last five years.	**AcceptH0**
3	**A**	There is no significant association between the promotional strategies adopted by organized retailers and their format type.	**Reject H0**

Sl No.		Hypotheses	Result
	B	There is no significant association between the effectiveness of promotional strategies adopted by organized retailers and their format type.	**Accept H0**
	C	There is no significant association between the facilities and services provided by organized retailers and their format type.	**Reject H0**
	D	There is no significant association between the methods to contact and followup customers adopted by organized retailers and their format type.	**Reject H0**
	E	There is no significant association between communication with customers by organized retailers and their format type.	**Reject H0**

4. Conclusion

This study covers the effectiveness of promotional strategies offered by organized retailers. It also provide the idea about contact, follow up and communication methods adopted by organized retailers. Organized retail sector provide one stop shopping, good atmosphere, attractive display, ply area, different promotional strategies, pleasant sales people etc. From the study it is found that when compared between organized and traditional retail format the respondent had more satisfaction with organized retail format, the reason for the visit is not necessarily for shopping but for hedonic pleasure and for stress relieving purpose but traditional retail sector give importance to price only.

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FUTURE PROSPECTS OF INFORMATION TECHNOLOGY SERVICES START-UPS IN KERALA, INDIA

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ABSTRACT

Start-ups have become a prominent phenomenon in the 21st century, playing a vital role in national economies by introducing innovative products and services. These businesses create new employment opportunities, boost national productivity, and help reduce poverty (Decker et al., 2014). Today, software and IT start-ups are major drivers of both economic growth and technological innovation. These start-ups focus on developing software-intensive products and services. The attention given to high-tech firms has grown significantly, as the IT sector is highly dynamic and companies in this field can rapidly adapt and evolve (Davenport, T. H., 1993). According to a report by Start-up India, over 20% of start-ups in India fall under the category of IT services start-ups. These IT start-ups are temporary organizations focused on creating innovative products and services using advanced technology. However, they often operate in uncertain and high-risk environments, as evidenced by their high mortality rate (Cho, Y., & McLean, G. N., 2009). While many small IT services start-ups have emerged in recent years, only a few have managed to survive. In light of this, the researcher sought to understand the reasons behind the rapid growth of IT service start-ups despite the alarming mortality rate. The study used a systematic random sampling method and a structured questionnaire to collect primary data from a sample of 285 IT services start-ups founders. Data analysis was performed using Factor analysis and ANOVA. The study found that expanding entrepreneurial opportunities and increased government support, both at the central and state levels, are key factors that IT services start-up entrepreneurs see as crucial for their success. They are optimistic about the future of the sector, citing significant potential for IT service exports, a growing market size, rise of e-commerce, and an increasing focus by large companies on creative talent. The study also revealed that founders' opinions on the growth prospects of IT services start-ups vary based on their individual and start-up characteristics.

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Keywords: IT services start-ups, Prospects, Growth of start-ups, Technology start-ups.

1. Introduction

The concept of a start-up is a relatively recent phenomenon in the 21st century, yet start-up businesses play a crucial role in national economies by introducing and developing innovative products and services. This, in turn, generates new employment opportunities, boosts national productivity, and helps reduce poverty (Decker et al., 2014). The number of start-ups continues to rise each year, supported by modern technology platforms like web and mobile technologies, cloud systems, and open-source software (Bosch et al., 2013). While technology-oriented projects have the greatest potential for growth in today's digital world, start-ups are also emerging across traditional industries and business sectors. A start-up is typically a small, temporary organization focused on developing a scalable, repeatable, and profitable business model (Blank & Dorf, 2020). According to data from Crunchbase (2014), over 200,000 start-ups have been founded in the past decade.

2. IT Services start-ups

Today, IT services and software start-ups are among the key drivers of innovation and economic growth in any country. These start-ups focus on building software-intensive products and services. Over the past two decades, significant changes have transformed our daily lives, driven by factors such as social media, digital commerce, and the rise of technology start-ups, particularly in software and IT services. Well-known examples of such start-ups include Facebook, Instagram, WhatsApp, Airbnb, and Amazon. In India, IT services now contribute $225 billion to the economy, with $170 billion coming from IT services exports. The sector employs around 5 million people (Inc42 report, 2022).

According to the Inc42 report (2021), India is the third-largest start-up hub globally. The average age of start-up founders in India is 28, with 9% of them being women. The number of new IT services start-ups has grown from 480 in 2010 to 2,000 in 2020. Most start-ups and investors are based in metropolitan cities. In 2015, the Prime Minister launched the "Startup India, Standup India" initiative, aiming to bring significant positive change to the lives of citizens

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across the country. In recent years, India has seen a remarkable surge in its start-up ecosystem, especially in the digital and software services sectors. A study by Sikka, G. (2015) revealed that India has the world's fastest-growing start-up ecosystem, with the average valuation of an Indian start-up at $2.3 million compared to $4.2 million for an American start-up. Among these start-ups, 43% focus on global markets, and 28% are technology hotspots. In India, most start-ups follow the Business to Consumer (B2C) model (59%), followed by Business to Business (B2B) (37%), and a small percentage (4%) adopt a B2C/B2B approach.

Kerala is emerging as a promising hub for start-ups (NASSCOM, 2018). However, in some states like Kerala, there is limited visibility of entrepreneurship, fewer support organizations, and fewer opportunities for founders to connect with others. As a result, the entrepreneurial ecosystem in these regions is less mature compared to cities like Bangalore, NCR, and Mumbai. Rural areas in Kerala also require more attention in terms of developing a robust entrepreneurial ecosystem. Nevertheless, the Kerala state government is taking steps to support early-stage start-ups through various initiatives under KSUM.

3. Review of literature

While there is extensive literature on technology start-ups, research focusing specifically on IT services start-ups remains limited. Mehta, P. (2013) outlined several strategies to foster women's entrepreneurial development, such as organizing regular entrepreneurship awareness programs specifically for women, providing training, offering entrepreneurial learning opportunities, and offering motivation, mentoring, and counseling to women entrepreneurs. Olaore et al. (2020) examined the prospects and challenges of internationalizing entrepreneurship and its impact on the competitiveness of SMEs. Their study found a significant positive relationship between internationalization strategies and SMEs' competitive performance. It also revealed that socio-cultural factors, influenced by foreign alliances, positively impact the competitive performance of SMEs in their home countries. Sharma, D. and Gautam, K.P. (2020) highlighted the promising prospects for entrepreneurial ventures in India by leveraging technological support from

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other countries, promoting the consumption of domestic products, discouraging imports, regulating prices of local products, exploring new markets, improving infrastructure, and offering early-stage entrepreneurship education. Meero et al. (2021) conducted an exploratory study on Bahrain's entrepreneurial ecosystem, concluding that government support through effective public institutions and an encouraging societal attitude are key factors in the success of start-ups. The study identified several opportunities for start-ups in Bahrain, such as the rapidly growing population and a diverse cultural environment. Kuratko, D. F., and Audretsch, D. B. (2021) explored the future of entrepreneurship, finding that entrepreneurship for the masses is diminishing and becoming more concentrated among a few. They also noted that start-up entrepreneurs with a focus on necessity-driven ventures may face greater challenges in finding growth, as the market is increasingly dominated by a few large firms. However, the rapid growth of crowdfunding is seen as a key driver for future entrepreneurship. Additionally, the study emphasized that coaching entrepreneurs, fostering partnerships, and accommodating diverse social and individual goals are crucial elements shaping the future of entrepreneurship. Van Gelderen et al. (2021) examined future trends in entrepreneurship and identified areas that have received less attention, such as the gig economy, everyday entrepreneurship, entrepreneurship in developing economies, and the accelerating pace of entrepreneurship.

4. Research gap

A review of the prospects for start-ups in the future reveals numerous possibilities and opportunities. Recently, there has been a significant focus on high-technology firms. The IT sector plays a vital role in this landscape, as IT companies are capable of rapid transformation and are easily recognized (Davenport, T. H., 1993). IT start-ups are temporary organizations that develop innovative products and/or services using advanced technology. However, these companies often operate in uncertain and high-risk environments, which are evident from their high mortality rates (Cho, Y., & McLean, G. N., 2009). In this context, the researcher aims to analyze the reasons behind the growth of IT service start-ups despite the high risk of failure. The study focuses on addressing the following research objectives:

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1. To identify the prospects for the growth of IT services start-ups in Kerala.
2. To analyze the differences in opinions among start-up founders regarding the growth prospects of IT services start-ups in Kerala, considering factors such as the incubation status of the start-ups and the educational level of the founders.

5. Hypotheses of the study

H1:Opinions of founders regarding prospects for the growth of IT services start-upsare same with respect to their educational level and incubation status.

6. Research methodology

This study is descriptive in nature and primarily utilizes data from primary sources. A structured questionnaire was created and distributed to the founders of IT service start-ups. Respondents were asked to rate items on a 1 to 5 Likert scale and interpret the gap between each scaled item, selecting one unit for their response. To assess the reliability and validity of the questionnaire, Cronbach's alpha (greater than 0.70) and content validity were applied. The study focuses on the operations of IT services start-ups in Kerala and is limited to the perceptions of IT service start-up founders listed in the Start-up India database as of January 21, 2023. The research covers sectors such as application (software) development, IT consulting, IT management, product development, web development, and others. The findings of this research could be beneficial for aspiring entrepreneurs in the IT services start-up sector and provide valuable insights for policymakers in India to design policies and initiatives that foster an entrepreneurial culture.

7. Opinions of start-ups founders regarding the prospects for growth of IT services start-ups in Kerala

From literature surveyed, there are tremendous opportunities for start ups especially for technology start-ups in future in Kerala. Advancement of information technologyin the country is mainly promoted and used by start-up companies in India. Central government initiatives like start-ups India stand-up India scheme, digital India initiatives etc. promote start-up culture especially technology start-ups in the country. It is found that rapidly

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growing population is one of the main opportunities for start-ups in future (Meero et al., 2021). There are good prospects for the entrepreneurial venture in the country by various means (Sharma, D & Gautam, K.P. 2020). To check the growth prospects of IT services start-ups in Kerala, 12 items are included in the survey questionnaire.Respondents were asked to rate this 12 items related problem factors on a 5-point Likert scale, ranging from 1 = strongly disagree to 5 = strongly agree. In order to study prospects in growth in IT services start-ups in Kerala and its dimensions, all the items are examined with help of Exploratory Factor Analysis. To use factor analysis, suitability of data was checked. To do this, both KMO test and Bartlett's test were used. Value of KMO of .714 reveals that factor analysis can be used for the present data. (p value is 0.000). So the result of KMO test and Bartlett's test reports that the present data is appropriate for factor analysis.

Table 1

Rotated Component Matrix of founders' perception on growth factors of IT services start-ups

	Components			
	1	**2**	**3**	
Accelerator's support	0.89			0.944
Incubators support	0.86			0.881
Good business climate	0.682			0.817
Support through Co-working space	0.647			0.771
Availability of adequate capital	0.511			0.883
Competitive advantage		0.77		0.724
Availability of infrastructure		0.705		0.727
Availability of Talent employees		0.7		0.672
Favourable regulatory environment		0.641		0.817
Favourable political environment			0.908	0.767
Adapt to customer needs			0.88	0.677
Team expertise and their commitment			0.565	0.526
Eigen value	3.379	1.95	1.581	

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Variance (%)	28.155	16.254	13.173	
Cumulative variance (%)	28.155	44.408	57.581	

Source: Computed data

From the table above, it can be observed that out of the 12 items (components), only 3 components with Eigenvalues greater than 1 were selected. This indicates that these three components are capable of explaining the maximum variance in the characteristics of the units. The total variance explained by all nine factors is 57.58%, with the three selected factors accounting for the majority of this variance. Specifically, the first factor explains 28.155% of the variance, the second factor explains 16.254%, and the third factor explains 13.173%.

Using factor analysis, the 12 dependent variables were reduced to three key factors. To identify the main challenges perceived by IT services start-ups, new labels were assigned to these three factors for hypothesis testing: Factor 1 – Government support for the entrepreneurial ecosystem, Factor 2 – Increasing entrepreneurial opportunities, and Factor 3 – Developing an entrepreneurial mindset. The Cronbach alpha coefficient for each of these three factors demonstrated strong reliability and internal consistency among the items: .796 (Factor 1), .714 (Factor 2), and .706 (Factor 3). Thus, the scales developed for analyzing the prospects for the growth of IT services start-ups in Kerala using factor analysis were deemed appropriate for hypothesis testing.

8. Difference in the opinions of start-ups founders regarding the prospects for growth of IT services start-ups in Kerala with respect to incubation status of start-ups.

In India, a significant number of incubation centers are being established by the government, private organizations, and through public-private partnerships to support start-up companies across the country. To compare the prospects for the growth of IT services start-ups in Kerala with their incubation status, the researcher formulated the following hypothesis.

H2: There is significant difference in the opinions of start-ups founders regarding the prospects for growth of IT services start-ups in Kerala with respect to incubation status of start-ups.

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Table 2

Difference in the opinions of start-ups founders regarding the prospects for growth of IT services start-ups in Kerala with respect to incubation status of start-ups.

Growth prospects	Incubtion status	N	Mean	S.D	Levene's Testfor Equality of Variances		t	Sig. (2-tailed)
					F	Sig.		
Govt. support for entrepreneurial ecosystem	Yes	92	3.93	0.73	5.793	0.017	-1.134	0.289
	No	193	4.02	0.61			-1.065	
Increasing entrepreneurial opportunities	Yes	92	4.27	0.54	0.483	0.488	1.252	0.212
	No	193	4.18	0.60			1.304	
Developing entrepreneurial mindset	Yes	92	4.30	0.62	0.039	0.844	1.993	0.047*
	No	193	4.14	0.63			2.007	

Source: Survey data, * Significant at 5% level of significance

Table 2 presents the descriptive statistics and t-test results, along with Levene's test, comparing the opinions of IT services start-up entrepreneurs regarding the growth prospects of IT services start-ups in Kerala based on the incubation status of the start-ups. For the variable "Government support for the entrepreneurial ecosystem," the p-value (.289) is greater than 0.05, indicating that the null hypothesis cannot be rejected. Therefore, there is no significant difference in the opinions of IT services start-up founders regarding government support for the entrepreneurial ecosystem based on incubation status.

For the variable "Increasing entrepreneurial opportunities," the p-value (.212) is also greater than 0.05, meaning the null hypothesis cannot be rejected. As a result, there is no significant difference in the opinions of IT services

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start-up founders regarding increasing entrepreneurial opportunities based on incubation status.

However, for the variable "Developing entrepreneurial mindset," the p-value (.047) is less than 0.05, leading to the rejection of the null hypothesis. This indicates that there is a significant difference in the opinions of IT services start-up founders regarding the development of an entrepreneurial mindset based on incubation status.

9. Difference in the opinions of start-ups founders regarding the prospects for growth of IT services start-ups in Kerala with respect to education level of the founders

Entrepreneurial aspirants often seek to identify business opportunities based on their educational background. To determine whether there is any difference in the prospects for growth in IT services start-ups based on the education level of founders, the following hypothesis was formulated.

H**3**: The opinions of IT services start-ups entrepreneurs regarding prospects for growth of IT services start-ups in Kerala differ based on education level of founders.

Table 3

Prospect for growth	Education level					F	Sig.
	Below +2	Degree	Diploma	PG	Others		
Govt.support for entrepreneurial ecosystem	4.20 (.24)	4.00 (.59)	4.09 (.60)	3.88 (.69)	3.06 (.16)	5.168	.000*
Increasing entrepreneurial opportunities	3.26 (.75)	3.82 (.74)	4.25 (.59)	4.23 (.50)	4.10 (.15)	5.360	.000*
Developing entrepreneurial mindset	3.74 (.28)	4.70 (.47)	4.05 (.62)	4.29 (.61)	4.90 (.15)	7.774	.000*

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ANOVA for significant difference in the opinions of start-ups founders regarding the prospects for growth of IT services start-ups in Kerala with reference to education level of founders.

Source: Survey data, * denotes significant at 5% level

Note : 1. The value without the bracket refers to Mean
2.The value within bracket refers to SD

Table 3 above presents the ANOVA results for the educational level and prospects for growth at a 5% significance level. The results indicate that all factors related to prospects for growth—such as government support for the entrepreneurial ecosystem, increasing entrepreneurial opportunities, and developing an entrepreneurial mindset—have p-values less than 0.05, leading to the rejection of the null hypotheses. Therefore, it can be concluded that the opinions of IT services start-up entrepreneurs regarding government support for the entrepreneurial ecosystem, increasing entrepreneurial opportunities, and developing an entrepreneurial mindset vary based on the education level of the founders

10. Results and Discussion

The study found that the most important prospects expected by IT services start-up entrepreneurs are increasing entrepreneurial opportunities and support from both the central and state governments, with the highest mean score of 4.20. Entrepreneurs see a promising future in this field, with ample potential for exporting IT services and products, a growing market size, the e-commerce boom, and big companies focusing on creative individuals. It was observed that increasing entrepreneurial opportunities hold the greatest importance (mean score of 4.20) for IT services start-up entrepreneurs. Additionally, the study identified that the opinions of IT services start-up entrepreneurs regarding government support for the entrepreneurial ecosystem, increasing entrepreneurial opportunities, and developing an entrepreneurial mindset vary based on the founders' educational background and the incubation status of their start-ups. To support the growth of IT services start-ups in the state, the government should introduce special policies, schemes, and subsidies, ensuring they are well-coordinated and communicated to all relevant parties through various digital media channels, including awareness programs in schools and

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colleges. A supportive and friendly atmosphere should also be fostered, particularly for young entrepreneurs.

11. Conclusion

This study primarily aimed to analyze the reasons behind the rapid growth of IT service start-ups in Kerala, despite the alarming mortality rate. A structured questionnaire was used to gather data from start-up founders. The findings indicate that increasing entrepreneurial opportunities and government support—both at the central and state levels—are the most significant prospects expected by IT services start-up entrepreneurs. The study revealed that the opinions of IT services start-up entrepreneurs regarding government support for the entrepreneurial ecosystem, increasing entrepreneurial opportunities, and developing an entrepreneurial mindset vary based on the founders' educational background and the incubation status of their start-ups. The government should focus on investing in higher education to foster an entrepreneurial mindset among students by strengthening the links between industry, academic institutions, and the government. Furthermore, adequate capital should be provided to IT start-ups through connections with angel investors, venture capitalists, and other funding sources. The study also highlighted the low participation of women in start-ups. To address this, the government and society should work towards empowering women by utilizing their potential in entrepreneurial activities through the implementation of special schemes and initiatives. The establishment of Technology Business Incubators (TBI) specifically for women founders could be a key step in this direction.

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REVIEW OF SURFACE PLASMON STUDIES OF GOLD/SILVER BIMETALLIC THIN FILMS

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Abstract

Surface Plasmon Resonance (SPR) is a powerful optical phenomenon extensively applied in biosensing, environmental monitoring, and chemical detection due to its exceptional sensitivity to refractive index changes at metal-dielectric interfaces. While traditional monometallic SPR sensors are effective, they often face limitations in sensitivity, stability, and selectivity. Bimetallic SPR sensors have emerged as a promising solution, leveraging the complementary plasmonic and structural properties of two metals to enhance performance. Among these, gold-silver (Au-Ag) bimetallic nanostructures have gained significant attention due to their unique synergistic properties, combining the chemical stability of gold with the superior plasmonic performance of silver. This review provides a comprehensive analysis of Au-Ag bimetallic SPR systems, focusing on their optical and electronic properties, structural tunability, and fabrication techniques. Gold-silver (Au-Ag) bimetallic SPR systems are widely used in biosensing, enabling sensitive detection of biomolecules and pollutants, and in surface-enhanced Raman scattering (SERS) for trace-level analysis. Challenges in stability, reproducibility, and large-scale synthesis are also analyzed, alongside potential strategies for overcoming these limitations. This review aims to provide a detailed understanding of Au-Ag bimetallic SPR systems, fostering further innovation in the development of advanced plasmonic materials.

Keywords:surface plasmon resonance, Bimetallic SPR sensors, Gold-silver bimetallic nanostructures,Biosensing

1. Introduction

Surface Plasmon Resonance (SPR) is a phenomenon that occurs when light interacts with free electrons at the interface of a metal and a dielectric

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medium, leading to the excitation of surface plasmon waves (SPWs). This phenomenon is highly sensitive to changes in the refractive index of the dielectric medium, making SPR a powerful tool for biosensing, environmental monitoring, and chemical detection [1]. Traditional SPR sensors typically use single-metal films, such as gold (Au) or silver (Ag), but these materials have inherent limitations. Gold offers excellent chemical stability but has a broader SPR curve, while silver provides a sharper SPR curve but is prone to oxidation and chemical instability [2].

To overcome these limitations, bimetallic SPR sensors, particularly those combining gold and silver, have been developed. These sensors leverage the complementary properties of the two metals, offering enhanced sensitivity, stability, and selectivity. This review focuses on the optical and electronic properties, structural tunability, and fabrication techniques of Au-Ag bimetallic SPR systems, as well as their applications in biosensing and SERS. We also discuss the challenges associated with these systems and potential strategies for overcoming them.

2. Fundamentals of Surface Plasmon Resonance

SPR involves the resonant oscillation of conduction electrons at the interface of a metal and a dielectric, excited by incident polarized light. The resonance condition is highly sensitive to changes in the refractive index near the metal surface, making SPR a valuable tool for sensing applications. SPR is typically observed using configurations like the Kretschmann or Otto geometry, which facilitate the coupling of light into surface plasmons. [1,2,3].

Monometallic systems, such as gold or silver films, have been extensively used in SPR sensors. Gold is chemically inert and suitable for biosensing, while silver exhibits sharper SPR peaks due to its narrower resonance bandwidth. However, silver's susceptibility to oxidation and degradation limits its practical applications. Bimetallic systems address these drawbacks by combining the desirable properties of both metals. Au-Ag systems, in particular, leverage gold's stability and silver's plasmonic efficiency, making them ideal for sensitive and robust SPR sensors [3,4].

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3. Optical and electronic properties of Au-Ag bimetallic thin films

3.1. Plasmonic Properties

The plasmonic properties of Au-Ag bimetallic thin films are a key factor in their performance as SPR sensors. Silver is known for its superior plasmonic properties, including a narrow SPR curve and high sensitivity, while gold offers chemical stability and biocompatibility. When combined, these metals create a synergistic effect that enhances the overall performance of the SPR sensor.

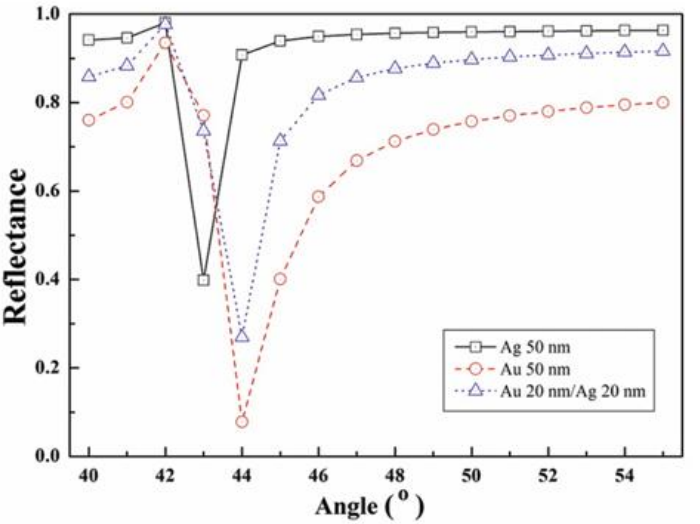

Figure 1: Reflectance curves for Au (50 nm), Ag (50 nm), and Au/Ag (20 nm/20 nm) thin films. The bimetallic film shows a narrower full width at half maximum (FWHM) compared to Au, indicating improved resolution. Adapted from Kim et al. (2018) [3].

In a study by Kim et al. (2018), the SPR properties of Au/Ag bimetallic thin films were compared with those of single-metal films. The authors found that the bimetallic films exhibited a higher figure of merit (FOM) and sensitivity compared to single-metal films. The FOM, which is a measure of the sensor's performance, was determined to be 56.9 for the Au/Ag bimetallic film, compared to 47.9 for Au and 89.1 for Ag single films [3]. This improvement is attributed to the transfer of electrons from Ag to Au, which increases the electron density in the Au region and enhances the SPR response.

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3.2. Evanescent Field Enhancement

The evanescent field, which decays exponentially from the metal-dielectric interface, plays a crucial role in SPR sensing. The strength and penetration depth of the evanescent field determine the sensor's ability to detect changes in the refractive index of the surrounding medium.

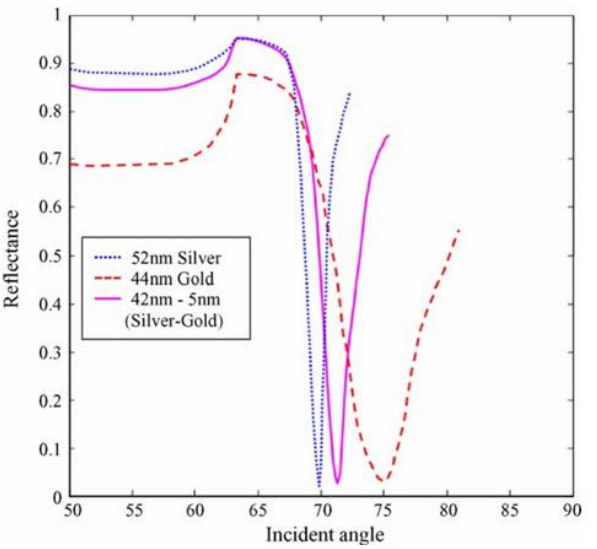

Figure 2: Simulated electric field intensities in Au, Ag, and Au/Ag bimetallic films. The bimetallic configuration shows enhanced field localization at the analyte interface. Adapted from Ong et al. (2006) [4].

Ong et al. (2006) demonstrated that Au-Ag bimetallic films provide a stronger evanescent field compared to single-metal films, leading to enhanced sensitivity. The authors found that the electric field intensity at the analyte-metal interface was 3.0 times higher for the bimetallic film compared to a single gold film [4].

4. Experimental Setups in Au-Ag Bimetallic SPR Studies

The experimental setups used in Au-Ag bimetallic SPR studies vary widely, reflecting the diverse approaches to optimizing sensitivity, stability, and reproducibility. A common feature across most studies is the use of the Kretschmann prism coupling configuration, which is employed in five out of the six reviewed studies. This configuration typically involves a HeNe

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laser(632.8–633 nm) as the light source, with p-polarized light directed through a prism to excite surface plasmon waves at the metal-dielectric interface. For example, Ong et al. (2006) used a red HeNe laser (633 nm) with a BK7 glass prism and a rotary stage to measure SPR reflectivity curves. Similarly, Kim et al. (2018) employed a 632.8 nm HeNe laser in their Kretschmann-Raether setup, achieving a resonance angle of 44° for a 20 nm Au/20 nm Ag bimetallic film.

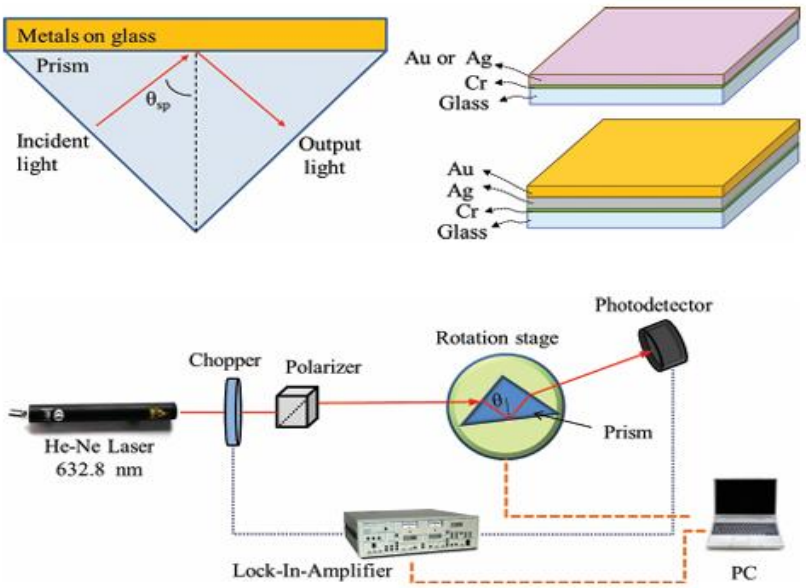

Figure 3: Schematic of the Kretschmann prism coupling configuration used in SPR experiments. Adapted from Kim et al. (2018) [3].

Fabrication techniques for Au-Ag bimetallic films also vary, with sputtering and thermal evaporation being the most common methods. Ong et al. (2006) used an E-beam evaporator to deposit Ag and Au films, while Kashyap et al. (2019) employed pulsed DC magnetron sputtering to achieve uniform film thicknesses of 35 nm Ag and 15 nm Au. The latter study demonstrated that this method reduces surface roughness, leading to a 3.5-fold reduction in FWHM compared to pure Au films. In contrast, Ghodselahi et al. (2014) synthesized Ag@Au nanoparticles using RF-PECVD and RF-sputtering, achieving a unique core-shell structure that enhanced localized SPR (LSPR) sensitivity for DNA detection.

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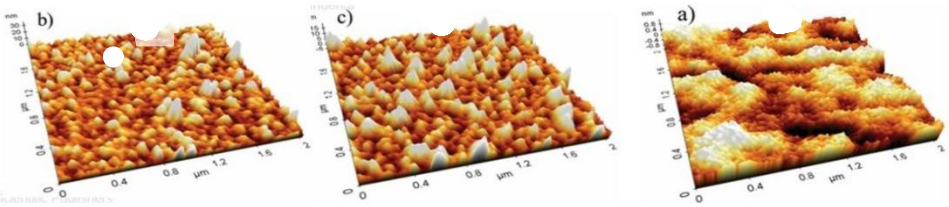

Figure 4: AFM images of Au (50 nm), Ag (50 nm), and Au/Ag (20 nm/20 nm) thin films. The bimetallic film shows reduced surface roughness compared to pure Ag. Adapted from Kim et al. (2018) [3].

Characterization of the fabricated films typically involves X-ray diffraction (XRD), atomic force microscopy (AFM), and UV-Vis spectroscopy. For instance, Ehler & Noe (1995) used XRD to confirm the formation of alloy-like interfaces in Ag/Au films, while Kim et al. (2018) employed AFM to measure surface roughness, finding values of 0.268 nm for Au, 5.692 nm for Ag, and 3.695 nm for Au/Ag bimetallic films. Ghodselahi et al. (2014) utilized UV-Vis spectroscopy to monitor LSPR peak shifts in response to DNA primer binding, demonstrating a blue shift for Au and a red shift for Ag.

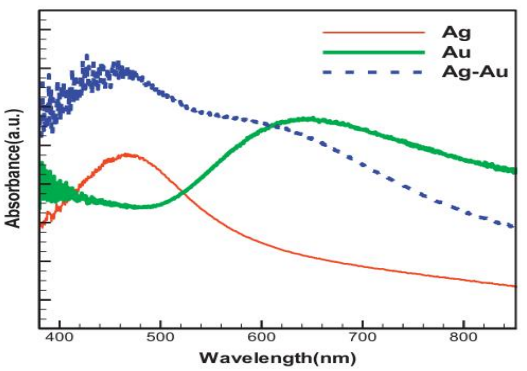

Figure 5: UV-Vis absorption spectra of Ag@Au nanoparticles before and after DNA primer exposure. The LSPR peak shifts indicate binding events. Adapted from Ghodselahi et al. (2014) [7].

Functionalization of the sensor surface is another critical aspect of SPR experiments. Zynio et al. (2002) functionalized Au/Ag films with a 1-hexadecanethiol (11-MUA) self-assembled monolayer (SAM), achieving a

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20% reduction in noise compared to pure Au. Similarly, Kashyap et al. (2019) immobilized anti-IgG antibodies using EDC/NHS chemistry, enabling the detection of IgG at concentrations as low as 0.1 mg/mL.

Despite these advancements, challenges remain in achieving large-scale reproducibility and long-term stability. For example, the oxidation of silver remains a significant issue, as highlighted by Kim et al. (2018), who proposed using a thin gold overlayer to protect the silver film. Additionally, the trade-off between sensitivity and FWHM continues to be a focus of research, with bimetallic films offering a promising solution by combining the plasmonic advantages of silver with the chemical stability of gold.

5. Structural Tunability and Fabrication Techniques

The thickness of the metal films is a critical parameter in SPR sensors, as it affects the resonance angle, FWHM, and sensitivity. Ong et al. (2006) conducted a detailed study on the optimization of film thickness for Au-Ag bimetallic SPR sensors. They found that a 42 nm silver layer with a 5 nm gold overlayer provided the best performance, achieving a sharp SPR curve with a narrow FWHM and high sensitivity [4].

Various fabrication techniques have been employed to create Au-Ag bimetallic thin films, including sputtering, thermal evaporation, and pulsed DC magnetron sputtering.

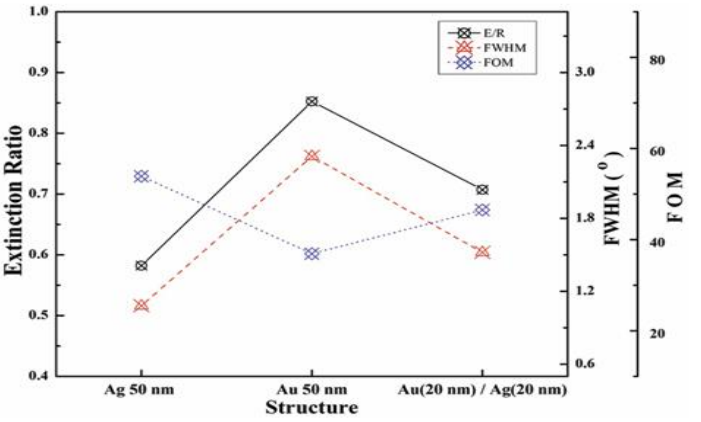

Figure 6: AFM images of Au (50 nm), Ag (50 nm), and Au/Ag (20 nm/20 nm) thin films. The bimetallic film shows reduced surface roughness compared to pure Ag. Adapted from Kim et al. (2018) [3].

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Kashyap et al. (2019) used pulsed DC magnetron sputtering to fabricate Au-Ag bimetallic films for SPR biosensors. The authors reported that the bimetallic films exhibited a 3.5-fold reduction in FWHM compared to single gold films, indicating higher detection accuracy [5].

6. Applications in Biosensing and SERS

Au-Ag bimetallic SPR sensors have been widely used in biosensing applications due to their high sensitivity and stability. Zynio et al. (2002) demonstrated that bimetallic films could detect changes in the refractive index of the surrounding medium with high accuracy. The authors found that the bimetallic films exhibited a higher signal-to-noise ratio compared to single-metal films, making them suitable for detecting small molecules [6].

In addition to biosensing, Au-Ag bimetallic films have been used in SERS for trace-level analysis.

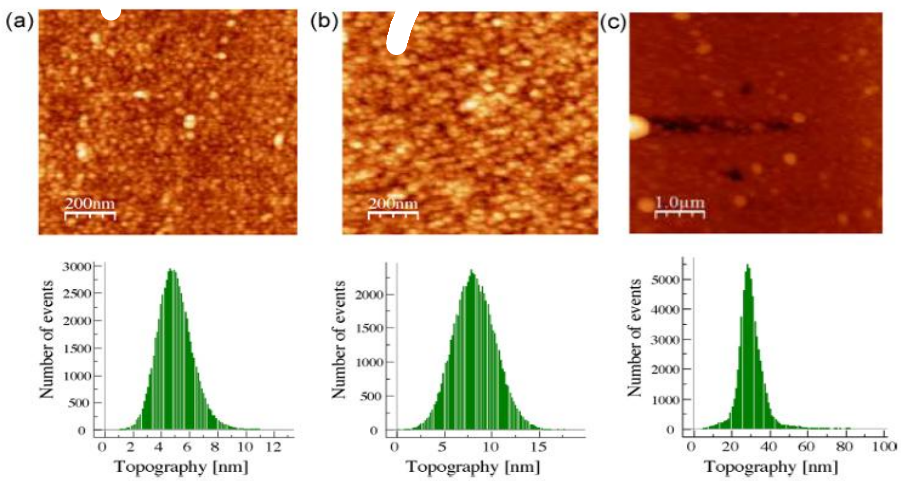

Figure 7: UV-Vis absorption spectra of Ag@Au nanoparticles before and after DNA primer exposure. The LSPR peak shifts indicate binding events. Adapted from Ghodselahi et al. (2014) [4].

Ghodselahi et al. (2014) synthesized Au-Ag bimetallic nanoparticles and demonstrated their application in SERS. The authors found that the bimetallic nanoparticles exhibited a higher sensitivity to DNA primers compared to single-metal nanoparticles, making them suitable for molecular detection [4].

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7. Challenges and Future Directions

Despite their advantages, Au-Ag bimetallic SPR sensors face challenges related to stability and reproducibility. Silver is prone to oxidation, which can degrade the sensor's performance over time. To address this issue, Kim et al. (2018) proposed using a thin gold overlayer to protect the silver film from oxidation. The authors found that the bimetallic film exhibited similar chemical stability to a single gold film, while maintaining the enhanced SPR properties of silver [3]. Another challenge is the large-scale synthesis of Au-Ag bimetallic films with consistent properties. Kashyap et al. (2019) highlighted the need for advanced fabrication techniques to achieve uniform film thickness and composition. The authors suggested that pulsed DC magnetron sputtering could be a promising approach for large-scale production [5].

8. Conclusion

Gold-silver (Au-Ag) bimetallic SPR thin films have demonstrated significant advantages over monometallic counterparts by combining the chemical stability of gold with the superior plasmonic properties of silver. These hybrid structures enhance sensitivity, selectivity, and tunability, making them invaluable in biosensing, environmental monitoring, and spectroscopy.Despite these advantages, challenges remain in terms of long-term stability, large-scale fabrication, and reproducibility. The oxidation of silver, variations in film thickness, and difficulties in achieving uniform nanostructures need to be addressed to ensure consistent performance. Advanced fabrication techniques such as pulsed DC magnetron sputtering and core-shell nanostructures offer promising solutions.Future research should focus on optimizing Au-Ag compositions, integrating additional nanomaterials, and developing hybrid plasmonic systems to further enhance performance. The incorporation of novel dielectric coatings, functionalized surfaces, and machine-learning-driven optimization could pave the way for next-generation SPR sensors with unprecedented sensitivity and reliability. By overcoming these challenges, Au-Ag bimetallic SPR systems can play a pivotal role in advancing plasmonic nanotechnology for biomedical and environmental applications.

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IMAGINING THE REGIONAL SPACES: A READING OF THE PLIGHT OF REFUGEES IN AMITAV GHOSH'S *THE HUNGRY TIDE*

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ABSTRACT

Thousands of refugees were forcefully displaced from places like Bangladesh following the Partition and found home in the Sundarbans. Sundarbans is a mangrove area in the delta formed by the confluence of the Ganges, Brahmaputra and Meghna Rivers in the Bay of Bengal. The story of the Sundarbans, including its human and wildlife populations, is intrinsically linked to the history of Partition. The postcolonial Sundarbans witnessed increasing human activity, their struggle for finding a home space amidst the wild surroundings, declining biodiversity and recognition of the uniqueness of the Sundarbans. The refugees sought to build an alternative social structure and space that would be more inclusive and give due dignity to their life and labour. In the novel *The Hungry Tide* Amitav Ghosh problematizes the tensions, crises existed among the human communities in Sundarban. Ghosh sets his novel in the Sundarbans, which is also called as the tide country, where the contours of land constantly change with the ebb and flow of water. The novel also addresses the complex struggle between humans and animals for survival. This paper mainly discusses how Amitav Ghosh objectively and dispassionately highlights the plight of the dispossessed people living on the island of Sundarban.

Keywords: Partition, Refugees, Regional Space, Sundarban, Home.

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Introduction

Literary analysis of regional spaces frequently demonstrates how geography affects human existence, especially in situations of displacement. In addition to being a distinctive natural setting, the Sundarbans are portrayed in Amitav Ghosh's *The Hungry Tide* as a disputed political area where refugees fight for their lives. The historical event of the Morichjhapi massacre, in which Bengali refugees—mostly Dalits—were subjected to severe state persecution for trying to establish themselves on protected territory, is brought to light in the novel. The novel explores how regional spaces serve as both a haven and a place of exclusion for displaced groups through its intricate narrative structure and weaving together ecological, historical, and political issues.

This paper aims to examine how refugees and the creation of regional space are portrayed in *The Hungry Tide*. It makes the case that Ghosh's book challenges prevailing narratives of ecological preservation, development, and national belonging while elevating the underrepresented voices of refugees. This research demonstrates how Ghosh reimagines regional areas as places of both promise and struggle by interpreting the Sundarbans as a location of tension between environmental control and human settlement.

The Sundarbans as a Regional Space

The biggest mangrove forest in the world, the Sundarbans, is a major setting in *The Hungry Tide*. The unstable existence of its residents is reflected in the depiction of this tidal zone as a liminal space where land and water continuously blend. The Sundarbans are a site where the settlers can try to reconstruct their life, but they also face challenges since they are susceptible to natural calamities, state aggression, and unstable economic conditions.

Regional space is not only a setting in Ghosh's book; rather, it actively shapes people's lives. Survival is a daily battle in this environment because of the hazardous fauna, thick trees, and erratic tides. The socio-political volatility of the refugees, who are frequently uprooted and denied a permanent position in the nation-state, is reflected in this geographical instability. As a result, the Sundarbans serve as a metaphor for the fluidity of identity and belonging, as uncontrollable forces continuously test human agency.

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Refugees and the Politics of Displacement

The situation of Bengali refugees who left East Pakistan (now Bangladesh) during and after the 1947 Partition and the 1971 Bangladesh Liberation War is one of the main themes of *The Hungry Tide*. The novel centres on the 1979 Morichjhapi massacre, in which the state violently expelled thousands of refugees—mostly Hindus from lower castes—who had tried to settle on an island in the Sundarbans.

Ghosh conveys this episode through Nirmal's viewpoint, an optimistic schoolteacher whose diary captures the refugees' hardships. His story is juxtaposed with that of Fokir, a fisherman whose life is profoundly connected to the sea's rhythms. Their experiences highlight various ways the marginalized assert their existence in an unwelcoming world. While Nirmal aspires for resistance and political transformation, Fokir personifies the quiet resilience of those who persist unnoticed.

The expulsion of the Morichjhapi settlers is depicted as a forceful demonstration of state authority, with environmental preservation being used to justify the removal of people. The government's choice to designate Morichjhapi as a protected zone highlights the contradiction inherent in contemporary governance—while the state asserts its commitment to safeguarding nature, it concurrently disrupts the lives of those who rely on it for their livelihoods. Consequently, the refugees emerge as casualties of both environmental regulations and caste-based marginalization, further entrenching their position as outsiders in the national narrative.

Memory, Resistance, and the Subaltern Voice

The novel not only reconstructs historical events but also interrogates the omission of refugee narratives from official accounts. Kanai, a city dweller and translator, discovers the history of Morichjhapi through Nirmal's diary, compelling him to confront the muted voices of history. His journey represents the process of revealing concealed histories and recognizing the pain of the marginalized.

Ghosh's portrayal of Morichjhapi contests prevailing historical narratives that overlook subaltern perspectives. While mainstream accounts concentrate on nationalism and progress, the novel emphasizes the importance of acknowledging the forgotten struggles of those considered disposable. In this

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way, *The Hungry Tide* serves as an act of literary resistance, ensuring that the voices of the dislocated are not erased from history.

Furthermore, the novel underscores the various methods of resistance adopted by the refugees. Some, like Kusum, directly confront state oppression, while others resist through resilience and adaptation. The act of storytelling itself emerges as a form of defiance, enabling the past to be remembered and reimagined.

Regional Space and the Ecological Conflict

An essential element of the novel is the tension between environmental protection and human habitation. The Sundarbans, recognized as a UNESCO World Heritage Site, is frequently examined through an ecological viewpoint, portraying human presence as a danger to biodiversity. However, Ghosh complicates this view by illustrating how those who are displaced under the guise of conservation have historically lived harmoniously with nature.

The character of Fokir offers a different perspective on coexisting with the environment, where human life is intricately linked to ecological cycles. His traditional wisdom and spiritual ties to the Sundarbans sharply contrast with the contemporary conservationist mindset, which aims to detach humans from nature. Consequently, the novel critiques the imposition of environmental policies from above that overlook indigenous lifestyles.

By contrasting the challenges faced by refugees with the broader conversation on conservation, Ghosh prompts significant ethical inquiries: Who is entitled to live in a particular area? Which interests are favored in environmental regulations? Can conservation practices be considered just if they disregard the experiences of the marginalized? In this way, *The Hungry Tide* confronts oversimplified narratives of ecological preservation and advocates for a more inclusive perspective on regional communities.

Conclusion

Amitav Ghosh's *The Hungry Tide* presents a profound examination of regional locations as contested areas of history, environment, and displacement. By concentrating on the experiences of refugees in the Sundarbans, the novel underscores the precarious lives of those excluded from prevailing narratives of nationhood and progress. Through its intricate

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depiction of Morichjhapi, the story critiques the brutality of governmental policies and the obliteration of marginalized histories.

Central to the novel is a poignant inquiry: What does it signify to belong? For the Sundarbans refugees, belonging is an ongoing challenge influenced by the currents of history, politics, and geography. By envisioning regional areas as both spaces of resilience and anguish, *The Hungry Tide* encourages readers to reconsider the connections between displacement, environment, and power in today's world.

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EXPLORING THE AI-KNOWLEDGE MANAGEMENT INTERFACE: PAVING THE WAY FOR SUSTAINABLE LEARNING

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ABSTRACT

Integrating artificial intelligence (AI) with knowledge management (KM) practices offers a promising way to improve sustainable learning in higher education. However, there is limited research on how this combination works, especially in developing countries. This study aimed to explore how AI-powered KM practices affect sustainable learning outcomes in Indian higher education institutions. A model was tested using responses from 401 students.The results showed that AI-driven knowledge creation, storage, discovery, and prediction had a strong positive impact on sustainable learning when used ethically. On the other hand, AI-based knowledge capture practices and customized knowledge delivery did not significantly affect sustainable learning. The model demonstrated significant explanatory power for sustainable learning outcomes. This study adds to the "knowledge-based view" and "absorptive capacity" theories by exploring AI and KM integration in education. It also supports the "responsible AI paradigm" by considering ethical issues in AI-driven educational systems. The findings lay the groundwork for future research on the relationship between AI, KM, and sustainable learning, providing valuable insights for improving educational practices and promoting lifelong learning.

Keywords: AI-based knowledge management, Sustainable learning, absorptive capacity, Higher education.

1. Introduction

1.1. Research Background

In recent years, the integration of Artificial Intelligence (AI) into various sectors has garnered widespread attention due to its transformative potential.

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In education, AI's capacity to process large amounts of data, recognize patterns, and generate predictive insights has led to significant advancements in teaching, learning, and knowledge management (KM) practices. Knowledge management, which involves the systematic management of knowledge creation, storage, sharing, and application, is a critical function in higher education institutions. It aids in improving decision-making processes, enhancing collaboration, and promoting continuous learning. When combined with AI, KM systems can become even more efficient, enabling institutions to offer personalized learning experiences, streamline knowledge flows, and optimize resources for better educational outcomes.

While AI and KM hold promise for improving educational practices, their integration in higher education, particularly in developing countries, remains underexplored. Developing nations face unique challenges, such as inadequate technological infrastructure, limited access to resources, and distinct cultural and social contexts, which may influence the implementation and effectiveness of AI-enhanced KM practices. In these regions, understanding how AI-driven KM systems can contribute to sustainable learning outcomes is crucial, but empirical studies on this subject are scarce. Most existing literature has focused on developed countries, which have more established infrastructure and resources, leaving a gap in research that considers the specific needs and conditions of developing countries like India.

1.2. Research Objectives

The rapid advancements in artificial intelligence (AI) and its applications across various sectors have sparked significant interest in higher education, particularly in enhancing learning outcomes and knowledge management (KM) practices. AI’s ability to process vast amounts of data, provide predictive insights, and automate tasks has the potential to revolutionize how knowledge is created, shared, and applied within educational settings. Knowledge management, on the other hand, focuses on the effective acquisition, organization, and dissemination of knowledge to facilitate better decision-making and learning processes. When integrated, AI and KM have the potential to create a more sustainable and effective learning environment in higher education, promoting both the personal and academic growth of students.

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The study aims to investigate the impact of AI-enhanced KM practices on sustainable learning outcomes in higher education institutions in developing areas of our country. By analyzing responses from 301 students and testing a proposed model using partial least squares structural equation modeling (PLS-SEM), the study seeks to explore how AI-driven knowledge creation, storage, discovery, and prediction influence learning sustainability. This research also considers the ethical dimensions of AI implementation, offering insights into how responsible AI practices can be integrated into educational systems.

In addition to contributing to the existing body of knowledge on AI and KM in education, this study expands on theoretical perspectives such as the "knowledge-based view" and "absorptive capacity" theories. It also aligns with the emerging "responsible AI paradigm," which emphasizes the importance of ethical considerations in developing and deploying AI technologies in education. Ultimately, the study aims to provide valuable insights that can guide the transformation of educational practices, fostering an environment of lifelong learning and sustainable development.

1.3. Research Questions

This study develops and tests a conceptual framework examining the influence of AI-enhanced KM on sustainable learning in Indian higher education, It offers insights for scholars and practitioners in education, AI, and KM fields, exploring how AI-driven KM can facilitate sustainable learning environments. The research contributes to educational technology and sustainable development discussions by investigating the synergy between AI and KM.

RQ1: How do AI-enhanced knowledge management practices impact sustainable learning outcomes in higher education institutions in India?

RQ2: What are the key factors, including ethical considerations, that influence the successful integration of AI in knowledge management systems to improve educational practices and learning sustainability in Indian higher education?

2. Literature Review

The need for effective management forms part of the management of knowledge creation itself. In this respect, the nature, characteristics and skills

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of the facilitator are crucial to the development of energy and synergy, which in turn will lead to knowledge creation, insight and innovation. A moderator's awareness of tacit knowledge and his/her ability to facilitate intangible value is vital to the success of a knowledge-focused web environment. Janette Young, in Personal Knowledge Capital, 2012, Knowledge creation theory is at the heart of knowledge management. It has enabled the processes of knowledge to be broken down into understandable parts. The theory of knowledge creation has been led by the work of Nonaka (1991) and Nonaka and Takeuchi (1995). Nonaka and Takeuchi's theory has achieved paradigmatic status since the mid-1990s (Gourlay 2006), and it has been described as one of the best and most influential models in knowledge strategy literature (Choo and Bontis 2002, cited in Gourlay 2006). As this theory has become so highly regarded, we need to understand the theory in further detail, to make the best use of it as we continue to advance into the twenty-first century. An organisation's ability to perceive the value of new knowledge, absorb it, and use it to accomplish desired outcomes is referred to as absorptive capacity theory (Cohen, 2013). In the context of AI-KM integration, this theory suggests that AI systems can help organisations capture diverse knowledge sources and facilitate sustainability (Rohde et al.,2024). The reviewed studies have shown the ability of AI to integrate various knowledge sources and facilitate knowledge exchange, (Manuti &Monachino, 2020; Olan et al., 2022). AI enhances knowledge discovery through techniques like natural language processing and machine learning (Lin et al., 2023; Majumder & Dey, 2022). The notion of intelligent information processing is centred on creating computational models and methods that imitate the cognitive functions of humans, including learning, reasoning, and solving problems (Newell & Simon, 2019). In the context of AI-KM integration, this idea suggests that AI-powered tools can enhance knowledge discovery processes by identifying relevant information, extracting insights, and uncovering patterns or connections (Safder et al., 2018).

3. Conceptual framework

Fig. 1 Illustrates the conceptual framework linking AI-driven knowledge management (AI-KM).

practices to sustainable learning. The framework highlights seven pathways representing key AI-KM practices: knowledge creation, knowledge capture

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practices, maximised knowledge storage, smart knowledge discovery, predictive knowledge, tailored knowledge delivery/sharing, and ethical AI-KM integration. Each pathway demonstrates how these AI-KM practices collectively support sustainable learning by enhancing knowledge processes and promoting responsible AI use. This framework visually synthesizes the hypotheses discussed earlier, emphasizing the central role of AI in transforming knowledge management to achieve sustainable and equitable learning outcomes.

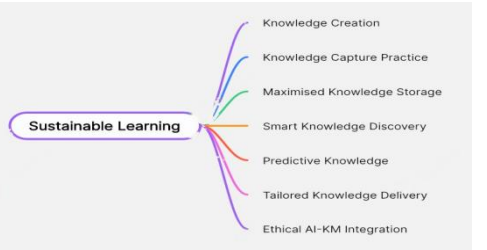

Fig. 1. Conceptual Framework

4. Research Method

4.1. Research Sample and Design

This study was conducted among students from higher education institutions across Kerala. The target population included students from private, aided, and state-affiliated universities. The sample encompassed various academic levels, including undergraduate, postgraduate, and research scholars, as well as a diverse range of disciplines such as arts, humanities, science, social sciences, and other fields.A convenience sampling approach was used, where a Google survey link was distributed to individuals and groups over a two-month period (March-April 2024). The use of convenience sampling was chosen for its practicality and efficiency, as it facilitated quicker survey distribution and response collection compared to other sampling methods. A total of 401 valid responses were obtained, which was deemed sufficient for conducting statistical analyses. The study defined sustainable learning as an internal factor with 5 items . The external factors included: knowledge creation (4 items), knowledge capture practice (KCP) (4 items), maximized knowledge storage (KS) (4 items), smart knowledge discovery (KD) (5 items), predictive knowledge (PK) (5 items), tailored knowledge delivery/share (TKD) (5 items),

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and ethical AI-KM integration (E) (5 items), making a total of 37 items. The authors conducted an extensive literature review and examined existing scales to build and validate the tool.

4.2. Data Analyses

This study employed PLS-SEM to analyze the research model. SmartPLS 4 software was utilized to test the model due to its ability to maximize explained variance in educational research. As emphasized by Hair and Alamer (2022), PLS-SEM offers flexibility in modeling complex relationships with observable variables while accounting for measurement error. SmartPLS supports various aspects of PLS-SEM analysis, including evaluation of the measurement model, assessment of the structural model, managing multicollinearity, handling second-order latent variables, and conducting mediation, moderation, and multigroup analyses with both numerical and categorical variables.

5. Results

5.1. PLS-SEM Model

The first step in evaluating the validity and reliability of the items in a PLS study is to examine the outer model. The evaluation of the model depends on whether the items reflect a concept directly (reflective measures) or contribute to a concept (formative measures), along with the overall structure of the measurement model itself (Davcik, 2014). It is essential to confirm the validity and reliability of the proposed measurement model before proceeding to hypothesis testing. Prior to analyzing the structural model, the convergent and discriminant validity of the measurement model must be assessed to ensure it meets the required standards (Hair & Alamer, 2022; Sarstedt, Marko & Ringle, 2020).For assessing reliability, the factor loadings of each item were examined. The recommended factor loading threshold is above 0.708, although values above 0.50 are also considered acceptable (Hair & Alamer, 2022). As shown in Table 1 and Figure 2, the standardized factor loadings for all items were within an acceptable range, ranging from 0.521 to 0.770.

5.2. Construct validation

Convergent validity checks how well different measures of the same concept are related (White, 2003). In this case, the average variance extracted

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(AVE) values show that five constructs (KC, KCP, KD, KS, PK) are above the 0.5 threshold, indicating they are valid (Cheung et al., 2024; Chin & Yao, 2014; Hair & Alamer, 2022).However, three constructs (ethical AI integration, sustainable learning, and tailored knowledge delivery/sharing) fall below this threshold. Even though their AVE values are low, it's important to remember that social science research is often complex and relies on self-reports and grey-box models (Bruschi, 2017). The variance inflation factor (VIF) values are below 5, showing no serious collinearity issues (Sarstedt et al., 2020).Other criteria, like standardized factor loading ≥ 0.5 and composite reliability ≥ 0.7, are also met in this model, supporting its validity (Bonett & Wright, 2014; Hanna et al., 2018; Purwanto & Sudargini, 2021). Taking all these factors into account, convergent validity is confirmed, though further exploration is needed for constructs below the threshold.

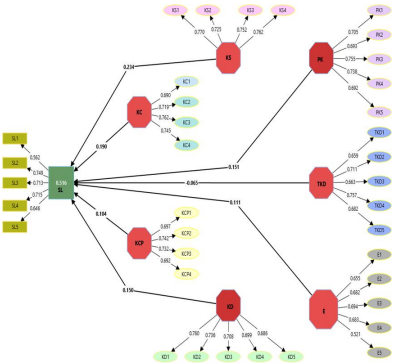

Fig. 2: PLS- Sem Algorithm

5.3. Discriminant Validity

Discriminant validity was assessed using two criteria. The first, based on Fornell and Larcker's (1981) method, suggests that the square root of the AVE for each construct should be greater than its correlation with any other construct in the model. Table 1 shows that the square root of the AVE for E AI-KM (0.650) is smaller than TKD (0.686), indicating a potential issue with discriminant validity between E AI-KM and TKD. Similarly, for PK, the square root of the AVE is smaller than TKD (0.721), suggesting a potential issue with discriminant validity between TKD and PK. The other constructs show acceptable values.

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Table 1

Fornell-larcker criterion

	E	KCP	KC	KS	PK	SKD	SL	TKD
E	0.650	/						
KCP	0.539	0.716	/					
KCP	0.541	0.618	0.729	/				
KS	0.539	0.637	0.558	0.753	/			
PK	0.640	0.578	0.530	0.618	0.717	/		
SKD	0.565	0.610	0.569	0.665	0.654	0.718	/	
SL	0.533	0.569	0.575	0.620	0.579	0.598	0.680	/
TKD	0.686	0.615	0.551	0.610	0.721	0.628	0.526	0.696

Next, the Heterotrait-Monotrait ratio (HTMT) values were examined. Table 2 shows that the HTMT ratio between E AI-KM and TKD, as well as between PK and TKD, is above the threshold of 0.85, indicating a lack of discriminant validity (Fornell & Larcker, 1981). For good discriminant validity, the HTMT values should be below 0.85, ideally under 0.90, to avoid multicollinearity (Ab Hamid et al., 2017). Therefore, these two constructs need further investigation.

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Table 2

Heterotrait-Monotrait ratio (HTMT) matrix

	E	KCP	KC	KS	PK	SKD	SL	TKD
E	/							
KCP	0.782	/						
KC	0.784	0.889	/					
KS	0.75	0.892	0.766	/				
PK	0.888	0.804	0.718	0.818	/			
SKD	0.781	0.844	0.774	0.875	0.86	/		
SL	0.76	0.817	0.813	0.847	0.784	0.804	/	
TKD	0.967	0.871	0.767	0.822	0.964	0.841	0.725	/

6. Revised Conceptual Framework

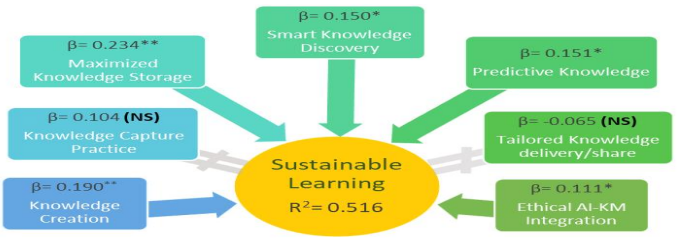

Fig.3: Revised Conceptual Framework

6.1. Implications and Future Research Scope

This study has added valuable insights into how AI, knowledge management (KM), and sustainable learning intersect in education. It tested an integrated model, offering insights into AI's role in knowledge creation, storage, discovery, and prediction. The study supports five out of seven hypotheses in the model, while challenging ideas about knowledge capture and tailored delivery. This highlights the complexity of learning environments and calls for more advanced frameworks. AI's impact on knowledge creation and storage extends existing theories and requires new concepts that include AI capabilities. Similarly, AI's role in discovery and prediction suggests a need to expand learning analytics and KM theories to education. The importance of ethical AI-KM integration is also emphasized. These findings suggest the

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development of comprehensive models combining KM, AI, pedagogy, and educational perspectives to support sustainable learning. Practically, these insights can help guide AI integration decisions for knowledge optimization and student support. Additionally, focusing on ethical AI integration highlights the need for responsible development and oversight in educational technology. Future research should include more diverse perspectives, particularly from educators, and explore long-term, multi-dimensional studies for global sustainability in learning. The study's limitations include its focus on a single state and the lack of input from key stakeholders like teachers. These factors limit generalizability, and future studies should consider cultural and socioeconomic differences.

7. Conclusion

This study explores the connection between AI and knowledge management (KM) in higher education, offering new insights into sustainable learning. The gap between expectations and results highlights the complexity of learning environments and calls for a fresh way of thinking about how knowledge works in AI-supported education. On the positive side, the study shows that AI-driven knowledge creation, storage, and discovery can lead to better learning outcomes, suggesting that AI has the potential to transform education beyond just being a technological tool.The results also suggest that educational strategies need to be adjusted, with AI not just as a tool but as a key driver of adaptive, lifelong learning skills. Importantly, this study raises the importance of ethical AI integration.This research opens up new directions for interdisciplinary studies at the intersection of AI, KM, and education. It encourages us to imagine learning environments where AI doesn't just support existing practices but changes how knowledge is created, shared, and used. The next step is to develop more comprehensive, context-sensitive frameworks that balance teaching realities and technology. Ultimately, the real challenge is to use these findings to build education systems that are both advanced in technology and ethically grounded.

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POLLEN GRAINS: SILENT WITNESSES IN FORENSIC SCIENCE – A COMPREHENSIVEREVIEW OF FORENSIC PALYNOLOGICAL STUDIES

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ABSTRACT

Forensic palynology, the scientific study of pollen and spores in criminal investigations, has emerged as a transformative field, offering unique insights into crime scene reconstruction, suspect tracking, and timeline establishment. Pollen grains, characterized by their species-specific morphology and resilience to environmental degradation, serve as valuable forensic indicators capable of linking people, objects, and locations with precision. This comprehensive review highlights the historical development of forensic palynology, its methodological advancements, and its diverse forensic applications. Traditional techniques, such as light microscopy (LM), remain widely used due to their accessibility, while advancements in scanning electron microscopy (SEM) have revolutionized pollen identification, enabling detailed examination of intricate morphological features. Case studies illustrate the utility of pollen evidence in various contexts, including soil and textile analysis, indoor and outdoor crime scenes, and death investigations, particularly in determining post-mortem movement and environmental context in drowning cases. However, despite its potential, forensic palynology faces significant challenges, including low awareness, high equipment costs, and a shortage of trained specialists. This review emphasizes the critical need for robust pollen reference databases tailored to specific geographical regions, interdisciplinary collaboration between botanists and forensic scientists, and investment in emerging technologies such as automated image analysis to streamline pollen identification. By consolidating past research and identifying

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future directions, this review underscores the immense value of forensic palynology in advancing modern criminal investigations. As science continues to unlock the secrets hidden within pollen grains, their role as silent witnesses in forensic science is poised to grow, revolutionizing the field.

Keywords: Forensic palynology, pollen analysis, crime scene reconstruction, interdisciplinary collaboration, forensic science advancements, pollen reference databases.

Introduction

Forensic palynology, the study of pollen and other microscopic plant material in a criminal investigation,[1] has emerged as a pivotal tool in the reconstruction of crime scenes and the identification of links between suspects, victims, and specific locations. This branch of forensic science leverages the resilience and distinctiveness of pollen grains, which are often found in diverse environments, including soil, clothing, bodies, and even on illicit substances. Palynologists have been able to utilize this microscopic evidence to trace the movement of individuals, identify the location of crimes, and establish temporal aspects of criminal events. The importance of forensic palynology lies in its ability to offer insights that are often not available through other forms of forensic evidence, making it a valuable resource in criminal investigations.

Historically, the origins of forensic palynology date back to the 1950s, when researchers began recognizing the potential of pollen analysis for solving crimes. Pioneering studies explored the role of pollen in determining the geographical source of a body, linking suspects to specific environments, and even analysing environmental factors in cases of death [2].. Early forensic applications were largely focused on natural settings, such as soil samples and vegetation surrounding crime scenes, but the field has rapidly expanded to encompass a wider range of investigative areas, from drug trafficking [3] to the analysis of bodies discovered in water [4]

The significance of forensic palynology is evident in its ability to help investigators establish connections between individuals or objects and crime scenes or specific locations, often with a level of precision that surpasses traditional forensic methods. Pollen grains are highly resilient, adhering to

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clothing and surfaces, and can remain identifiable even after prolonged exposure to environmental conditions, offering clues about the timing, location, and movement of individuals [5]. The ability to distinguish pollen from a vast array of plant species makes it a powerful tool for identifying geographic locations and uncovering previously unknown details about a crime scene.

This review aims to explore the emerging trends and applications of forensic palynology, examining how advances in technology, such as automated image analysis and isotope analysis, are reshaping the field. It will also address the challenges faced by forensic palynologists, including the need for improved training, standardization of methods, and the underutilization of this science in legal settings. By evaluating both historical and current trends in forensic palynology, the review will highlight the immense potential of this tool in future criminal investigations and outline key areas for further research and development.

Palynology, the study of pollen grains and spores, holds immense potential across various scientific disciplines. In the context of forensic science, Forensic Palynology involves the examination of modern samples and fossil pollen grains, spores, and other acid-resistant micro-plant remains within a legal framework. This field has been successfully employed in criminal trials in several countries, including Australia, New Zealand [6], United Kingdom, and Canada. Despite India's rich plant diversity, the utilisation of pollen grains as biomarkers in forensic investigations remains largely unexplored. While pollen morphology has been extensively studied for various purposes such as comparative data, breeding systems, pollination biology, and hybridization, the application of pollen DNA profiling in forensic contexts is a new and innovative avenue. This suggests that there is potential for using DNA extracted from pollen grains as a forensic tool, which could provide additional valuable information in criminal investigations (Bryant, 2013). Previous forensic analyses in India have considered pollen as a form of botanical dust debris, yet the potential for comprehensive pollen-based forensic applications has not been fully realised in the intricate world of forensic science, where every detail can be a crucial clue, an unlikely hero has emerged: the humble pollen grain. Often dismissed as mere allergens, these microscopic particles are revolutionizing criminal investigations. A field known as forensic palynology has been steadily growing since the 1950s, harnessing the power of

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pollen analysis to shed light on crimes, track suspects, and reconstruct crime scenes. While the full potential of pollen grains in forensic investigations remains untapped, the advancements in this field are undeniably transforming the way we approach criminal cases.

Pollen grains are nature's resilient messengers. Their ability to withstand harsh environmental conditions and chemical degradation allows them to persist in soil, water, and on various surfaces for extended periods. Coupled with their unique morphological characteristics specific to each plant species, pollen grains become invaluable forensic indicators. These tiny particles, often unnoticed, can easily transfer from one surface to another, silently connecting people, objects, and places with remarkable precision. Pioneering research by scientists like Bryant, Jones, and Mildenhall has demonstrated the immense potential of pollen analysis in reconstructing events and linking suspects to crime scenes. For instance, pollen found on clothing or in soil samples can provide crucial information about the location and season, serving as compelling evidence in criminal cases.

Technological advancements have significantly enhanced the analytical capabilities of forensic palynology. Traditionally, light microscopy (LM) has been the primary tool for examining pollen grains. While LM remains a cost-effective and widely accessible technique, the advent of scanning electron microscopy (SEM) has revolutionized the field. SEM allows for detailed examination of pollen morphology, capturing intricate structural features that can differentiate between closely related species. As Bryant (2013) emphasized, the combined use of LM and SEM significantly improves the accuracy and reliability of forensic pollen analysis. However, these advancements come with challenges, including the high cost of SEM equipment, the complex sample preparation process, and the specialized training required to interpret the results.

Forensic palynology is not a recent innovation. Historical applications of the science encompass archaeology, environmental research, and criminal investigations. Mildenhall's work in New Zealand during the 1990s demonstrated its ability to link suspects to crime scenes and disprove alibis. Meanwhile, Arguelles et al. (2015) analysed pollen from a 16th-century Korean mummy to gain insights into the individual's diet, environment, and time of death. These studies highlight the interdisciplinary nature of

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palynology and its relevance to both historical and contemporary contexts. Despite its immense potential, forensic palynology faces significant challenges, including low awareness, a shortage of trained experts, and limited funding. Research studies by Bryant and Jones (2006) and Cheema (2014) have highlighted the underutilization of pollen evidence in regions like the United States,[7] attributing it to a lack of awareness and institutional recognition. To address these issues, initiatives such as establishing specialized forensic units, like the Environmental and Forensic Ecology Unit in Great Britain, have been proposed. Additionally, researchers like Hirapure (2014) have emphasized the importance of developing comprehensive pollen reference databases tailored to specific geographical regions [8]. These databases can serve as invaluable tools for identifying pollen types and linking them to particular environments or seasons.

Emerging technologies hold the promise of overcoming some of the limitations of forensic palynology. Automated image analysis and 3D modelling are transforming the field by streamlining the identification process. Sure et al. (2013) demonstrated the effectiveness of automated classification methods in improving the accuracy and efficiency of data analysis. By building robust reference image collections,[9] these tools can reduce the reliance on manual identification, making the process faster and more accessible to laboratories with limited resources. Such advancements offer significant hope for expanding the application of pollen evidence in criminal investigations.

The utility of forensic palynology extends beyond outdoor crime scenes. Indoor crime investigations can also benefit from this scientific discipline. Morgan et al. (2014) investigated the persistence of pollen grains in indoor environments, such as those from fresh flowers. Their findings revealed that pollen can remain in a location long after the source has been removed, providing valuable clues in indoor crime scenes. Similarly, Wiltshire et al. (2015) demonstrated the potential of pollen evidence to corroborate or refute witness statements, particularly in sexual assault cases [1]. Rapid pollen analysis techniques developed in these studies have proven valuable in providing timely information to investigators. The interdisciplinary nature of forensic palynology is perhaps its greatest strength. As Babcock and Warny (2014) noted, this field blends elements of botany, earth science, and criminal

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investigation, offering a unique perspective on criminal cases [10]. This multidisciplinary approach not only enhances the field but also provides students and practitioners with a comprehensive understanding of scientific methodologies and concepts. However, for forensic palynology to reach its full potential, significant investments in training, facilities, and interdisciplinary collaboration are essential.

In conclusion, pollen grains are tiny but powerful agents of change in forensic science. Their resilience, transferability, and species-specific morphological features make them invaluable forensic indicators. Despite challenges such as limited awareness and resource constraints, advancements in technology and growing recognition of their potential point to a promising future. By fostering collaboration between botanists, forensic scientists, and legal professionals, and by investing in the necessary tools and training, forensic palynology can become an indispensable tool in future criminal investigations. As science continues to unlock the secrets hidden within these microscopic particles, pollen grains are poised to revolutionize the way we understand and solve crimes.

Challenges and Limitations in Forensic Palynology

Forensic palynology, while a powerful tool in criminal investigations, faces several challenges and limitations that impact its effectiveness and broader acceptance in forensic science. One of the primary technical challenges involves sample collection and contamination. Pollen is pervasive in the environment and can easily transfer to various surfaces, including clothing, bodies, and items at a crime scene. As a result, collecting uncontaminated samples becomes increasingly difficult, and any contamination can undermine the accuracy of pollen evidence. Moreover, forensic palynologists must deal with the inherent degradation of pollen grains over time, making it challenging to preserve and analyse older samples effectively (Bryant et al., 1990). Additionally, accurate identification of pollen remains a significant hurdle. While light microscopy and scanning electron microscopy (SEM) are commonly used, distinguishing between species with similar morphological features requires expertise and a comprehensive database of local pollen types. Misidentification, especially in regions with diverse vegetation, can lead to erroneous conclusions (Martínez et al., 2015).

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Another critical issue is the lack of training and expertise in forensic palynology. The number of forensic palynologists remains limited globally, and specialized education and certification programs are not widespread. Many forensic labs lack staff who are sufficiently trained to handle and analyse pollen evidence. As forensic palynology is still a niche area within the broader field of forensic science, the absence of qualified professionals hinders its effective application in criminal investigations (Babcock & Warny, 2014). Without standardized educational and certification pathways, there is a risk of inconsistent quality and reliability in forensic palynology results.

Forensic palynology also suffers from underutilization in legal contexts, particularly in law enforcement. Despite its potential, many countries and jurisdictions do not recognize or fully incorporate forensic palynology as a routine investigative tool. This can be attributed to factors such as the limited awareness of its value, the need for specialized expertise, and the perceived complexity and cost of implementing palynological analysis in investigations (Cheema, 2014). In many legal systems, forensic palynology has not yet been fully embraced, and law enforcement agencies may not prioritize its use, resulting in missed opportunities for solving crimes through pollen evidence [11].

Additionally, there are significant methodological gaps within forensic palynology that hinder its effectiveness and consistency. Currently, there is no standardized protocol for sample collection, analysis, and reporting of results, leading to variability in forensic practices and outcomes. The lack of a unified approach across different labs and jurisdictions creates challenges in the comparability of data and the admissibility of pollen evidence in court (Hirapure, 2014). Developing and adopting standardized methodologies, as well as improving the consistency of analysis techniques, is crucial for enhancing the reliability and widespread acceptance of forensic palynology in legal contexts. Addressing these technical, educational, and methodological challenges is essential to realizing the full potential of forensic palynology as an invaluable tool in criminal investigations.

Latest Trends in Forensic Palynology

Forensic palynology has seen notable advancements in recent years, driven by innovations in technology and interdisciplinary approaches. Below are some of the latest trends:

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1. **Advanced Imaging and Analytical Techniques**:
   - High-resolution imaging tools like SEM (Scanning Electron Microscopy) and automated segmentation algorithms for pollen grain analysis are now improving precision and efficiency in forensic studies .[11], [12]
   - 3D imaging and automated identification are being utilized to enhance the accuracy of pollen analysis, reducing dependency on manual segmentation.
2. **Rapid Qualitative Methods**:
   - Rapid palynological scanning methods have been developed to provide actionable insights quickly, especially in time-sensitive investigations, such as suspect testimony analysis in sexual assault cases (Wiltshire et al., 2015).
3. **Indoor and Fabric Pollen Retention Studies**:
   - Studies on the spatial and temporal distribution of pollen grains within indoor environments have gained traction. They emphasize the persistence of pollen grains and their potential use in reconstructing crime scenes in domestic settings [13].
   - Research on pollen adherence to different fabric types has revealed species-specific retention patterns, aiding in refining evidence collection methods [14].
4. **Multidisciplinary Approaches**:
   - Integration of forensic palynology with other scientific fields, such as medicolegal investigations, archaeology, and botany, is expanding its applications. For instance, collaborative approaches are being employed to study drowned bodies and water-discovered remains (Martínez et al., 2015).
5. **Database Development and Geographical Mapping**:
   - Comprehensive pollen databases are being constructed to assist forensic investigations by linking pollen types to specific regions and ecosystems (Hirapure, 2014).
   - Digital tools for mapping pollen distribution across diverse environments are becoming more common.
6. **Novel Applications**:
   - Studies on historical remains, such as analysing pollen in coprolites from archaeological sites, provide insights into diet and seasonality of

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death, demonstrating the broader applications of forensic palynology (Arguelles et al., 2015).

- The application of stable isotope analysis to pollen grains is being explored, although expertise in this area remains limited (Bryant, 2013).

7. **Global Awareness and Collaboration**:
   - Increased focus on advocating for forensic palynology in underutilized regions like the United States (Bryant and Jones, 2006) and New Zealand (Mildenhall, 1990) has led to collaborative efforts to establish standardized protocols and training.

These trends underline the dynamic evolution of forensic palynology, with technological innovations and interdisciplinary collaborations paving the way for more robust and reliable forensic investigations.

Conclusion

In conclusion, forensic palynology has emerged as a valuable and increasingly vital tool in criminal investigations, offering unique insights into a wide range of forensic contexts. Its application spans from linking suspects to crime scenes to tracing the origins of illicit substances like fentanyl, showcasing its versatility and growing importance in modern forensic science. While traditional methods such as light microscopy (LM) and scanning electron microscopy (SEM) continue to play a pivotal role in pollen analysis, the integration of newer technologies, including automated image analysis and stable isotope analysis, holds the potential to further enhance the precision and scope of forensic palynological investigations. Additionally, challenges such as the need for adequate training, the underutilization of forensic pollen data, and the development of standardized protocols for sample collection and analysis remain key barriers to broader adoption and recognition of this discipline in forensic practice. As forensic palynology continues to evolve, there is a pressing need for further interdisciplinary collaboration, improved methodologies, and increased awareness among law enforcement and forensic professionals. With its ability to offer crucial evidence in both criminal and civil cases, forensic palynology has proven its worth and promises to be an indispensable tool in the future of forensic investigations. As research in this field advances, forensic palynology is poised to play an even greater role in resolving complex cases and enhancing the accuracy of crime scene reconstructions.

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TRADITIONAL ISLAMIC EDUCATION SYSTEMS IN KERALA: THE EVOLUTION OF OTHUPALLI

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ABSTRACT

The Othupalli system represents an indigenous primary religious schooling method developed by Kerala's Mappila Muslims, paralleling maktabs or Qur'anic schools in other Muslim communities. It focused on oral teaching, where the teacher, known as "Musliyar," "Mullakka," or "Mulla," recited lessons for students to memorize. The curriculum revolved around Qur'an recitation, Adhkar (hymns and invocations), and Arabic reading. The term "Othupalli" originates from "oath" (oral articulation) and "Palli" (learning centers in Buddhist and Jain traditions). These single-teacher institutions, often situated near mosques or in teachers' homes, remained the primary centers for Muslim education in Kerala until the 20th century.

Role: Sole educational centers for Qur'anic and basic religious knowledge.

In conclusion, the traditional education systems of Othupalli have played a pivotal role in preserving and disseminating Islamic knowledge among the Muslim communities of Kerala. Rooted in oral teaching methods and shaped by local cultural influences, these systems have successfully adapted to changing times while maintaining their core objectives. The Othupalli system provided foundational religious education. Even today, these systems complement modern education, ensuring that younger generations remain connected to their religious and cultural heritage. Their resilience and adaptability underscore the importance of integrating tradition with modernity in education.

Keywords: Othupalli, Oral teaching, Qur'an recitation, Adhkar, Arabic learning, Musliyar/Mullakka/Mulla, Memorization, Cultural influence, Palli (learning centers), Mosque-adjacent schools, Primary religious education.

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1.Indroduction

The Othupalli system, a cornerstone of Islamic education in Kerala, represents a unique synthesis of indigenous educational traditions and Islamic pedagogy. Rooted in Kerala's pluralistic cultural landscape, these traditional religious schools emerged as the primary centers for religious learning long before the advent of the Madrasa movements. The term Othupalli—derived from othu (recitation) and palli (school)— encapsulates its emphasis on the oral transmission of knowledge, particularly Quranic studies and Arabic language. Historically paralleling the Ezhuthupallis (writing schools) of non-Brahmin communities, Othupallis served as vital institutions for fostering religious consciousness among Kerala's Muslim community, known as the Mappilas.

Islam's arrival in Kerala dates back to the 7th century CE, brought by Middle Eastern traders, making it one of the oldest Muslim communities in South Asia. The Mappilas, while integrating into the local Malayali culture, maintained their religious identity through institutions like the Othupallis. These schools, often located near mosques or teachers' homes, operated as single-teacher institutions where students memorized Quranic recitations, prayers (Adhkar), and basic Arabic under the guidance of a Musliyar, Mullakka, or Mulla. The Othupalli system not only preserved Islamic education but also reflected the broader sociocultural and educational practices of Kerala, drawing from influences as diverse as Buddhist and Jain traditions.

This article explores the historical roots, operational models, and enduring legacy of the Othupalli system, situating it within the context of Kerala's evolving educational landscape amidst colonial modernization. By examining its curriculum, methodology, and socio-cultural significance, this study highlights the Othupalli's role in shaping Islamic education and its continued relevance in contemporary times.

2. Othupallis: Centers of Religious Learning in Kerala

Before the advent of the Madrasa movements, Othupallis served as the primary centers for disseminating and exchanging religious knowledge among Kerala's Muslim community. The religious consciousness fostered by these traditional institutions laid the foundation for the thriving religious

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environment observed today. Othupallis played a crucial role in instilling essential religious values within society, functioning similarly to modern Madrasas.

2.1. Etymology and Historical Roots

The term othu—meaning recitation—originated with the Nambudiri Brahmins, who used it to describe Vedic chanting. With Islam's arrival in Kerala via Arab traders in the 7th century, Muslims adopted othu to denote Quranic recitation. The sufTIX palli, historically linked to Buddhist and Jain monastic schools, was repurposed by Kerala's Muslims for their mosques and learning centers. By the medieval period, Othupalli became synonymous with Islamic education, blending Brahminical oral traditions with Quranic teachings.

The Othambalam (recitation halls) of Brahmin communities further influenced Othupallis' pedagogical structure. However, unlike the exclusive Ezhuthupallis for writing, Othupallis prioritized recitation while occasionally incorporating basic literacy.

3. Structure and Curriculum

Othupallis were organized in diverse ways, reflecting the flexibility and adaptability of these traditional Islamic learning centers. Their structure and curriculum were designed to cater to the religious and cultural needs of Kerala's Muslim community, emphasizing Quranic recitation, foundational Islamic principles, and practical religious practices

3.1. Operational Models

Othupallis operated in three primary settings, each reflecting the community's resources and needs:

Mosque-Integrated Othupallis:

Classes were conducted under the eaves of mosques, utilizing the mosque's space for teaching.

This model was common in areas where mosques served as central community hubs.

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Adjacent-Hut Othupallis:

Small huts or structures were built next to mosques specifically for teaching purposes.

These huts provided a dedicated space for education while remaining closely tied to the mosque.

Independent Othupallis:

Some Othupallis functioned as standalone institutions, completely separate from mosques. These were often found in areas with larger Muslim populations or where community resources allowed for independent schools.

In addition to these models, wealthy families occasionally invited teachers to their homes to educate their children, though this practice was less common.

3.2. Curriculum

The curriculum of Othupallis was centered on imparting essential Islamic knowledge and practices. Key components included:

l. **Quranic Recitation:**

- The primary focus was on memorizing and reciting the Quran, a practice known as Vayichukoottiyoth.
- Students began with basic Arabic phonetics, progressing to full chapters (Juz) of the Quran.

2. **Fundamental Tenets of Faith (Aqeedah):**

- Students learned the core beliefs of Islam, including the oneness of God (Tawhid), prophethood, and the afterlife.

3. **Religious Practices (Ibadah):**

- Practical aspects of worship, such as performing prayers (Salat), purifieation rituals (Wudu), and fasting during Ramadan, were taught.
- Texts like Niskarakkanakku were widely used to explain the rules and regulations of prayer.

4. **Supplementary Texts**:

- Small books like Ten Kittabs were used in some regions to teach additional religious concepts. o Students also memorized Duas

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(supplieations) for daily life, such as prayers after meals or during illness.

3.3. Teaching Methodology

The teaching methods in Othupallis were rooted in oral tradition and repetition:

- Oral Recitation: Mullahs (teachers) recited Quranic verses, which students repeated until memorized.
- Writing Practice: While writing was not the primary focus, students used writing boards made of Chedikallu paste. Teachers wrote Arabic letters on these boards using bamboo sticks dipped in ink, and students practiced copying them.
- Flexible Learning: There was no formal syllabus, allowing teachers to adapt lessons to students' abilities and needs.

4. Teachers and Societal Impact

Beyond education, Othupallis served as community hubs, strengthening social bonds and fostering a shared Islamic identity. These schools made religious education accessible, enabling individuals to actively participate in communal and religious life. The teachers also instilled ethical values and discipline, contributing to the moral development of their students.

4.1. Regional Variations in Titles

Teachers, pivotal to Othupallis, were addressed as:

- Mollakka (Central Malabar). . Mallami (Koyilandy).
- Seethi (Northern Kerala).

Graduates of prestigious seminaries like Ponnani Dars earned titles like Musliyar.

4.2. Social Significance

Proficiency in Mala (prayer beads) and Maulid (Prophetic hymns) determined social standing. Those lacking such skills faced ostracization. Education levels influenced marriage prospects, with Othupalli-trained individuals revered for their piety.

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5. Colonial Reforms and Decline

British administrators perceived Othupallis as breeding grounds for anti-colonial sentiment, particularly after the Mappila uprisings of 1921. They believed that the religious fervor and traditional teachings instilled in students contributed to resistance against colonial rule. Reports from British officials highlighted the lack of modern education as a key factor in the "backwardness" of Kerala's Muslim community, prompting efforts to reform the Othupalli system.

5.1. Colonial Perception of Othupallis

British administrators perceived Othupallis as breeding grounds for anti-colonial sentiment, particularly after the Mappila uprisings of 1921. They believed that the religious fervor and traditional teachings instilled in students contributed to resistance against colonial rule. Reports from British officials highlighted the lack of modern education as a key factor in the "backwardness" of Kerala's Muslim community, prompting efforts to reform the Othupalli system.

5.2. Key Reforms and Interventions

1.1871-1894: Initial Reforms o The British government began providing financial aid to Mullahs (teachers) and students in Othupallis.

The aim was to incentivize the teaching of secular subjects, such as Malayalam and arithmetic, alongside religious education.

2.1921: Pos-Uprising Reforms

Following the Mappila uprisings, a commission was appointed to investigate the causes of the rebellion.

The commission concluded that the lack of modern education was a significant factor, leading to a mandate for the inclusion of secular subjects in Othupallis.

3.1926: Integration of Secular Education o The British appointed special officers, such as Syed Alikutty Master and Syed Abdul Gafoor Shah Sahib, to oversee the integration of Malayalam and other secular subjects into the Othupalli curriculum.

Othupallis were required to divide their schedules, dedieating half the day to religious studies and the other halfto secular education.

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4.1947: Ban on Religious Education in Schools o When C. Rajagopalachari, the Chief Minister of the Madras Presidency, banned religious education in schools, many Othupallis were converted into government-aided Muslim schools.

This marked the final blow to the traditional Othupalli system, as religious instruction was relegated to informal settings or replaced entirely by modern curricula.

5.3. Economic and Social Changes

In addition to colonial reforms, broader socio-economic changes contributed to the decline of Othupallis:

- **Economic Migration:** The migration of Kerala's Muslim population to regions like Burma, Ceylon, and later the Gulf countries disrupted community structures and reduced the demand for traditional education.
- **Rise of Madrasas:** With the establishment of modern Madrasas under various Muslim organizations, Othupallis lost their prominence as centers of Islamic learning. Many Othupallis were either converted into Madrasas or abandoned altogether.

6. Legacy

Though Othupallis vanished, their legacy persists. They preserved Islamic identity through oral traditions and ritual practices, shaping Kerala's Muslim renaissance. Today, nostalgic recollections of Mollakkas and childhood recitations endure in rural villages, symbolizing a bygone era of cultural cohesion.

7. Conclusion

The Othupallis of Kerala were far more than mere centers of religious education; they were the heart and soul of the Muslim community's cultural and spiritual life. For centuries, these traditional institutions played a pivotal role in preserving Islamic knowledge, fostering religious identity, and strengthening community bonds. Through their emphasis on Quranic recitation, practical religious practices, and oral traditions, Othupallis ensured that the essence of Islam was passed down from one generation to

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the next. However, the winds of change brought by British colonial rule and socio-economic transformations led to their gradual decline. Colonial reforms, aimed at modernizing education and reducing religious influence, transformed Othupallis into institutions focused on secular learning. The rise of modern Madrasas and the migration of Kerala's Muslim population for economic opportunities further accelerated their disappearance.

Yet, the legacy of Othupallis endures. They laid the foundation for contemporary Islamic education systems, influencing the structure and pedagogy of modern Madrasas. The cultural practices and traditions nurtured in Othupallis, such as Mala and Maulid, continue to be integral to Kerala's Muslim identity. For many, Othupallis remain a cherished memory, symbolizing a time when education was deeply rooted in community values and religious devotion.

In reflecting on the history of Othupallis, we are reminded of the resilience and adaptability of Kerala's Muslim community. These institutions were not just schools; they were custodians of faith, culture, and tradition. Their story is a testament to the enduring power of education in shaping communities and preserving heritage. As we look to the future, the lessons of Othupallis inspire us to value and protect the cultural and educational systems that define who we are.

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A STUDY ON THE CONTRIBUTION OF ENTREPRENEURSHIP TO ECONOMIC DEVELOPMENT AND GROWTH IN INDIA

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ABSTRACT

The current study examines how important entrepreneurship is to India's economic development and prosperity. India provides a distinctive setting for examining how entrepreneurship affects economic advancement because it is one of the most populous and dynamic nations in the world. Traditional economic theories place a strong emphasis on the importance of labour, capital, and knowledge; nevertheless, this study explores the degree to which entrepreneurship functions as a separate but significant force behind India's economic expansion. The goal of the study is to clarify the complex interrelationships among entrepreneurship, conventional growth factors, and India's unique socioeconomic circumstances. Its main goal is to present empirical data and insights on the ways that, in the Indian setting, entrepreneurship interacts with elements including governmental regulations, cultural influences, and technology breakthroughs.

Keywords: Entrepreneurship, economic development, prosperity and growth.

1. Introduction

Humans have always been entrepreneurs in many facets of life. It has served as the foundation for the growth of human society. But as it has developed, it has been characterized in a variety of ways. One definition of entrepreneurship is "the process of innovation and utilizing opportunities with a great deal of effort and tenacity in addition to taking on monetary,

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psychological, and social risks. It is in fact driven by independence, self-satisfaction, and profit promotion (Hisrich, 2007: 172). It ensure that the estimated 150 million Indian youth entering the workforce over the next few years can realize their true potential through access to a world-class innovation and entrepreneurial ecosystem, leveraging rapidly advancing, accessible, and affordable technologies that are transforming our world and enabling an incredible set of opportunities for innovation and new job creation. This includes 10500 engineering and related institutions, approximately 39000 colleges, and India's demographic dividend and rapidly growing economy.

The process of starting and managing a new company with the goal of making money is known as entrepreneurship. In both developed and developing nations, it is a key driver of economic growth and development. In the end, consumers gain from entrepreneurial activity because it stimulates innovation, market rivalry, and the creation of new jobs. It is impossible to overestimate the contribution of entrepreneurship to economic growth. In addition to discussing the many advantages of entrepreneurship, this study will look at how it supports economic growth and development.

In the opinion of (Chaudhari, 2023) the nation's economic and social development depends on its entrepreneurs. Entrepreneurship is affected by a wide range of elements, including social, political, psychological, and economic ones. Entrepreneurship is more difficult to succeed when negative factors are present, whereas good factors create an environment that is conducive to entrepreneurship. According to (Chaudhari, 2022) Regardless of size or mode of operation, entrepreneurs attempt to establish and manage their own manufacturing, processing, or business divisions. The story of Indian entrepreneurship is riddled with contradictions. In pre-colonial and colonial eras, the entrepreneur was seen more as a trader-money lender merchant, limited by caste relations as well as religious, cultural, and social forces ranging from the idea of fate to the joint family system. Small enterprises remain the primary participants in entrepreneurship in India.

The research (Ayarekar & Vidyapeeth, 2023) determined that entrepreneurs adjust by fostering innovation, boosting competition, and creating jobs as economic opportunities and trends shift. The externalities associated with entrepreneurship are more favourable. By serving as an example for other

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young people, young individuals who launch their own businesses might offer instructional or demonstrative externalities. (Yoganandan G et al., 2018) claimed that entrepreneurship is the single most crucial element for a country's growth. The nation's economy is boosted by the employment opportunities that entrepreneurs create. Entrepreneurs' capacity to turn their concepts into products will contribute to the country's development as a developed one.

Tushar Chaudhari. (2024) narrated that numerous individuals in India, where unemployment and poverty rates are still high, have chosen to work towards a brighter future independently, with or without government support. Ownership of a Business in India, the standard of education has a direct impact on economic growth. India's education system is essential to the growth of the nation since it provides a safe refuge for prospective entrepreneurs. They have the potential to create work for themselves and others, as well as the ability to develop winning qualities. Entrepreneurial education can broaden an individual's knowledge base, identify opportunities, and offer solutions for overcoming environmental obstacles. Higher education institutions would set up incubators where students might demonstrate their skills.

ReferenceLink: https://www.researchgate.net/publication/378745266.

2. Materials and Methods

The secondary data collected for the descriptive study. It used tables and Charts.

Every year, 137 nations' entrepreneurial ecosystems are evaluated by the Global entrepreneurial Index. The performance of these is then compared to one another. Each nation's performance in the local and international arenas is depicted in this way. Data on the local population's entrepreneurial attitudes, skills, and goals are gathered by the GEDI technique, which then weighs the results against the social and economic "infrastructure" that is currently in place. The 14 "pillars" that are produced by this procedure are used by GEDI to gauge the condition of the local environment. According to the Global Entrepreneurship Monitor (GEM) 2023/2024, India has become a global leader in the entrepreneurial scene, coming in second out of 49 economies.

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EFC	Entrepreneurial framework condition
A	Financial environment related with entrepreneurship
B1	Government concrete policies, priority, and support
B2	Government policies bureaucracy, taxes
C	Government programs
D1	Entrepreneurial level of education at Primary and Secondary
D2	Entrepreneurial level of education at Vocational, Professional, College and University
E	R&D level of transference
F	Professional and commercial infrastructure access
G1	Internal market dynamics
G2	Internal market burdens
H	General physical infrastructures and services access
I	Cultural, social norms and society support

Source : GEI Data

India ranks second out of 49 nations in the new Global Entrepreneurship Monitor (GEM) 2023/2024 Report, making it one of the greatest places in the world to launch a business. Along with the Netherlands and the United Arab Emirates, India is one of just three GEM nations where all EFCs were deemed more than adequate. High scores on framework factors like "social and cultural norms" that encourage entrepreneurship and "entrepreneurship education at the school and post-school level" lend credence to India's impressive achievement. It is one of just five nations where experts rate the social support and resource availability for female entrepreneurs as adequate or superior. Over the past year, India's rating has risen from fourth to second.

Rank	Country	GDP world bank international 2011	GEI
61	Namibia	9350	31.1
62	Azerbaijan	16433	30.5

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63	Belize	7342	30
64	Kazakhstan	21089	29.7
65	Morocco	6958	29.2
66	Macedonia	11966	29.1
67	Peru	10942	28.4
68	India	5372	28.4
69	Bulgaria	16022	27.8
70	Panama	16585	27.7

Source: 2018 GEI Data

With an estimated 630.52 lakh businesses, the micro sector employed 1076.19 lakh people, or over 97% of the industry's total workforce. A total of 31.95 lakh (2.88%) and 1.75 lakh (0.16%) of the MSME sector's employment were provided by the small sector, which employed 3.31 lakh people, and the medium sector, which employed 0.05 lakh estimated MSME. Statement depicts the sector-by-sector employment distribution in rural and urban areas.

Distribution of employment by type of Enterprises in Rural and UrbanAreas

(Numbers in lakh)

Sector	Micro	Small	Medium	Total	Share (%)
Rural	489.30	7.88	0.60	**497.78**	**45**
Urban	586.88	24.06	1.16	**612.10**	**55**
All	**1076.19**	**31.95**	**1.75**	**1109.89**	**100**

Source:MSME Annual Report 2023-24

With an estimated 14.20% of all MSME in the nation, the State of Uttar Pradesh had the most. 74.05% of the expected total number of MSME in the nation was distributed among the top 10 states. The distribution of estimated businesses in the top ten states is displayed in Statement and Figure given below.

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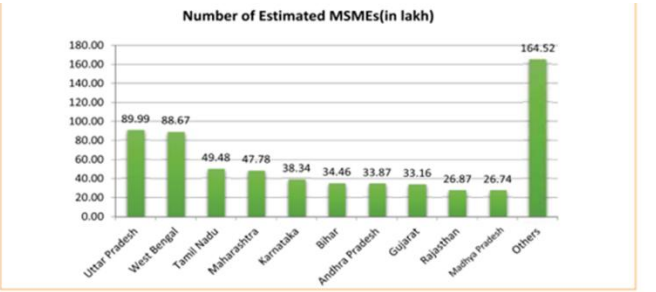
State-wise Distribution of enterprises

Sl. No.	State/UT	Estimate Number of MSME	
		Number (in lakh)	Share (in %)
1	Uttar Pradesh	89.99	14
2	West Bengal	88.67	14
3	Tamil Nadu	49.48	8
4	Maharashtra	47.78	8
5	Karnataka	38.34	6
6	Bihar	34.46	5
7	Andhra Pradesh	33.87	5
8	Gujarat	33.16	5
9	Rajasthan	26.87	4
10	Madhya Pradesh	26.74	4
11	Total of above ten States	469.36	74
12	Other State/UTs	164.52	26
13	**All**	**633.88**	**100**



Source:MSME Annual Report 2023-24

3. Results and Discussion

Entrepreneurship enhances the standard of living for both individuals and communities by generating new companies and jobs, opening doors for the production of wealth. Increasing employment through entrepreneurship boosts economic competitiveness. Better goods and services are the end outcome, which leads to satisfied customers. One important factor in the generation of jobs is entrepreneurship. Entrepreneurs generate jobs for themselves and others by launching new companies. This lowers unemployment rates and enhances the community's general economic health. The Global Entrepreneurship Monitor claims that millions of jobs have been created globally as a result of entrepreneurship. This is especially crucial in emerging nations because reducing poverty and fostering economic progress depend heavily on the creation of jobs. Local poverty can be eradicated with the aid of

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entrepreneurship. Entrepreneurship gives people the chance to better their financial circumstances by starting new companies and jobs. Being an entrepreneur gives people the opportunity to enhance their financial security, which may eventually result in societal transformation and general progress. Entrepreneurs support the economic health of their communities by starting new companies. This may encourage more money to be invested in the neighborhood, which may lead to better facilities, services, and infrastructure. Individuals, communities, and nations can achieve economic independence through entrepreneurship. Entrepreneurs can produce revenue and improve the general economic health of their community by starting new companies. For emerging nations, where economic power is frequently concentrated in the hands of a small number of powerful businesses, this is especially crucial. Entrepreneurship gives small enterprises and individuals a chance to compete in the market, which can result in more stability and diversity in the economy. The entry of new startups into the market stimulates competition and innovation. They push established companies to enhance their goods and services, which eventually helps customers.

Capital investment is stimulated by entrepreneurship in both nations and cities. Entrepreneurs draw in both domestic and foreign investment by starting new companies. In the future, this may even enable them to access other labor markets and perhaps international markets.This investment has the potential to boost the community's economy overall and open up new doors for job seekers and businesses. For a corporate environment to be prosperous and sustainable, capital formation is necessary. Entrepreneurs are renowned for their capacity to spot market gaps and develop solutions to close them. Entrepreneurs who concentrate on business innovation, such as creating new products or services, finding new solutions, or refining current ones, boost competition, which lowers costs and raises quality. Entrepreneurs are able to develop more effective ways for using resources by seeing new company prospects and implementing innovative production techniques. Because it reduces waste and boosts production, this helps the entrepreneur as well as the economy as a whole. Entrepreneurs can generate demand where none previously existed by launching new goods or services. As a result, completely new industries may emerge, which could further boost the economy's general growth. Indeed, research has indicated a positive correlation between economic growth and entrepreneurial activity. Countries with strong levels of entrepreneurship

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typically have faster rates of economic growth, according to the European Research on Management and Business Economics. Additionally, entrepreneurship contributes significantly to balanced regional development. Entrepreneurship can lessen regional inequities by establishing new companies and job opportunities in previously undeveloped areas and encourage general growth.

Promoting startups and entrepreneurship will ensure an unprecedented surge in well-earned growth, prosperity, and well-being that can serve the interests of the rest of the world as well as the spirit of New India. Building a nation of job creators, not just job seekers, is essential for sustainable growth. The need for tight collaboration between the business community, academia, and the federal, state, and municipal governments is at the core of this.India has always produced a large number of brilliant thinkers, scientists, engineers, doctors, inventors, philosophers, and artists.

The following are some notable policy initiatives:

1. Soft Loan Scheme for Women Entrepreneurs: To support prospective female entrepreneurs in the state, the KSUM established this initiative. Under this initiative, the State Government offers a working capital soft loan of INR 15 L.
2. International Exchange Program: The Kerala government encourages new businesses to participate in a in various startup events happening across the globe.
3. Innovation and Entrepreneurship Development: Under this initiative, entrepreneurs and new businesses with innovative ideas for how to succeed in the market can receive cash and support. Colleges of engineering, management, polytechnics, science, and the arts have built these platforms.
4. Support for rural innovators: The Kerala government started this innovation grant program to assist new businesses and entrepreneurs in rural areas.
5. Innovation Grant: The Kerala government started an innovation grant program to assist small and medium-sized businesses in thriving in the industry. This initiative offers businesses and entrepreneurs financial support to enable them to swiftly transform their ideas into completed products.

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6. Startup Communities Development and Partnership Programs: To identify and compile all potential startups that would be interested in relocating to Kerala, the government of Kerala started this community project.
7. Entrepreneur Support Scheme: This program gives business owners all the help they require to make sure their operations are successful. The main objective of this program is to assist small, micro, and medium-sized enterprises.

4. Conclusion

Entrepreneurship's contribution to economic growth is crucial for the growth of new companies. Learning everything there is to know about this field will provide you the skills and information you need to be successful in the future. Students can obtain useful insights and practical support by participating in entrepreneurship development programs. By increasing local wealth, diversifying the economy, generating and maintaining jobs, and expanding the local tax base, economic development is a process of focused initiatives and activities aimed at enhancing a community's financial well-being and standard of living. Innovation and imagination, taking risks and achieving them, organisation and management, and other tasks are the four roles of an entrepreneur. By identifying new business opportunities and putting creative production methods into practice, entrepreneurs can create more efficient ways to use resources. This benefits both the business owner and the economy at large since it lowers waste and increases output. Entrepreneurship is a major driver of economic growth and development. By creating new businesses and jobs, entrepreneurship increases the GDP and per capita income.

The research suggested that entrepreneurial education can broaden an individual's knowledge base, identify opportunities, and offer solutions for overcoming environmental obstacles. Higher education institutions would set up incubators where students may demonstrate their aptitudes and talents in expanding their enterprises. At the elementary school level, the government should include entrepreneurial education in the curriculum. Additionally, encourage their participation by giving the institutions money to invest in research and development.

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A COMPARATIVE STUDY ON MULTI MODAL EMOTION RECOGNITION USING NEURAL NETWORKS

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Abstract

Affective computing has gained significant attention in recent years due to its potential to transform areas such as mental health monitoring, human computer interaction, and personalized advertising. Its growth has been largely driven by advancements in sub-domains like sentiment analysis and emotion recognition. Deep Learning (DL) has played a pivotal role in this progress, enabling the development of Multimodal Emotion Recognition (MER) systems that can effectively process data from multiple sources, including audio, video, and text. Despite these advancements, MER systems still face several challenges that need to be addressed. This study presents a novel fusion method for audio-visual emotion recognition by integrating features from audio and visual modalities. Audio and video data are preprocessed separately, with audio emotion features extracted using a 2D CNN-based model (audio-net) designed to process Mel-spectrograms, and visual expression features extracted using a 3D CNN-based model (visual-net) capable of analyzing facial expression image sequences. The extracted features are then fused and enhanced using Deep Canonical Correlation Analysis (DCCA) to improve feature correlation between the two modalities. The proposed approach demonstrates the potential for more accurate and robust emotion recognition by effectively leveraging complementary information from audio and visual sources. This systematic review explores the advancements in multimodal emotion recognition systems utilizing Convolutional Neural Networks (CNNs) and Deep Neural Networks (DNNs). By integrating data from multiple modalities such as audio, video, and

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text, these systems have significantly enhanced the accuracy and robustness of emotion recognition. The review focuses on the methodologies, architectures, and feature fusion techniques employed in CNN- and DNN-based models. The findings provide a comprehensive understanding of the current state of multimodal emotion recognition and outline future research directions to address existing gaps, aiming to advance the field's application in areas such as mental health, human-computer interaction, and personalized systems.

Keywords: Multimodal Emotion Recognition (MER), Deep Learning (DL), Sentiment analysis, Human-computer interaction, Deep Canonical Correlation Analysis (DCCA), Convolutional Neural Networks (CNNs), Deep Neural Networks (DNNs), Mel-spectrograms, Modality alignment Feature correlation, Audio-net, Visual-net

1. Introduction

Emotion is a powerful way for humans to express their feelings, desires, needs, interests, and concerns, and it serves as a key communication tool between different living beings. As computers continue to advance in the AI era, they have become integral to our daily lives. However, for computers to respond effectively in human interactions, they must be able to recognize human emotions. For example, emotion recognition can improve welfare services by monitoring the condition of elderly individuals or facilitate the automatic diagnosis of mental health conditions. Emotion-aware chatbots are already helping to streamline daily activities, and speech emotion recognition has the potential to aid in therapeutic conversations. Moreover, software developers are now encouraged to design applications that adapt their offerings based on the emotional state of customers or create intelligent machines, like teaching robots in schools or healthcare robots. As a result, there has been growing interest in the recognition and classification of human emotions, derived from sources such as facial expressions, speech, and body language.

Multimodal Emotion Recognition (MER) refers to the process of identifying and classifying human emotions by combining multiple signals from sources like text, speech, and facial cues. This area of research spans across fields such as medicine, security, AI, and human-computer interaction (HCI). Emotions can be extracted from a variety of sources, including physical data (e.g., video,

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audio, text) and physiological signals (e.g., EEG, ECG). What differentiates unimodal emotion recognition from bimodal or multimodal approaches is the fusion of modalities. Fusion involves creating a unified representation that captures how different modalities interact or complement each other to achieve the desired result. Two common fusion strategies in emotion recognition are feature-level fusion (early fusion) and decision-level fusion (late fusion). The predictions from various modalities can be integrated using methods like averaging, majority voting, highest accuracy, signal variance, weights based on channel noise, or optimization modeling. For example, in decision-level fusion, researchers classify emotions using weighted criteria to minimize, or even eliminate, discrepancies between the predictions from different modalities.

Multimodal Emotion Recognition (MER) aims to identify and classify human emotions by leveraging multiple sources of data, such as text, speech, facial expressions, and physiological signals. The choice of datasets is critical in developing robust and generalizable MER models, as they provide the foundation for training, testing, and validating machine learning algorithms. Each dataset offers a unique set of modalities, characteristics, and challenges, which can significantly influence the model's performance and application. The field of multimodal emotion recognition has seen a variety of datasets developed for different tasks and domains, each providing different combinations of modalities. Some datasets focus on specific emotional expressions, while others aim to capture more complex emotional states across diverse real-world settings. In this introduction, we will explore and compare some of the widely used datasets in MER research, examining their strengths, limitations, and the modalities they incorporate. This comparison will help guide researchers in selecting appropriate datasets for their specific applications, such as healthcare, human-computer interaction, or consumer emotion analysis.

2. Experimental Methods

2.1 Data Collection

The first step in the methodology for multimodal emotion recognition is gathering a diverse and comprehensive dataset that includes multiple modalities (text, speech, facial expressions, physiological signals). This dataset should

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contain labeled emotion categories, such as happiness, sadness, anger, surprise, and neutral.

Text-based: Emotion-labelled text data from online platforms, social media, or dialogues.

Speech-based: Audio data containing emotional speech samples with labeled emotions, such as the EmoReact or RAVDESS dataset.

Facial expressions: Videos or image datasets such as AffectNet or FER-2013 containing emotional facial expressions.

Physiological signals: Datasets that contain electroencephalogram (EEG) or electrocardiogram (ECG) data with emotion labels, such as DEAP or AMIGOS.

2.2 Preprocessing

Text modality:

- Tokenize the text data into words or subwords.
- Perform text normalization (e.g., lowercasing, removing punctuation).
- Apply techniques like word embeddings (Word2Vec, GloVe) or transformer-based models (e.g., BERT) for feature extraction.

Speech modality:

- Extract features from raw audio, such as Mel-frequency cepstral coefficients (MFCCs), pitch, and tone.
- Normalize the audio data and perform speech segmentation for temporal alignment.

Facial expression modality:

- Detect faces using pre-trained models like OpenCV or dlib.
- Extract facial landmarks and compute facial action units (AUs) or use deep learning models like CNNs to classify facial expressions.

Physiological signals:

- Preprocess signals by removing noise, normalizing the data, and segmenting the time series data based on emotion-relevant events.
- Extract features such as heart rate variability (HRV) or EEG power spectra.

2.3 Feature Extraction

For each modality, a feature extraction technique should be employed to convert raw data into meaningful representations.

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Text: Use pretrained embeddings (Word2Vec, FastText, BERT, etc.) to convert text into vector form.

Speech: Extract time and frequency domain features like MFCCs, pitch, tone, and formant frequencies.

Facial Expression: Utilize CNN-based feature extractors or extract landmark-based features (such as distance between facial features).

Physiological Signals: Employ statistical or spectral features such as HRV, EEG band power, or temporal patterns from ECG/EEG signals.

2.4. Multimodal Fusion

The next step is combining features from the various modalities (text, speech, facial expressions, and physiological signals) using either early fusion (feature-level fusion) or late fusion (decision-level fusion).

Early Fusion (Feature-Level Fusion):

Concatenate the extracted features from each modality into a single feature vector.

Input the concatenated vector into a deep neural network model (e.g., fully connected networks (FCNs) or CNNs).

Late Fusion (Decision-Level Fusion):

Train separate neural network models for each modality. Perform emotion classification independently on each modality. Combine the predictions using methods like majority voting, averaging, or weighted voting based on model accuracy or confidence scores**.**

2.5 Neural Network Architecture

Deep Convolutional Neural Networks (CNNs):

- For image-based or video-based emotion recognition (e.g., from facial expressions).
- Can also be used for feature extraction in audio data (e.g., spectrograms).

Recurrent Neural Networks (RNNs) or LSTMs (Long Short-Term Memory):

- Particularly useful for sequential data such as speech and text.
- Can capture temporal dependencies in speech and text data, making them useful for emotion classification in time-series data.

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Multimodal Fusion Networks:

- Combine CNN, RNN, or LSTM with attention mechanisms to model the interaction between modalities.
- Implement multi-stream neural networks where each modality is processed separately before fusion layers are used for decision-making.

Transformer Networks:

- Use attention mechanisms to weight different modalities based on relevance.
- BERT and other transformers are widely used for text data, and multimodal transformers can extend this approach to integrate speech, facial expressions, and other modalities.

2.6 Training the Model

Split the dataset into training, validation, and test sets. Train the neural network models using an appropriate loss function, such as cross-entropy loss for classification tasks. Use backpropagation and optimization techniques like Adam or SGD to adjust weights and minimize loss. Implement early stopping to prevent overfitting.

2.7 Datasets for multimodal emotion recognition

2.7.1. AffectNet

AffectNet is one of the largest and most comprehensive datasets for facial expression recognition, consisting of over 1 million facial images labeled with seven different emotions: happiness, sadness, surprise, anger, disgust, fear, and neutral. This dataset provides a rich resource for researchers focusing on visual emotion recognition and can be used in combination with other modalities to create multimodal models. However, its limitation lies in the fact that it is predominantly visual, lacking modalities such as speech or physiological signals.

2.7.2. RAVDESS (The Ryerson Audio-Visual Database of Emotional Speech and Song)

The RAVDESS dataset is specifically designed for speech emotion recognition and includes audio and video recordings of professional actors expressing a range of emotions through speech and song. It includes both audio

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files (speech) and video files (facial expressions) in a controlled environment. While RAVDESS provides both speech and visual cues, its scope is limited by its relatively small sample size compared to other multimodal datasets, and it primarily features scripted expressions rather than natural, spontaneous emotions.

2.7.3. DEAP (Dataset for Emotion Analysis using Physiological Signals)

DEAP is a well-known dataset in the domain of physiological emotion recognition. It includes EEG, ECG, and other physiological signals alongside video data, providing valuable insights into emotion recognition using bio-signals. DEAP has been widely used for emotion classification tasks related to mental health and well-being. However, it lacks textual or speech data, meaning that it is restricted to specific physiological measures and visual stimuli. Combining DEAP with other datasets that provide textual or vocal data could help develop more robust multimodal emotion recognition systems.

2.7.4. EmoReact

EmoReact is a multimodal dataset designed for recognizing emotions in real-world, natural settings. It includes facial expressions, speech, and text, making it suitable for training models that rely on multimodal input. The dataset is valuable for researchers working on interactive systems, such as emotion-aware chatbots or virtual assistants. EmoReact's strength lies in its naturalistic, conversational setup, but it may be challenging to scale due to the need for extensive annotation and the complexity of real-world data.

2.7.5. Affectiva and the iMotions Database

Affectiva, in partnership with iMotions, provides datasets that include both facial expressions and physiological signals (e.g., heart rate, skin conductance) collected through webcams and wearable devices. This multimodal dataset has been used in various emotion recognition applications, from advertising analysis to healthcare. The combination of facial expressions and physiological signals helps capture more nuanced emotional states. However, the dataset's reliance on facial expressions may limit its ability to generalize across different cultures or settings.

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2.7.6. CREMA-D (Crowd-sourced Emotional Multimodal Actor Database)

CREMA-D is a large dataset containing audio-visual data (speech and facial expressions) and includes a diverse set of actors from various demographic backgrounds. It is useful for multimodal emotion recognition because of its size and the diversity of emotional expressions. However, its limitation is that it lacks physiological signals, which can sometimes provide deeper insights into emotional states. The dataset's primary focus is on the interaction between speech and facial cues, making it particularly useful for applications like virtual assistants or automated customer service.

2.7.7. MELD (Multimodal EmotionLines Dataset)

MELD is a large-scale multimodal dataset consisting of dialogue data, with each utterance labeled with emotions such as happiness, sadness, anger, fear, surprise, and disgust. It includes three modalities: audio, video, and text, making it suitable for building dialogue-based emotion recognition systems. MELD's strength is its focus on natural, conversational data, but it may not capture more subtle emotional states as effectively as datasets incorporating physiological signals.

2.7.8. EmoDB (Emotional Speech Database)

EmoDB is an audio-based dataset that includes recordings of emotional speech from professional actors. While it provides a comprehensive set of emotions and is widely used for speech emotion recognition, it lacks additional modalities such as facial expressions or physiological signals. Integrating EmoDB with visual data or physiological data from other sources could provide a more comprehensive solution for multimodal emotion recognition.

2.7.9. SAVEE (Surrey Audio-Visual Expressed Emotion)

SAVEE is another dataset that includes audiovisual data for emotion recognition, containing audio recordings along with corresponding facial expressions. While it is effective for studying how emotional states manifest through speech and facial expressions, its scope is limited in terms of the variety of emotions covered and the lack of physiological signals.

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3. Results

Evaluation Metrics

- To evaluate the performance of the multimodal emotion recognition system, use common classification metrics:
- Accuracy: The proportion of correct predictions.
- Precision, Recall, and F1-Score: Useful for imbalanced datasets where emotions may not be evenly distributed.
- Confusion Matrix: Provides a breakdown of correct and incorrect classifications for each emotion.
- AUC-ROC Curve: Assesses the model's ability to discriminate between emotion classes.

Results Analysis

- Analyze the performance of the model for each individual modality as well as the multimodal fusion model.
- Compare fusion strategies (early vs. late fusion) to determine the optimal method for combining modalities.
- Visualize the model's performance over epochs to observe convergence and any overfitting behavior.

4. Conclusion

In summary, each dataset for multimodal emotion recognition offers unique features and limitations depending on the modalities included. Datasets like **AffectNet** and **CREMA-D** focus on facial expressions, while **DEAP** provides insights into physiological signals. **RAVDESS** and **EmoReact** contribute audiovisual data, and **MELD** stands out with its focus on multimodal dialogue. To build a comprehensive and robust multimodal emotion recognition system, it is crucial to choose the appropriate dataset based on the intended application, whether it's healthcare, human-computer interaction, or emotional well-being analysis. Combining these datasets or augmenting them with additional data from other sources could help overcome individual limitations and lead to more effective emotion recognition models.

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FINTECH AND ITS IMPACT ON KERALA TOURISM

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Abstract

Tourism is a dynamic industry contributing significantly to economic, social, and cultural development. In recent years, Financial Technology (Fintech) has emerged as a transformative force across sectors, revolutionizing financial transactions and improving efficiency. The tourism industry, being financially intensive, has integrated fintech solutions—such as digital payments, blockchain, and artificial intelligence—to streamline services and enhance global connectivity. This conceptual paper investigates the impact of fintech on Kerala's tourism industry. Focusing on Kerala—a prominent tourist destination in India—the paper examines how fintech reshapes consumer behavior, payment systems, and financial models. It highlights fintech's role in promoting financial inclusion, security, and cost efficiency. By reviewing global practices and synthesizing existing literature, this study offers insights into Kerala's digital transformation in tourism. It further proposes strategic directions for leveraging fintech to enhance the sector's competitiveness. The findings contribute to scholarly discourse on digital tourism and offer policy recommendations for sustainable fintech adoption in Kerala.

Keywords: Tourism, Fintech, Economic growth, Kerala, Digital Transformation, Financial Inclusion

1. Introduction

Kerala, often referred to as "God's Own Country," is one of India's most popular tourist destinations. Known for its serene backwaters, lush landscapes, hill stations, and cultural richness, Kerala welcomes millions of domestic and international visitors annually. Tourism contributes significantly to the state's economy, with segments such as eco-tourism, medical tourism, and heritage

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tourism playing key roles. With the rise in smartphone penetration and digital awareness, financial technology (Fintech) is emerging as a transformative tool in Kerala's tourism ecosystem.

Fintech refers to the use of innovative digital technologies to deliver financial services efficiently. In the context of tourism, Fintech helps enable secure digital transactions, promote financial inclusion, reduce operational costs, and enhance the overall tourist experience. This paper examines how Fintech solutions such as digital payments, blockchain technology, AI-based tools, and decentralized finance are being integrated into Kerala's tourism sector. It further explores how these advancements are helping overcome key challenges related to security, accessibility, and customer satisfaction. By analyzing recent trends, literature, and policy initiatives, this paper aims to provide an academic and strategic foundation for further integration of Fintech into Kerala's tourism industry. The study underscores the importance of collaborative efforts between government, private stakeholders, and tourists to unlock the full potential of Fintech in tourism development.

2. Literature Review

2.1 Fintech Adoption in Kerala's Tourism Sector

The integration of financial technology (fintech) into the tourism industry has garnered significant attention in recent years, particularly in regions like Kerala, India. This literature review examines existing studies on fintech adoption within Kerala's tourism sector, highlighting key findings and identifying areas for future research. According to World Travel & Tourism Council (WTTC) reports, mobile payment systems such as Google Pay, Apple Pay, and Paytm have significantly reduced dependency on cash transactions, leading to greater efficiency in financial operations within the tourism industry (WTTC, 2021). The introduction of blockchain technology has further ensured transparency in payments and booking processes, reducing fraud risks (Tapscott & Tapscott, 2018). Kerala's tourism industry has embraced digital financial solutions through Unified Payments Interface (UPI)-based transactions, digital wallets, and QR-code-based payments. Studies indicate that these innovations have increased the accessibility of tourism-related financial services, especially for international travelers who prefer digital transactions (Krishna & Nair, 2022). The

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Kerala government has promoted digital payments under its "Cashless Kerala" initiative, ensuring that tourism dependent businesses, such as homestays, resorts, and houseboats, integrate digital payment systems (Kerala Tourism Development Corporation, 2023). Fintech platforms also facilitate micro-loans and crowdfunding for small-scale tourism entrepreneurs, further enhancing financial inclusion (Gopalakrishnan, 2022).Financial Inclusion: Small and medium-sized tourism enterprises (SMTEs) benefit from Fintech by accessing microfinance and digital lending platforms (Rajan & Menon, 2022).Fraud Prevention & Security: Blockchain technology and AI-based fraud detection ensure safer financial transactions in the tourism industry (Sundaram & Joseph, 2023).Increased Revenue Generation: Digital financial solutions increase efficiency in revenue collection for the state's tourism sector (Krishnakumar & Varma, 2023).Digital Literacy Barriers: Many local tourism entrepreneurs and service providers still lack adequate knowledge about Fintech applications (Thomas & Rajan, 2022).

2.2 Cybersecurity Risks

Increasing dependence on digital transactions raises concerns about data privacy and cyber fraud (Menon & Abraham, 2023). Infrastructure Gaps: Some remote tourism destinations lack proper internet connectivity, affecting Fintech adoption (Govindan, 2022). Regulatory Issues: Complex financial regulations and compliance requirements pose challenges for new Fintech-based tourism enterprises (Nair & Venugopal, 2023).

3. Government Initiatives Supporting Fintech in India

The Indian government has launched several initiatives to boost fintech adoption and financial inclusion, including:

- Digital India Initiative: Encourages digital payments and financial inclusion.
- Jan Dhan Yojana (PMJDY): Provides bank accounts and digital access to financial services.
- Unified Payments Interface (UPI): A seamless payment platform facilitating quick transactions.
- Regulatory Sandbox by RBI: Encourages fintech innovation and regulatory support.

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- Startup India and Standup India: Provides funding and tax benefits for fintech startups.
- Bharat Bill Payment System (BBPS): Simplifies bill payments across India.

Despite these challenges, fintech remains a crucial driver of innovation in Kerala's tourism sector, fostering improved financial inclusion, customer satisfaction, and operational sustainability.

4. Kerala's Digital Infrastructure and Fintech Adoption

Kerala has made significant strides in digital infrastructure, making it a prime location for fintech integration in tourism. Key aspects include:

- High internet penetration and smartphone usage
- K-FON Project: Ensuring affordable internet access for all
- Government-backed e-Governance and digital services
- Strong banking network facilitating digital transactions
- Growth in UPI, mobile wallets, and digital banking adoption
- Expansion of digital lending and microfinance solutions
- Increasing adoption of QR-based payments by SMEs and local businesses

5. Role of Fintech in Transforming Global Tourism

Fintech plays a crucial role in improving the travel experience worldwide by offering: • Contactless, multi-currency, and UPI-based payment solutions.

- Low-cost, real-time currency exchange and international transactions.
- Digital insurance for real-time medical and trip cancellation coverage.
- AI-driven expense tracking and budget management.
- Payment integration for small tourism businesses to expand their reach globally.

6. Impact of Fintech on Kerala's Tourism Industry

- Contactless and mobile payments enhance transaction speed and security.
- Multi-currency digital wallets simplify international travel.
- Reduced fraud and transaction costs for businesses.

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- AI-powered real-time claim settlements for travel insurance.
- Micro-loan and digital lending solutions for tourists and small tourism businesses.

7. Challenges and Considerations

Despite fintech's potential, Kerala's tourism sector faces challenges in digital adoption:

- Infrastructure development: Need for improved digital payment acceptance points.
- Digital literacy: Educating tourists and local businesses about fintech services.
- Security concerns: Addressing cyber fraud, identity theft, and transaction security.

8. Research Gaps in Fintech Adoption for Kerala Tourism

Several gaps in existing literature highlight the need for further research**:**

- Lack of studies on fintech's impact on Kerala's tourism sector.
- Limited research on tourists' adoption of digital payment methods.
- Need for research on how fintech can improve sustainable tourism in Kerala.
- Underexplored role of fintech in enhancing local businesses and tourism SMEs.
- Absence of data on customer experiences with fintech in Kerala's tourism sector.
- Gaps in addressing digital payment fraud and cybersecurity threats.
- The role of government policy in promoting fintech adoption remains under-researched.

9. Scope of Future Research

Future research can focus on:

- Pilot projects in specific Kerala destinations, such as Malappuram, to test fintech adoption.
- Cybersecurity measures to ensure safe digital transactions in tourism.
- Government strategies to incentivize fintech adoption in tourism.

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- Tourists' perceptions, preferences, and trust in digital payment systems in Kerala.

10. Expected Outcomes

- Insights into fintech's role in transforming Kerala's tourism industry.
- Understanding opportunities and challenges for local tourism businesses.
- Identification of the most effective fintech tools for the tourism sector.
- Recommendations for fintech adoption to enhance the tourist experience.
- Policy suggestions to support fintech-driven tourism growth.

11. Policy Implications

To drive fintech adoption in Kerala's tourism sector, policymakers should consider:

- Implementing policies that encourage fintech integration in tourism services.
- Fostering collaboration between fintech companies and tourism stakeholders.
- Providing incentives for SMEs to adopt digital payment solutions.
- Strengthening cybersecurity measures to protect financial transactions.
- Promoting financial literacy among tourists and local businesses.

12. Conclusion

Fintech integration within Kerala's tourism sector has the potential to transform the financial landscape of travel and hospitality. By enabling seamless digital transactions, enhancing security, and expanding financial access, fintech plays a vital role in improving tourist experiences and business operations. However, challenges such as digital literacy gaps, cybersecurity risks, and inadequate infrastructure need to be addressed for inclusive growth. The paper emphasizes the need for proactive policy support, awareness programs, and public-private collaboration to facilitate sustainable fintech adoption in tourism. Future studies should explore practical applications and

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consumer perspectives on fintech in Kerala's tourism to further refine these strategies.

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A STUDY ON KERALA'S ECONOMIC POTENTIAL AND BANK MERGERS: STRENGTHENING THE STATE'S POSITION IN INDIA'S FINANCIAL LANDSCAPE

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Abstract

This study explores the role of bank mergers in enhancing Kerala's economic potential, focusing on how the consolidation of financial institutions can strengthen the state's position in India's broader financial landscape. Kerala, known for its socio-economic achievements and rapidly growing service sectors such as IT, healthcare, tourism, and education, faces challenges in accessing adequate capital and financing infrastructure development. Bank mergers, driven by the Indian government's financial consolidation agenda, offer an opportunity to address these gaps by creating larger, more financially resilient institutions capable of providing greater access to credit, improving the investment climate, and supporting the state's long-term economic goals. The study synthesizes existing literature to analyze the role of financial consolidation in addressing credit accessibility challenges, fostering technological advancements, and supporting infrastructure projects in Kerala. Furthermore, the research identifies both the potential benefits and challenges of banking sector consolidation, including operational synergies, regulatory constraints, and post-merger integration issues. This study also explores the impact of bank mergers on Kerala's economic growth, with a focus on credit access, infrastructure financing, and the development of key service sectors such as IT, healthcare, and tourism.

Key words: Bank Mergers, Kerala Economy, Financial Inclusion, Economic Development, Investment Climate, Service Sector Growth.

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1. INTRODUCTION

Kerala, known for its strong socio-economic indicators and growth in sectors like IT, tourism, healthcare, and education, still faces challenges in sustaining economic growth. Key issues include limited access to development capital, infrastructure financing, and credit availability for underserved groups, especially SMEs and rural areas. Although Kerala has a robust banking network comprising PSBs, private banks, RRBs, and cooperatives efficient credit allocation remains a concern. The consolidation of banks through mergers and collaborations offers both challenges and opportunities. Strengthened, larger banks could better support Kerala's economic needs by improving credit access, attracting investment, and financing infrastructure projects. This article examines how banking sector consolidation can enhance Kerala's economic prospects and its role in India's financial ecosystem.

2. LITERATURE REVIEW

Bank mergers globally have been shown to boost economic growth by improving financial access, increasing lending capacity, and enhancing financial stability (Agoraki et al., 2010). In India, such mergers have created stronger institutions capable of funding large-scale infrastructure projects and supporting national economic objectives (Reddy, 2014). Kerala, with its service-driven economy especially in IT, healthcare, education, and tourism faces constraints due to limited access to capital for infrastructure and sectoral investment (Nair, 2017). Despite a developed banking network, financial inclusion, particularly in rural areas, remains a challenge (RBI, 2019). Merged banks can offer more competitive and diverse financial products, supporting urbanization and economic expansion (Sharma, 2018). Larger institutions also improve investor confidence, lower transaction costs, and enhance the investment climate (Gupta & Singh, 2019). However, any consolidation in Kerala must consider the state's unique socio-economic context to ensure effectiveness (Thomas, 2020). Mergers can also improve credit access for SMEs, which often struggle due to the limited scale of regional banks (Sen, 2018).

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3. OBJECTIVES OF THE STUDY

1. To analyze the impact of bank mergers on Kerala's economic growth, particularly in terms of credit access and infrastructure financing.
2. To examine the role of bank mergers in promoting the growth of Kerala's service sectors, including IT, tourism, and healthcare.
3. To explore the challenges and opportunities associated with the consolidation of Kerala's banking sector.

4. KERALA'S ECONOMIC GROWTH AND THE ROLE OF CREDIT ACCESS

Kerala's economy has shown remarkable resilience and growth in recent years, primarily driven by the service sectors, including IT, tourism, healthcare, and education. However, the state faces challenges in terms of accessing capital for large-scale infrastructure projects, which are critical for its long-term development. The financial sector in Kerala, though well-developed, remains fragmented, with a mix of small, medium, and large banks. This fragmentation has historically limited the capacity of banks to provide adequate credit for infrastructure projects and small and medium-sized enterprises (SMEs).

4.1. The Role of Bank Mergers in Improving Credit Access

Bank mergers are often seen as a mechanism for creating larger, more financially stable institutions capable of providing greater credit to a variety of sectors. When smaller, regional banks merge, they typically increase their lending capacity due to a larger deposit base and better capital adequacy.

4.1.1. Increasing the Lending Capacity of Banks:

Merged banks, with a larger asset base and improved financial stability, are in a stronger position to offer loans to both private enterprises and government infrastructure projects.

4.1.2. Enhancing Credit Flow to SMEs.

Small and medium-sized enterprises (SMEs) in Kerala, which constitute a significant portion of the state's economy, often face challenges in securing loans from traditional banks due to limited credit history or collateral. Merged

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banks can overcome these barriers by utilizing more advanced credit assessment tools, better risk management frameworks, and by spreading risks across a wider portfolio.

4.1.3. Addressing Credit Gaps in Rural Areas:

While Kerala has a relatively high level of banking penetration, rural areas still face challenges in accessing credit. Bank mergers can address these gaps by expanding the reach of financial services to underserved rural areas through branch networks and digital banking solutions.

4.1.4. Improving Financial Products for Rural Populations:

Merged banks can offer more diversified financial products that are tailored to the needs of Kerala's rural population, such as affordable home loans, agricultural financing, and small-scale infrastructure projects.

4.2. Impact of Bank Mergers on Infrastructure Financing

Infrastructure development is a cornerstone of Kerala's long-term economic growth strategy. The state's government has ambitious plans to upgrade its infrastructure to support its growing service sectors, attract investment, and improve the quality of life for its residents. Bank mergers can significantly impact infrastructure financing by:

4.2.1. Increased Pool of Capital for Infrastructure Projects:

Infrastructure projects typically require large amounts of capital over extended periods. Merged banks, by pooling their resources, are able to amass a larger capital base, making it easier to finance large infrastructure projects such as the construction of highways, water supply systems, and urban development initiatives.

4.2.2. Public-Private Partnerships (PPP) and Project Financing:

One of the challenges in Kerala has been financing infrastructure projects through public-private partnerships (PPPs). Merged banks can play a more prominent role in facilitating PPPs by providing the necessary capital for such projects and helping to manage risks associated with long-term investments.

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4.2.3. Financing of Green and Sustainable Infrastructure:

Kerala is increasingly focusing on sustainable development, including eco-friendly infrastructure such as green buildings, renewable energy projects, and waste management systems. Merged banks can better align with national and global sustainability goals by providing specialized financial products aimed at supporting environmentally conscious infrastructure projects.

4.2.4. Improved Risk Management for Infrastructure Projects:

Financing infrastructure projects comes with inherent risks, including cost overruns, project delays, and regulatory challenges. Merged banks, by having a stronger balance sheet and more advanced risk management frameworks, are better equipped to manage these risks.

5. KERALA'S SERVICE SECTOR

Kerala's service sector is one of the most dynamic and rapidly growing components of its economy. The state is well-known for its thriving information technology (IT) industry, globally recognized tourism sector, and robust healthcare services. These sectors are vital to Kerala's economic growth, generating employment, attracting investment, and contributing significantly to its GDP.

5.1 Bank Mergers and the Growth of Kerala's IT Sector

Kerala's **IT sector** has seen remarkable growth in recent years, particularly with the establishment of IT parks like Techno park in Trivandrum and Info park in Kochi. The sector contributes significantly to the state's employment and export earnings. However, financing remains a crucial issue for the continued expansion of this sector.

Role of Bank Mergers in IT Sector Growth:

1. **Improved Access to Capital for Tech Startups and SMEs**: The IT sector in Kerala comprises a mix of established large firms and emerging startups. For startups, securing venture capital and loans for working capital or expansion remains difficult.
2. **Financing for Infrastructure and Innovation**: IT companies often require substantial investment in infrastructure, including office

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spaces, data centers, and R&D facilities. Larger, merged banks, with more capital and diversified portfolios, can provide loans for infrastructure development at more favorable terms.

3. **Supporting Technological Up gradation**: The IT sector is heavily reliant on staying ahead of technological advancements. Merged banks can offer favorable financing options for upgrading technology, purchasing new software, and investing in modern computing infrastructure.
4. **Improved Access to International Markets**: A larger, merged banking entity would likely have better global outreach and more robust international operations. Merged banks could offer trade finance solutions and foreign exchange services, enabling IT companies to expand their operations globally, especially in high-demand markets like the U.S. and Europe.

5.2. Bank Mergers and the Growth of Kerala's Tourism Sector

Kerala's **tourism industry** is another cornerstone of its service economy. Known as "God's Own Country," the state attracts millions of domestic and international tourists annually, contributing significantly to employment, foreign exchange earnings, and local business activity.

Role of Bank Mergers in Tourism Sector Growth:

1. **Better Financing for Hospitality Infrastructure**: The tourism industry in Kerala requires constant investment in infrastructure, including the development of hotels, resorts, transportation services, and tourist attractions. Bank mergers can help create financial institutions with a larger capital base, making them more capable of offering long-term, low-interest loans to tourism-related businesses.
2. **Better Financing for Hospitality Infrastructure**: Kerala is increasingly focusing on niche tourism markets such as eco-tourism, medical tourism, and cultural tourism. Merged banks, with their increased resources, could offer customized loans for eco-friendly tourism projects, medical tourism facilities, and initiatives that preserve Kerala's cultural heritage.

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3. **Seasonal Cash Flow Management**: Tourism businesses often face seasonal fluctuations in income, with peak seasons seeing a surge in demand and off-seasons leading to cash flow challenges. Merged banks can offer more flexible financial products, such as short-term working capital loans, to help tourism businesses manage these seasonal fluctuations.
4. **Marketing and Global Outreach**: As larger and more financially robust entities, merged banks may have the capacity to support tourism businesses with marketing initiatives, particularly in international markets. Banks could collaborate with the Kerala Tourism
5. **Bank Mergers and the Growth of Kerala's Healthcare Sector** Kerala's healthcare sector is one of the most developed in India, known for its high standards of medical care, advanced hospitals, and a growing medical tourism industry. The state has also become a popular destination for medical tourists seeking affordable and high-quality healthcare.

5.3 Role of Bank Mergers in Healthcare Sector Growth:

1. **Funding for Hospital Infrastructure**: The healthcare sector requires significant investment in physical infrastructure, such as hospitals, clinics, diagnostic centers, and medical equipment. Merged banks, with larger financial resources, can offer larger-scale loans to healthcare providers, supporting the construction and expansion of healthcare facilities.
2. **Investment in Medical Research and Innovation**: Kerala's healthcare industry, while advanced, still faces challenges in terms of innovation and research. Merged banks can play a crucial role by providing funding for medical research and the development of new healthcare technologies.
3. **Financing for Medical Tourism**: Merged banks can create financial products designed specifically for the medical tourism industry, such as loans for building or expanding medical tourism facilities, including specialized hospitals, wellness resorts, and rehabilitation centers.

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4. **Supporting Affordable Healthcare Access**: With larger financial resources at their disposal, merged banks can contribute to improving financial inclusion in the healthcare sector.

6. CHALLENGES OF BANK CONSOLIDATION IN KERALA

6.1. Disruption of Local Banking

- ✓ Risk of Reduced Community-Centric Services
- ✓ Impact on Customer Relationships.

6.2. Cultural Integration and Employee Challenges

- ✓ Resistance from Employees.
- ✓ Loss of Institutional
- ✓ Training and Realignment Costs

6.3. Risk of Reduced Competition

- ✓ Higher Interest Rates and Fees
- ✓ Limited Product Variety.

6.4. Integration of Technological Systems

- ✓ Operational Disruptions
- ✓ Investment in New Technology

7. FINDINGS OF THE STUDY

The study finds that bank mergers have significantly contributed to enhancing financial inclusion and expanding credit availability, particularly for small and medium-sized enterprises (SMEs) in Kerala. By consolidating resources, merged banks have been able to extend services to underserved regions, thereby promoting financial literacy and economic participation. Larger financial institutions also possess the capacity to fund critical infrastructure projects, aiding Kerala's urbanization. The IT sector has benefited from improved access to investment capital and advanced digital banking solutions, while the tourism industry has gained from affordable financial products and a more stable investment climate. In rural and semi-urban areas, mergers have improved financial access for marginalized communities, addressing a long-standing gap in banking services. However, the study also highlights challenges such as operational and cultural integration issues that can delay the realization of merger benefits. It emphasizes the need to consider Kerala's unique demographic and economic

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landscape when implementing consolidation efforts. Furthermore, the regulatory framework set by the Indian government plays a pivotal role in shaping the success or limitations of bank mergers, which ultimately position Indian banks to better compete on a global scale.

8. CONCLUSION

The consolidation of Kerala's banking sector brings both opportunities and challenges. While concerns exist around service disruption, cultural integration, job security, and reduced competition, mergers offer the potential to build stronger, more resilient banks that can better support Kerala's economic development. These larger institutions can improve access to capital, enhance efficiency, and promote financial inclusion, contributing to a more competitive and inclusive economy. The study concludes that bank mergers are instrumental in advancing Kerala's growth by improving credit availability, supporting infrastructure projects, and aiding the expansion of key sectors like IT and tourism. However, to fully realize these benefits, it is essential to manage the integration process effectively and address issues such as regulatory hurdles, operational challenges, and regional disparities.

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القضايا الهوية فى الرواية العربية "موسم الهجرة إلى الشمال" نموذجا

محبوب .سى.ك
باحث قسم اللغة العربية , جامعة عليكره اسالمية, الهند

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أتاذ مساعد، قسم اللغة العربية ، كلية آابير الدرااات المتقدمة

الالصة

أائلة الهوية في الرواية العربية تمثل موضوعا مهما ومثيرا للنقاش في الدب العربي. يتعلق هذا المفهوم بكيفية تمثيل الهوية الثقافية والوجدانية للشخص والمجتمع في الرواية العربية. يمكن أن تتضمن هذه الائلة تفكيك الهوية الوطنية والثقافية، والتعبير عن التحولت الجتماعية والسيااية، والبحث عن الهوية الشخصية والجماعية. تاريخيا، قد ترتبط هذه الائلة بالمستويات المختلفة للهوية العربية، بما في ذلك الهوية القومية واسقليمية والدينية. تستند العديد من الروايات العربية إلى هذه القضايا لاتكشاف تأثيرها على الفراد والمجتمعات، وتسليط الضوء على التحولت والصراعات التي تشكل الهوية. الدب اسفريقي أدب يختلف عن غيرها من بلدان الخرى بأنه أدب إنساني بامتياز, يعبر عن تاريخها وثقافتها وحضارتها المحفورة فى ممر اليام, عبرت الرواية الفريقية في المرحلة الحديثة عن قضايا خاصة ظلت عالقة في المحلي من هموم اسنسان الفريقي، وجاءت مرحلة ما بعد الاتعمار في تشخيص ترابات الثقافة التي تركها المستعمر في أفريقيا من خلل نخب ايالية وثقافية. حاول الروائي الفريقي اللعب على أوتار التاريخ والتراث الشفهي؛ سعادة الكتابة عن أحداث من التاريخ رامها الكتاب بطرق اردية ممزوجة بالخيال

الكلمة الرئيسية: الرواية العربية اسفريقية, الهوية, موام الهجرة إلى لشمال

مقدمة:

تعد مسألة الهوية من أبرز اسشكاليات التي شغلت الفكر اسنساني، خاصة في السياقات الثقافية التي شهدت صداما حضاريا أو احتكاكا بين الشرق والغرب. وقد انعكس هذا الهتمام جليا في الدب، لايما في الرواية بوصفها جنسا أدبيا قادرا على اتيعاب تحولت الذات وتعبيراتها المتشابكة. وتأتي رواية "موام الهجرة إلى الشمال" للكاتب السوداني الطيب صالح كواحدة من أبرز النصوص التي تناولت اؤال الهوية في السياق العربي اسفريقي.

إذ تتقاطع في هذه الرواية قضايا الثقافة، والنتماء، والخر، والتاريخ الاتعماري، لتشكل بذلك رؤية نقدية عميقة لمسار الفرد العربي اسفريقي الذي يعيش حالة من التمزق بين ماضيه الصيل وواقعه المزدوج. ومن خلل بطل الرواية مصطفى اعيد، تطرح الرواية أائلة جوهرية حول صورة الذات في مرآة الغرب، والوعي بالهوية في ظل هيمنة ثقافية واجتماعية معقدة.

يروم هذا البحث إلى تحليل هذه القضايا من خلل مقاربة فنية ونقدية للرواية، والوقوف على أهم تمثلت الهوية فيها، اواء في بعدها الثقافي أو النفسي أو الحضاري، مع محاولة فهم السياق التاريخي والجتماعي الذي أنتجها، وآليات التعبير الفني التي اتعان بها الكاتب

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الهوية في فترة ما بعد الستعمار

المسألة الهوية ليست مفهوما محددا ومؤطرا، بل يمكن أن تكون ظاهرة متخيلة ومتحولة. تتحول الهوية ببساطة إلى قضية عندما تكون في أزمة وعندما تكون الحداث التي من المفترض أن تكون ثابتة ومتسقة ، يتم نقلها من خلل تجربة الغموض وعدم اليقين (شور، 1996). وهكذا، عندما يعيش شخص ما في منزل آخر ل ينتمي إليه، مثل هذا الشخص اوف يشعر بعدم الاتقرار. ويؤكد اروب (1994) هذا المعنى في كتابه "المنزل والهوية"، مشيرا إلى أن المنزل يوفر المن والهوية والمكان الذي يشعر فيه المرء بالراحة ويسود فيه الاتقرار والدفء والراحة والاترخاء والمعنى. ولهذا السبب، يحاول معظم الشخاص الذين يعيشون خارج أوطانهم تثبيت هوياتهم وإزالة الحواجز المحتملة. وبهذا المعنى، يصف شولتز وهامر (2003) الهوية بأنها "بحث شتاتي عن الهوية" عندما تصبح قضية تثير حدودا جديدة,

ولعل البحث عن الهوية هو الموضوع الهم الذي له حضور مهيمن في النصوص الدبية العربية ما بعد الاتعمارية. وكانت جذورها في خطاب النهضة (النهضة العربية) عندما فكر المثقفون العرب في وضعهم الثقافي مقارنة بأوروبا. ول شك أن المثقفين العرب، خلل النضال من أجل الاتقلل، كانت تحركهم أيضا رغبة عارمة في تعريف أنفسهم فيما يتعلق بالخرين (المواوي، 2003). إن تأثير اسمبريالية الغربية على الهوية الشرقية قوي بالفعل. وهكذا فإن الهوية ما بعد الاتعمارية، بعد اتقلل الدول الشرقية وإنهاء اتعمارها، تصبح غير مستقرة ومتأرجحة ومتغيرة باتمرار بسبب خصوصيات الهوية ثقافيا واقتصاديا واياايا

النقطة الرئيسية الخرى المرتبطة بهوية ما بعد الاتعمار هي "الحداثة" التي اتسمت بنظام التعليم الاتعماري الذي فرض على البلدان المستعمرة. وفي هذا الصدد، يوضح كيلي وألتباخ (1978) أن التعليم الاتعماري كان مصمما في المقام الول لخدمة مصالح القوى الاتعمارية. ولذلك، فإن نظام التعليم الاتعماري له تأثير هائل على هويات السكان الصليين، وخاصة من خلل اللغة والثقافة والدين. وفي ظل هذه العوامل، ظلت مسألة الهوية تثار باتمرار. الثقافة هي أحد العناصر التي تلعب دورا أاااايا في تحديد وتشكيل هوية اسنسان.

في هذا السياق التاريخي المشحون بالصراع العربي مع الغرب، والمثقل بإشكالت النهضة في مرحلة ما بعد الاتقلل، أدت الرواية العربية مهمة امية تجلت أاااا في دفع القارئ إلى التأمل وإثارة الائلة بعيدا عن التشويق الزائف,ولعله من الروايات التي يمكن إدراجها في هذا المضمار، نجد رواية (الحي اللتيني) 1954م لسهيل إدريس، التي عالجت العلقة الحضارية بين الشرق والغرب، ثم جاءت بعدها رائعة (موام الهجرة إلى الشمال) 1966م للطيب صالح، التي قدمت نموذجا حقيقيا للصراع الحضاري بين الشخصية الشرقية ونظيرتها الغربية، حيث ارتطمت عبر هذه الرواية البيئة العربية بالبيئة الغربية بعنف شديد؛ وبالموازاة مع خطاب العلقة مع الخر الذي هيمن على الرواية العربية في هذه المرحلة التاريخية، هناك خطاب الذات وما عانته من ويلت النفصال والتشرذم، ومن الروايات التي عالجت هذا الموضوع نجد رواية (جومبي) 1966م للكاتب أديب نحوي، ورواية (العصاة) 1964م ساماعيل صدقي، هذه الرواية التي غلب عليها خطاب القومية العربية، وكيفية تكون الوعي القومي العربي بعد مراحل تاريخية فارقة وهي مرحلة العصر العثماني، ومرحلة الحتلل الغربي اسمبريالي، ومرحلة الاتقلل، ثم مرحلة الصراع العربي اسرائيلي.

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ملاص رواية موسم الهجرة إلى الشمال

ركزت رواية موام الهجرة إلى الشمال على صراع الحضارات برواية مليئة بمشاعر التغيير، وبذاكرة خصبة مفعمة بالصراعات بين طبيعة الحياة في مدينة لندن، وبين الحياة في السودان، وقد أثبت الكاتب الطيب صالح أن النتيجة ل تتعدى حقيقة أن اسنسان هو واحد في كل مكان وزمان، وبين ذلك من خلل شخصيتين، هما؛ مصطفى اعيد والراوي؛ فمصطفى اعيد الناجح عملي وهو الفاد المنحل أخلقيا رجع إلى السودان بشخصية لم تستطع التأقلم اسيجابي مع المجتمع، أما مصطفى اعيد فهو شخص يتيم تفجرت مواهبه وطاقاته ثم خالف مبادئ وثوابت مجتمعه في الغربة عندما أتيحت له البدائل، فكانت شخصيته مخالفة لشخصية الراوي الذي عايش ظروفا مشابهة تقريبا وقد رجع من المكان نفسه الذي رجع منه مصطفى، غير أن الراوي عاش حياته في الغربة حسب متطلباته الغرائزية المنضبطة، ليعود بعدها إلى بلده السودان ويستغل خبراته ومهاراته لخدمة بلده. تقوم رواية موام الهجرة إلى الشمال على ذاكرتين مكانيتين؛ المكان الول بريطانيا، إذ كان الراوي مجهول الهوية يدرس، والمكان الثاني في السودان إذ يلتقى فيه مصطفى اعيد مع الراوي. قضى الراوي ابع انوات في أوروبا للدرااة، وبعدها عاد إلى قريته (ود حامد) التي تقع قرب نهر النيل في السودان، لم يشعر الراوي بالراحة عند وصوله قريته، وذلك بعد أن تعايش مع أجواء وعادات الشعب البريطاني، ولكنه عندما امع صوت الريح مداعبة أشجار النخيل وأصوات الحمام، وأصبح يشعر بالحنين والدفء والهدوء. بعد مضي يوم من عودته للقرية وأثناء احتسائه الشاي مع والديه، شاهد الراوي رجل لم يألف وجهه من قبل، متواط العمر كان يقف بصمت بين الجموع المستقبلة، وبعدما األ الراوي والده عن هوية هذا الشخص، رد والده بأنه شخص غريب امه مصطفى اعيد انتقل للعيش في قرية (ود حامد) قبل خمس انوات، وقد تزوج ابنة محمود واشترى مزرعة، ولكنه بقي منعزل ، ول يعرفون الكثير عنه. لقد جاءت الرواية في وقت كانت فيه العلقة بين الشرق والغرب علقة اتعمارية الطابع، مبنية على الشك وعدم الثقة، تقوم على محاولة الاتكشاف والبحث عن مساحات للتلقي الفكري والجتماعي من أجل التفاق على اتجاه إنساني لهذه العلقة، بعيدا عن النزاعات التاريخية، وقد نجح الروائي الطيب صالح في التمهيد لهذا التجاه، إذ لقت رواية موام الهجرة إلى الشمال قبول اتثنائيا في الشرق والغرب، إذ تأخذ القارئ في رحلة بين المستويين الجتماعي والثقافي في السودان الذي كان يعيش مظاهر التخلف إلى بريطانيا التي كانت تتمتع آنذاك بمظاهر التقدم والتحضر في كافة الصعدة، وقد أثبت الطيب صالح حقيقة أن المم مهما اختلفت طباؤعها فإنها تتشابه على الصعيد اسنساني، كما بين مدى الفرق الواضح بين التقليد العمى للغرب الذي طالما أوقع مصطفى في المهالك، وبين أخذ الفائدة الحقيقية من تلك المجتمعات المتقدمة لخدمة السودان كما فعل الراوي، وقد عبر عنه الطيب صالح بصراع الحضارات الذي ل يزال يمثل الشغل الشاغل للمفكرين إلى يومنا هذا(بكر السباتين- نقد أدبي: موام الهجرة إلى الشمال للروائى الطيب الصالح).

صراع الهوية بين الشرق والغرب

ولعل البحث عن الهوية هو الموضوع الهم الذي له حضور مهيمن في الرواية العربية. ول شك أنه خلل النضال من أجل الاتقلل، كانت لدى المثقفين العرب أيضا رغبة عارمة في تعريف أنفسهم مقارنة بالخرين (المواوي، 2003). إن تأثير اسمبريالية على الهوية الشرقية قوي بالفعل. وهكذا

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تصبح الهوية ما بعد الاتعمارية، بعد تصفية االتعمار الدول الشرقية، غير مستقرة. في موام الهجرة إلى الشمال لصالح، أدت الختلفات الثقافية إلى أزمة هوية. المستعمر يسخر من لبس مصطفى اعيد النوبان "هذه ليست عمامة، قال، هذه قبعة.... عندما تكبر، قال الرجل، وتترك المدراة وتصبح مسؤول في الحكومة،" اوف ترتدي قبعة كهذه" (ص 20). وفي هذا السياق، يرثي صالح إزاحة "العمامة" اسالمية بـ"قبعة" المستعمر

أحد المواضيع الرئيسية في مرحلة ما بعد الاتعمار هو "الرد على الكتابة"، أي شكل من أشكال المقاومة من خلل النوع الروائي (Widdowson, 2006; Thieme, 2001). يصف موام الهجرة إلى الشمال لصالح ضغط الثقافة الغربية على البلدان المستعمرة بأنه تدمير للثقافة السودانية. ويبين صالح في الرواية أن الثقافة البريطانية تتصادم مع الثقافة السودانية خاصة والثقافة الشرقية عامة. يمكن تفسير علقات مصطفى اعيد بين العراق على أنها خطاب متعارض بين الثقافتين العربية والبريطانية. ويدعو مصطفى في علقاته إلى تطبيق الخطاب الاتعماري للحفاظ على التصنيفات الاتعمارية. وبذلك صنف عشاقه كجزء من الغرب القااي. يمكن وصف رفض مصطفى لعشاقه الوروبيين بأنه إنكار مجازي للغرب. عند الهبوط في بلده، أصبح الحب الاتثنائي للراوي الذي لم يذكر امه لبلده واضحا. على الرغم من أن الراوي الذي لم يذكر امه "تعلم الكثير والكثير" (صالح، ص. ل) عن الثقافة والتقاليد الغربية، إل أنه لن يناقشها بعد ذلك، لنه يحتاج إلى اغتنام الفرصة للتعبير عن حبه لشعبه. إنه يشعر بسعادة غامرة لنه يعيش مرة أخرى في وطنه "بعد غياب طويل دام ابع انوات خلل فترة دراته في أوروبا" (ص 1). عندما كان الراوي الذي لم يذكر امه في أوروبا، "كان يشتاق إليهم]القروبين[، وكان يحلم بهم، وكانت لحظة غير عادية عندما وجده أخيرا واقفا بذاته بينهم" (ص 14) . وحياته هناك مختلفة – مكان يوجد فيه المستعمر، "أرض يموت امكها من البرد" (ص 14). إنه يقدر "دفء حياة القبيلة" (ص 14) و"لم يشعر وكأنه ريشة تجتاحها العاصفة ولكن مثل تلك النخلة، كائن له خلفية، له جذور، وله هدف" (ص 14). يوضح الوصف أعله أن الراوي ل يزال مدركا للجانب اسيجابي للحياة القبلية والقرية؛ حياة مفيدة وثابتة مليئة بالدفء والسهولة والبساطة. ووجد الراوي أنه على الرغم من كل شيء، ل يزال والده يقرأ القرآن ويدعو. علوة على ذلك، ل تزال والدته تخدم الارة وتقدم لهم الشاي في الصباح. وفي اليوم الثاني من عودته إلى قريته، لحظ أن "نعم، الحياة جيدة والعالم لم يتغير كما كان دائما" (ص 15).

مصطفى اعيد، الذي تشبه تجربته تجربة الراوي، عاش فترة طويلة في بريطانيا لغراض الدراة واختبر الثقافة الوروبية. يبدأ الراوي في ملحظة ذلك يحمل هذا الشخص غير المألوف معه معايير البتكار والتطرف الغربي التي تتعارض تماما مع قيم القروبين. وعندما يحاول الراوي أن يكشف أن الوروبيين، إلى حد كبير، مثل الشرقيين، كان مصطفى اعيد هادئا عاجزا عن الكلم. وهنا ينقل الراوي راالة إلى الناس في الشرق، وخاصة الشباب، مفادها أن الوروبيين مثلنا تماما. لديهم الخير والشر في مجتمعهم مثلنا - "هناك مثل هنا، ل أفضل ول أاوأ" (49). يلتزم مصطفى اعيد الصمت لنه يعرف حقيقة ما يقوله الراوي. يتمتع مصطفى بمعرفة أفضل عن الحياة الغربية من الراوي ولكن لديه وجهة نظر مختلفة عن الوروبيين. لقد رفض أن يقول كل ما يتعلق بالوروبيين، مع أنه كان يتمنى لو فعل ذلك لنه كان يخشى أن يساء فهمه خاصة من رفيقه محجوب (ص 16). محجوب ذكي لكنه ل يفهم لماذا المستعمرون مجرد أفراد عاديين مثلهم، رغم أنهم فرضوا عليه ثقافة ل تناالب مجتمعه ودينه. لقد اعتدوا على بلده وشوهوا الصورة العربية لشرعنة

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مشروعهم الاتعماري. ويفكر بعض العرب بعمق في التأثير السلبي للعراف التي تعتبر من يكرهها "كافرا"، كما رددت بنت مجذوب الراوي قائلة ""خفنا أن ترجعي معك كافرا غير مختون لزوجة"" (ص16). وتوضح اهى قداية مشكلة هؤلء المثقفين الذين تعلموا ذات يوم في أوروبا، مثل الراوي مصطفى اعيد، وحتى الطيب صالح نفسه. لقد عادوا إلى ديارهم مزودين بأفضل الوصايا والتعليم. إنهم يحملون معهم أهمية التعليم للثروات الوروبيين, ليجعلوا أنفسهم أعزل أمام عامة الناس. علوة على ذلك، "إنهم يعيشون تحت وطأة العراف والااطير، وبدل من القتال، اتسلموا تحت وطأة العادات وأصبحوا كامنين وخاملين بشكل واضح" (قداية، 2003، ص 210).

جد الراوي هو رمز الحياة المتواضعة والبسيطة قبل احتلل السودان، حياة خالية من أي تعقيدات أو صعوبات أو مشاكل. كل تعقيدات الحياة وتحدياتها جلبها المستعمر. يمكنه أن يقول إن جده "شيء ثابت في عالم ديناميكي" (ص 50). عندما يروي مصطفى حياته في بريطانيا، شعر الراوي بالختلفات بين الثقافتين (الثقافتين الغربية والشرقية). كان الراوي مكتئبا وخائفا للغاية، مما يعني أن قصص مصطفى تهدد أمله في حياة مستقرة خالية من الاتعمار. وما أن "وصل الراوي إلى باب جده" واتمع إلى "صوته وهو يصلي" (ص 50)، حتى شعر بالبتهاج. ولكن عندما يعود إلى مجتمعه؛ ول يحاول تغيير العادات السيئة السائدة في قريته، فكل مجتمع له أخلق حميدة وايئة.

اتخدم الطيب صالح أاللوب التنبؤ ليعطي القراء لمحة عما ايحدث. ورغم أن الراوي امع بقصة "امرأة من قبيلة المريسصاب قتلت زوجها وكانت الحكومة بصدد القبض عليها" (ص 98-99)، إل أنه لم يحاول التوقف إدارتها. تتقدم القصة ببطء لتحقق لحظة أجزائها الضرورية: اسعداد، والتوصيف، والذروة، والقرار. ويلعب الهجين دورا بارزا في بنية الشخصيات الرئيسية في موام الهجرة إلى الشمال، حتى أن مصطفى اعيد أطلق عليه اام جديد هو "اسنجليزي الاود" (صالح، ص 54). يتصرف مصطفى مثل المستعمرين "بينما كان لديه نوع من الشعور بالتفوق تجاههم ... و]هو[، فوق كل شيء آخر،]هو[مستعمر (ص 87). الختلف بين الغربي والشرقي تتميز الثقافات , وجود التهجين (بابها، 2012). ويوصف مصطفى اعيد بأنه "غسق مظلم كالفجر الكاذب" (صالح، ص36). مشهد آخر تمت إعادة النظر فيه في الرواية هو عندما يعود الراوي إلى وطنه ويتحدث إلى قراءه كجزء من الجمهور "أيها السادة، بعد غياب طويل،]عدت[إلى شعبي" (ص 14). يدل هذا المشهد على أن الراوي لديه شعور بالخوف من تلوث وعدوى التهجين الثقافي. وذلك لن الثقافة الغربية تؤثر على هويته، كما أوضح جيزي (1997) أنه "يحاول]الراوي[طمأنة نفسه بأن السنوات التي عاشها في إنجلترا لم تهز إحساه الفريد والمتأصل بالهوية" (ص ، 130). ومع ذلك، فإن موقف مصطفى اعيد تجاه والدته يمكن أن يعكس روحه الاتعمارية، وهويته في غير محلها، وإعجابه بالغرب. وكما تصوره الرواية، يصف مصطفى والدته بأنها امرأة غامضة ذات أقنعة كثيرة والسيدة روبنسون بأنها امرأة عظيمة ذات رائحة أوروبية عظيمة. يصف هذا الوضع رفض "الذات" (الدونية) والشوق إلى "الخر" (المتفوق)، فضل عن الضياع في العالم الهجين. يحاول مصطفى اعيد إقناع المجتمع اسنجليزي بأنه واحد منهم. لكنه يظل شخصا في مكانة أدنى بينهم، فزوجته جان موريس دائما ما تفضحه بسبب هويته وتقول له "]أنت[قبيح" (ص 36)، وأحيانا يقولون له "]ما رأينا[وجها أقبح من]وجهك[" (ص36).

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الاتمة

اتخدمت هذه الدرااة نظرية ما بعد الاتعمار لتسليط الضوء على قضية صراع الهوية الشرقية والغربية في موام هجرة إلى الشمال لطيب صالح. وقد أظهر التحليل بشكل رئيسي البحث عن الهوية الذي يبدو وكأنه علقة مستمرة وغير متوازنة بين الشرق والغرب. ويصور الغرب الشرق في رواياتهم كأشخاص بحاجة إلى التحضر والتحرر. ومن ناحية أخرى، يحاول بعض مثقفي الشرقي، مثل الطيب صالح، مقاومة الهيمنة الغربية والرد عليها من خلل ألوب "الرد" ويصف طيب صالح مسألة الهوية بأنها غير مستقرة وغير متوازنة ومتأرجحة بين الثقافتين. وفي ظل هذه الظروف، ل يمكن للشرق والغرب أن يلتقيا أبدا. إن تأثير المستعمر يخلق حالة من الصراع على الهوية في المجتمع المستعمر، والذي بدوره يخلق بيئة معقدة لها تداعيات عديدة في تحديد هويتهم الحقيقية. تقدم هذه الدرااة في تقديم الدلة التجريبية والتحليل المنطقي لكيفية تأثير الوروبيين على الهوية الثقافية غير الغربية، وخاصة في موام الهجرة إلى الشمال، من منظور ما بعد الاتعمار. يمكن لهذا التحليل أن يعزز معرفتنا بكيفية اتخدام كتاب ما بعد الاتعمار لتقنيات الصور والرمزية كوايلة "للرد" ومقاومة على السيطرة الوروبية. وقد وصف الطيب الصالح اساتعمار بالجرثومة : " اساتعمار جرثومة فتاكة, اذ جعلنا من أنفسنا مسرحا لها, ونظرنا اليها على أنها قدر, تحكم فى ماضينا, وما زال مستمرا فى الحاضر, والمستقبل". هناك مؤلفات عديدة عن موام الهجرة إلى الشمال لطيب صالح. إل أن هذه الدرااة تقتصر على الصراع الهوية بين الشرق والغرب بعد اساتعمار خلل الرواية موام الهجرة إلى الشمال . قد تعقد المزيد من البحاث مقارنة بين روايات ما بعد الاتعمار، بما في ذلك موام الهجرة إلى الشمال، حول فكرة صراع الهوية بين الشرق.

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