IMPORTANT DATES

Abstract Submission	22-09-2025
Acceptance Intimation	24-09-2025
Full Paper Submission	26-09-2025
Conference Date	30-09-2025

Registration Category	Conference Fee (Rs)	ISBN Book and Certificate Fee (Rs)	Total (Rs)
Students	100	500	600
Research Scholars	150	500	650
Academicians	150	500	650
Corporate participants	200	800	1000
In Absentia	100	900	1000

•**On-the-spot registration** will be available for participants.

Mode of Payment

All participants are required to pay the registration fee through **online mode** to the following account:

REGISTRATION LINK:

https://nmcc.ac.in/Register.aspx

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Dr. G.D. Biji
Principal i/c

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Asst. Professor & HOD, PG Department of Commerce
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NESAMONY MEMORIAL CHRISTIAN COLLEGE

Marthandam - 629165, Kanniyakumari District, TamilNadu, India.

(A Christian Minority Institution Managed by C.S.I. Kanniyakumari Diocese)
(Affiliated to Manonmaniam Sundaranar University, Tirunelveli)

63rd Position in India Rankings- 2025 for Colleges by NIRF
www.nmcc.ac.in

NATIONAL CONFERENCE
ON
"AI IN MODERN COMMERCE: CHALLENGES AND OPPORTUNITIES" (NCAIMCO'25)

Date : 30-09-2025, *Venue: Seminar Hall –II*

Organized by
POST GRADUATE DEPARTMENT OF COMMERCE

RESOURCE PERSONS

Dr. B. MUTHU PANDIAN
Assistant Professor, Department of Commerce,
School of Professional Studies, Sikkim University
(A Central University), Gangtok, Sikkim,
(North Eastern Region of India)

Dr. C. SELDEV CHRISTOPHER
Professor, CSE Department,
St. Xavier's Catholic College of Engineering,
Chunkankadai, Nagercoil, Tamil Nadu
(Southern Region of India)

About the College

Nesamony Memorial Christian College, Marthandam, Tamil Nadu, established in 1964, is a renowned institution of higher education affiliated to Manonmaniam Sundaranar University, Tirunelveli. The college is founded with a strong missionary zeal, dedicated to the cause of providing quality higher education to the economically and socially marginalized communities along the western gates of Kanyakumari. The college offers a diverse range of academic programs, including 18 Under Graduate, 15 Post Graduate, 12 Certificate and 12 Ph.D courses, reflecting its commitment to comprehensive education. Ranked 63rd in the NIRF national rankings, the institution continues to uphold academic excellence and social responsibility. Nesamony Memorial Christian College stands as a beacon of holistic education, nurturing creativity, teamwork, service, dedication, devotion and discipline among its students. The remarkable growth of the institution over the decades is a testament to divine guidance and unwavering commitment to its mission.

About the Department

The primary objective of the PG Department of Commerce is to provide higher education to socially and economically backward communities. Since its establishment in 1993, the M.Com. program has steadily developed. The B.Com. program was introduced in 2010, followed by research programs encouraging students pursue to M.Phil. and Ph.D. degrees. The B.Com. curriculum has also been regularly upgraded to meet academic needs.

The department has highly qualified and experienced faculty members who are dedicated to mentoring students in a strong academic and research-oriented environment. It consistently works to bring pride to the college by conducting numerous academic activities that enhance students' knowledge and career prospects.

About the conference

Artificial Intelligence

AI is transforming modern commerce through automation, data-driven decisions and personalized consumer engagement. It enhances efficiency, competitiveness and innovation, but also raises concerns about ethics, transparency and workforce impact.

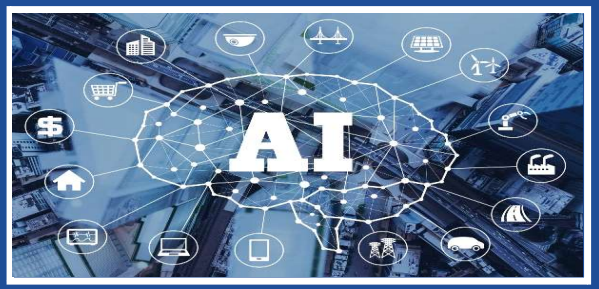
Opportunity

A key opportunity is **personalization**, as consumers seek tailored experiences. AI powers recommendation engines, chatbots and virtual assistants boosting satisfaction and loyalty. It also enables innovation in digital market places, fintech and manufacturing through predictive maintenance, quality control and automation.

Challenges

However, challenges remain **Data privacy, security and algorithmic bias** can erode trust and fairness, requiring ethical AI practices and accountability. **High costs** hinder small businesses while automation displaces jobs, creating a need for re-skilling and education. Many AI models also lack explain ability, complicating regulation and trust. Additionally, unequal adoption across nations risks widening global gaps.

Thus, AI offers vast opportunities in commerce, but sustainable growth depends on addressing these challenges responsibly.



Sub Themes

- ✓ AI-Driven Personalization
- ✓ Automation in Customer Service
- ✓ Supply Chain and Logistics Optimization
- ✓ Fraud Detection and Risk Management
- ✓ AI in Marketing and Consumer Insights
- ✓ AI in Financial Services and FinTech
- ✓ Sustainable and Green Commerce
- ✓ Integration with Emerging Technologies
- ✓ Data Privacy and Security Concerns
- ✓ High Cost of Implementation
- ✓ Workforce Displacement and Skill Gaps
- ✓ Explain ability and Accountability of AI Systems
- ✓ Regulatory and Ethical Challenges

The sub themes are not limited; any other topic relevant to the overall theme of conference can be submitted.

Guidelines for Paper Submission

- Authors are invited to submit original and unpublished research papers not exceeding 2000 words or 5 pages.
- Each paper must include an abstract (not exceeding 200 words) and five key words.
- The abstract and full article must contain the name(s) of the author(s) (maximum of two authors), complete postal address, email ID, and mobile number.
- Submissions must be prepared in A4 size, MS Word format, with 1-inch margins on all sides, typed in Times New Roman font. The title should be in font size 14 (bold), and the main text in font size 12, with 1.5 line spacing.
- Citations and references should strictly follow the APA style of referencing.
- Authors will be notified of acceptance after review and are encouraged to present their papers at the conference.
- All selected papers will be published in the conference proceedings with ISBN number, subject to a separate payment.
- Certificates will be provided to all registered participants.
- Full Papers should be submitted to the following email ID: nmccpgcommerce@gmail.com

NESAMONY MEMORIAL CHRISTIAN COLLEGE

Marthandam - 629165, Kanniyakumari District, TamilNadu, India.

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PROCEEDINGS OF NATIONAL CONFERENCE ON

"AI IN MODERN COMMERCE: CHALLENGES AND OPPORTUNITIES"

(NCAIMCO '25)

30-09-2025,
Venue: Seminar Hall –II

Organized by

POST GRADUATE
DEPARTMENT OF COMMERCE

9 789393 320780

PROCEEDINGS OF NATIONAL CONFERENCE ON AI IN MODERN COMMERCE : CHALLENGES AND OPPORTUNITIES

(NCAIMCO-2025)

Date : **30-09-2025**
Venue : **Seminar Hall - II**

Organized by :

POST GRADUATE DEPARTMENT OF COMMERCE

NESAMONY MEMORIAL CHRISTIAN COLLEGE
Marthandam-629165, Kanniyakumari District,Tamil Nadu,India
(A Christian Minority Institution Managed by C.S.I. Kanniyakumari Diocese)
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DECLARATION

Prepared by

Post Graduate Department of Commerce
Nesamony Memorial Christian College
Marthandam – 629165

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No. of Pages : 260

ISBN : **978-93-93320-78-0**

CHIEF PATRON

Correspondent - Secretary's Message

It is with great joy and pride that I convey my warm greetings to all the delegates, scholars, resource persons, and students participating in the National Conference on "AI in Modern Commerce: Opportunities and Challenges," organized by the Post Graduate Department of Commerce, Nesamony Memorial Christian College, Marthandam.

Artificial Intelligence stands at the forefront of a technological revolution that is transforming the way we conduct business and engage with society. Its applications - from automating routine processes to enabling advanced data analytics - offer unprecedented opportunities for efficiency, innovation, and growth. At the same time, the rapid integration of AI into commerce brings forth significant challenges, including ethical considerations, job displacement concerns, and the need for continual upskilling. A balanced understanding of these dimensions is essential for shaping a responsible and inclusive future.

This conference provides an excellent platform for academic experts, and aspiring professionals to share insights, deliberate on emerging trends, and propose sustainable solutions. I am delighted that our Post Graduate Department of Commerce has taken the initiative step.

I extend my heartfelt appreciation to the Head & convener, organizing secretary and organizing committee members, distinguished speakers, and enthusiastic participants for their dedication and commitment to making this event a success. May the discussions and collaborations that emerge here inspire innovative ideas and guide us toward the ethical and effective adoption of AI in modern commerce.

Wishing the conference a fruitful and memorable outcome

Prof. Dr. A.J.S. Pravin, MD, DD (Derm).,
Correspondent - Secretary
Nesamony Memorial Christian College, Marthandam.

ISBN : 978-93-93320-78-0

PATRON

Principal's Message

It is my privilege to extend warm greetings to all participants, resource persons, and delegates of the National Conference on "AI in Modern Commerce: Opportunities and Challenges," organized by the Post Graduate Department of Commerce, Nesamony Memorial Christian College, Marthandam.

Artificial Intelligence today stands as a defining force in commerce, reshaping markets, operations, and customer engagement. While offering immense opportunities through automation, analytics, and innovation, it also poses challenges in ethics, data privacy, and skill development. Thoughtful dialogue and collaborative research are essential to address these concerns responsibly.

I commend the Department of Commerce for providing this academic platform that brings together scholars, professionals, and students. On behalf of the college, I thank the organizers, speakers, and participants for their contributions and wish the conference every success.

***Dr.* G.D. Biji**
Principal i/c
Nesamony Memorial Christian College, Marthandam.

ISBN : 978-93-93320-78-0

THE GOVERNING BOARD MEMBERS' MESSAGE

We are pleased to extend our heartfelt greetings to all participants of the National Conference on "AI in Modern Commerce: Opportunities and Challenges" organized by the Post Graduate Department of Commerce, Nesamony Memorial Christian College. This academic gathering is a commendable initiative that reflects the institution's commitment to excellence, innovation, and research in emerging areas of knowledge.

Artificial Intelligence is revolutionizing the global economy, transforming how businesses operate, and creating new opportunities in commerce and industry. It is essential that students, educators, and researchers explore these changes and understand how AI can be applied responsibly to promote growth and sustainability.

The Board appreciates the efforts of the Convener, Organizing Secretary, Joint Secretary, Organizing Committee members, students Representatives and Students Coordinators who have worked diligently to make this conference a success. The scholarly papers presented and published in this Proceedings Book showcase the intellectual strength and creativity of our academic community.

We hope this conference inspires continued research, collaboration, and innovation among scholars and professionals. May Nesamony Memorial Christian College continue to be a center of learning that embraces technology and shapes future leaders in the field of commerce.

Governing Board Members,

Nesamony Memorial Christian College.

Dr. C. Edward Jaya Singh
(Staff Representative)

Adv. R. Ajith Kumar
(Member)

Mr. S. Sunil Kumar
(Member)

Mr. J. Jaya Singh
(Member)

Mr. T. Kingsly Thomas
(Member)

Mr. R. Selva Kumar
(Member)

ISBN : 978-93-93320-78-0

VICE PRINCIPAL'S MESSAGE

I am delighted to convey my best wishes to the organizing secretary, organizers, participants, and contributors of the National Conference on "AI in Modern Commerce: Opportunities and Challenges." This conference highlights the growing significance of Artificial Intelligence in today's commercial and academic world.

AI is no longer a futuristic concept; it is a present reality that influences every sphere of business, from marketing and finance to supply chain management and customer relations. Understanding its applications and implications is essential for students, researchers, and professionals who wish to stay relevant in this dynamic environment.

The Post Graduate Department of Commerce deserves appreciation for initiating this timely academic event, which encourages the exchange of innovative ideas and research insights. The articles included in this Proceedings Book reflect diverse perspectives and valuable contributions from scholars across institutions.

I hope this conference inspires everyone to pursue continuous learning, embrace technological changes, and apply AI tools ethically and effectively in commerce. May this event mark another milestone in our institution's commitment to academic excellence and meaningful research.

Dr. C. H. Arun,
Vice Principal,
Nesamony Memorial Christian College.

ISBN : 978-93-93320-78-0

BURSAR'S MESSAGE

It gives me great pleasure to convey my warm greetings to the Post Graduate Department of Commerce on the occasion of the National Conference on "AI in Modern Commerce: Opportunities and Challenges." This conference marks an important initiative toward exploring the evolving role of technology in the field of commerce and business studies.

Artificial Intelligence has emerged as a transformative force in the modern world, influencing every aspect of commercial activity - from marketing and finance to data management and customer relations. While AI offers immense opportunities for innovation and efficiency, it also presents significant challenges concerning ethics, employment, and data privacy. By choosing this theme, the department has created a valuable platform for meaningful academic dialogue and the exchange of ideas among scholars, researchers, and practitioners.

I deeply appreciate the vision and dedication of the Head and Convener, the Organizing Secretary, Joint Secretaries, and all faculty members of the department for their sincere efforts in organizing this event. The release of the Conference Proceedings symbolizes the department's commitment to research, innovation, and collaboration. I am confident that this conference will inspire participants to explore new dimensions in commerce education and responsible use of AI in business.

I extend my best wishes for the grand success of the conference and for fruitful deliberations ahead.

Dr. Y. Jacob Vetharaj,
Bursar ,
Nesamony Memorial Christian College.

ISBN : 978-93-93320-78-0

Head & Convener's Message

It is a privilege to welcome all participants, resource persons and delegates to the National Conference on "AI in Modern Commerce: Opportunities and Challenges," organized by the Post Graduate Department of Commerce, Nesamony Memorial Christian College, Marthandam.

Artificial Intelligence is reshaping business practices worldwide by driving automation, predictive analysis, and innovative customer solutions. While AI offers immense opportunities for growth and efficiency, it also presents challenges such as ethical considerations, data security and the need for continual skill enhancement. Addressing these issues through dialogue and research is vital for sustainable progress.

This conference serves as a valuable platform for sharing ideas and inspiring new perspectives on integrating AI responsibly into modern commerce. I extend my sincere thanks to our Correspondent-Secretary, Principal, Organizing secretary and Organizing Committee Members, Student representatives and coordinators and participants for their support and enthusiasm.

Wishing every success to this academic endeavor.

C. Christial Pappa

Dr. C. Christial Pappa,
Head & Convener.

ISBN : 978-93-93320-78-0

Organizing Secretary's Message

I am delighted to welcome all distinguished speakers, scholars, and participants to the National Conference on "AI in Modern Commerce: Opportunities and Challenges," organized by the Post Graduate Department of Commerce, Nesamony Memorial Christian College, Marthandam.

Artificial Intelligence is transforming commerce with innovations in automation, analytics, and customer engagement, while also raising ethical and technical challenges. This conference provides a meaningful platform to exchange ideas and explore practical solutions.

I sincerely thank our Correspondent-Secretary, Pprincipal, Head & Convener Joint Secretary, Organizing Committee Members, Student representatives and coordinators and other college faculty members, research scholars, participants students delegates for their support in making this event a reality and wish the conference every success.

Dr. V. Viji Kumar,
Organizing Secretary.

ISBN : 978-93-93320-78-0

Joint Secretary's Message

It gives me great pleasure to extend my warm greetings to all participants, resource persons, and delegates of the National Conference on "AI in Modern Commerce: Opportunities and Challenges," organized by the Post Graduate Department of Commerce, Nesamony Memorial Christian College, Marthandam.

Artificial Intelligence is transforming global commerce by enhancing efficiency, enabling predictive analytics, and creating innovative business solutions. At the same time, it presents challenges such as data privacy, ethical considerations, and the need for continuous skill development. Addressing these opportunities and concerns through meaningful dialogue is essential for sustainable growth.

This conference provides an excellent platform for academicians, researchers, and students to share their insights and explore practical approaches to responsible AI adoption. I sincerely appreciate the efforts of the organizing team, faculty members, and enthusiastic participants for making this event possible.

Wishing the conference every success and fruitful deliberations.

Dr. A. Joel Keenes,
Joint Secretary.

ISBN : 978-93-93320-78-0

Organizing Committee Members' Message

We are delighted to extend a warm welcome to all dignitaries, academicians, research scholars, speakers, and participants to the National Conference on "AI in Modern Commerce: Opportunities and Challenges," organized by the Post Graduate Department of Commerce, Nesamony Memorial Christian College, Marthandam.

Artificial Intelligence is reshaping the landscape of commerce by driving innovation, enhancing efficiency and opening up new opportunities. At the same time, it poses significant ethical and technical challenges. This conference serves as a valuable platform to share research insights, exchange ideas, and explore practical strategies for the responsible adoption of AI in modern business practices.

We express our sincere gratitude to our Management, Principal, Faculty, Student Representatives and Coordinators for their unwavering support. We also extend our heartfelt thanks to all delegates for their participation and we wish the conference grand success.

ORGANIZING COMMITTEE MEMBERS

Dr. R. Rema Mary

Mr. C. John Samuel

Dr. S. Prabin

Dr. V. Sunitha

Dr. P. Merlin

Adv. J. Dishore Jaya Ananth

ISBN : 978-93-93320-78-0

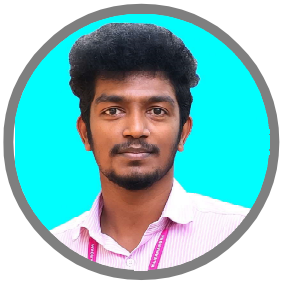
Messages from

Department PG & UG Students' Secretaries and Coordinator

The Department is proud to present the proceedings of the National Conference on "AI in Modern Commerce: Opportunities and Challenges." The event highlighted transformative applications of Artificial Intelligence in banking, retail, logistics, and data-driven decision-making. Distinguished speakers shared insights on AI-driven analytics, ethical concerns, and future employment trends. PG and UG students actively participated through paper presentations, showcasing innovative ideas and critical thinking. The conference fostered collaboration between academia and industry, inspiring students to explore AI technologies for sustainable commercial growth and entrepreneurial opportunities in the evolving digital economy.

We sincerely thank the Management, Principal, Convener, Organizing Secretary, faculty, staff, student representatives, and student coordinators for their invaluable support and guidance. Their dedication and active participation made the National Conference on "AI in Modern Commerce: Opportunities and Challenges" a successful and enriching experience for all attendees.

Department PG & UG Students' Secretaries and Coordinator



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(PG Secretary)

S.K. Shelin Sharo, III B.Com.
(UG Secretary)

Assiem .A, III B.Com.
(Student Coordinator)

ISBN : 978-93-93320-78-0

Student Coordinators' Message

We are delighted to extend our warm greetings to all delegates, resource persons, and participants of the National Conference on "AI in Modern Commerce: Opportunities and Challenges," Organized by the Post Graduate Department of Commerce, Nesamony Memorial Christian College, Marthandam.

It is a privilege to assist in organizing this event, which provides a valuable platform for sharing knowledge, exchanging ideas, and exploring the transformative role of Artificial Intelligence in modern commerce. We are grateful to our faculty, Organizing committee, and all participants for their support and cooperation in making this conference a meaningful and successful academic experience.

We sincerely thank the Management,Principal, Convener ,Organizing secretary, Joint secretary, Organizing committee for their guidance and support, and our generous sponsors for their contributions, which made this National Conference on "AI in Modern Commerce: Opportunities and Challenges" a successful and enriching experience. Your encouragement and assistance are truly appreciated.

Student Coordinators'

Rincy R L, Basim Muzammil M & John Jerin D (II M.com)
Ajay K, Sarthy R & Reegan R K (I M.com)
Assiem A, Divya B, Abish S, Aaron J & Ajish T S (III. B.com)
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Preface

About the College

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Challenges

However, challenges remain **Data privacy, security and algorithmic bias** can erode trust and fairness, requiring ethical AI practices and accountability. **High costs** hinder small businesses while automation displaces jobs, creating a need for re-skilling and education. Many AI models also lack explain ability, complicating regulation and trust. Additionally, unequal adoption across nations risks widening global gaps.

Thus, AI offers vast opportunities in commerce, but sustainable growth depends on addressing these challenges responsibly.

Sub Themes

- ✓ AI-Driven Personalization
- ✓ Automation in Customer Service
- ✓ Supply Chain and Logistics Optimization
- ✓ Fraud Detection and Risk Management
- ✓ AI in Marketing and Consumer Insights
- ✓ AI in Financial Services and FinTech
- ✓ Sustainable and Green Commerce
- ✓ Integration with Emerging Technologies
- ✓ Data Privacy and Security Concerns
- ✓ High Cost of Implementation
- ✓ Workforce Displacement and Skill Gaps
- ✓ Explain ability and Accountability of AI Systems
- ✓ Regulatory and Ethical Challenges

The sub themes are not limited; any other topic relevant to the overall theme of conference can be submitted.

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Chief Patron

Prof. Dr. A.J.S. Pravin, MD., DD (Derm), *Correspondent - Secretary*

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Convener

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Joint Secretary

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Aasim A S, Akashya N S, Sanjay S & Arjun S (I B.Com)

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PROGRAMME SCHEDULE

Date : **30-09-2025**

Inauguration : **10.00 am –10.30 am** *Venue :* **Seminar Hall –II**

Session I : 10.45 -11.45 am

Invited Talk : **Dr. B. MUTHU PANDIAN**
Assistant Professor, Department of Commerce,
School of Professional Studies, Sikkim University,
(A Central University), Gangtok.

Session II : 11.45 -12.45 pm

Invited Talk : **Dr.C.SELDEV CHRISTOPHER**
Professor, CSE Department,
St.Xavier's Catholic College of Engineering,
Chunkankadai, Nagercoil, TamilNadu.

Lunch Break (12.45 pm to 1.30pm)

Session III : 1.40 pm – 2.40 pm

PAPER PRESENTATION

VENUE : **SEMINAR HALL – II**

Valedictory : 2.40 pm – 3.40 pm.

ISBN : 978-93-93320-78-0

Resource Persons

Dr. B. MUTHU PANDIAN

Assistant Professor, Department of Commerce,
School of Professional Studies,
Sikkim University, (A Central University), Gangtok, Sikkim.

Dr. C.SELDEV CHRISTOPHER

Professor, CSE Department,
St. Xavier's Catholic College of Engineering,
Chunkankadai, Nagercoil. Tamil Nadu,India.

Invited Talk

Sl.No.	*Resource Persons*	*Title*
1	Dr. B. MUTHU PANDIAN	Intelligent Sustainability: AI-Powered Business Solutions for a Better Future
2.	Dr. C. SELDEV CHRISTOPHER	AI and Business Ethics: Redefining Accountability in the Digital Era

ISBN : 978-93-93320-78-0

Editorial Board

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CONTENTS

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ISBN : 978-93-93320-78-0

IMPACT OF DIGITAL FOOD DELIVERY PLATFORMS ON RESTAURANTS

Mr. A. CHARLES [1] **Dr. V. PRABAKARAN[2]**

1. Mr. A. Charles, *Research Scholar, Register No: PC2333014013001, SRM Institute of Science and Technology, Vadapalani Campus, Chennai-26, India.*

2. Dr. V. Prabakaran, *Head and Assistant Professor, Research Supervisor, Department of Commerce (Hons), International Accounting and Finance, College of Science and Humanities, SRM Institute of Science and Technology, Vadapalani Campus, Chennai 26, India.*

ABSTRACT

Technological advancements have transformed the restaurant industry, significantly increasing the use of online food delivery services. These services allow customers to conveniently order meals from the comfort of their homes, compare prices, and access a diverse range of restaurant options with just a tap on their smart phones. This research paper explores the benefits of integrating online food delivery apps into restaurant businesses and examines their impact on inventory management. Additionally, the study highlights key challenges faced by restaurants, offering insights into how they can enhance customer service and maximize profitability.

Keywords:

Technological advancement, customer convenience, integration, inventory management, operational efficiency customer service enhancement, profitability.

1. INTRODUCTION

The rise of technology and smart phones is transforming our way of life. With just a few taps, people can enjoy restaurant-quality meals in the comfort of their homes while streaming their favorite shows. The traditional experience of dining out with family and friends is gradually being replaced by the convenience of ordering food online. Whether it's a working professional exhausted after a long day or someone simply craving a change from home-cooked meals, food delivery apps provide an effortless solution with just a single tap.

The restaurant industry is one of the fastest-growing sectors in the Indian economy, and its revenue is expected to rise further with the increasing demand for ready-to-eat meals. This study focuses on Chennai, Tamil Nadu - one of the state's most significant commercial hubs. Over the years, Chennai has experienced substantial migration from neighboring towns and villages, contributing to its vast and diverse population. With rapid urbanization and a growing workforce, the demand for ready-cooked food has surged, making food delivery services like Swiggy, Zomato, and Uber Eats highly popular in the city.

A key area of interest in this study is the restaurant industry's approach to inventory management, particularly for perishable food products. Unlike durable goods, perishable items have a limited shelf life and must be carefully managed to minimize waste and optimize supply chains. Fluctuations in demand and supply further complicate inventory management, making it a crucial factor in ensuring profitability and sustainability in the restaurant sector.

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Nesamony Memorial Christian College, Marthandam.

1.1 Need for the Study

1. ***Collaboration with Third-Party Logistics***
   - Restaurants aiming to excel in the competitive restaurant sector should consider partnering with third-party logistics providers for online food delivery.
2. ***Understanding Benefits and Drawbacks***
   - Every business decision has its advantages and disadvantages. This study will provide insights into both aspects of using online food delivery apps.
3. ***Significance of Online Food Delivery Apps***
   - The study will highlight the growing importance of food delivery apps and their role in modern restaurant operations.
4. ***Efficient Inventory Management***
   - With technological advancements, managing inventory effectively has become crucial for restaurant success. This study will emphasize the need for efficient inventory control.
5. ***Identifying Operational Challenges***
   - The study will explore the challenges faced by restaurants in integrating online food delivery and managing operations smoothly.
6. ***Enhancing Customer Service***
   - By understanding these challenges, restaurants can make necessary improvements to provide better service and enhance customer satisfaction.

1.2 Objectives of the Study

- To examine the role and significance of third-party logistics outsourcing in food delivery.
- To analyses the impact of online food delivery apps on restaurant inventory management.
- To identify and evaluate the key challenges faced by restaurant owners.

1.3 Research Gap

The literature review reveals that most studies on online food delivery apps focus on consumer behavior and perception. While some research examines restaurants outsourcing third-party food logistics services, there is a notable gap in studies addressing inventory management. This aspect is critical for ensuring smooth operations and efficient sales in restaurants but remains largely unexplored.

1.4 Review of Literature

Saxena (2019) highlights that online food delivery apps serve as a medium for restaurants to deliver food directly to customers' doorsteps. The rapid adoption of this service is attributed to the increasing working population and their hectic work-life balance, particularly in metropolitan areas. The absence of human intervention in online food ordering enhances accuracy and ensures a more private experience for users.

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Gupta (2019) emphasizes the transformative impact of technology on the restaurant industry, reshaping its entire framework. The convenience provided by technologically advanced online food delivery services has created a new level of comfort for consumers worldwide.

Das (2018) examines the influence of food delivery startups, specifically Swiggy and Zomato, on the restaurant business. The study explores various business strategies employed by these companies and highlights how traditional business models have evolved to incorporate online marketing in order to meet diverse consumer demands.

Hong Lan et al. (2016) investigates customer perceptions of online food ordering and delivery services, analysing consumer feedback on the services provided by different platforms. The study suggests that the online food delivery market is still in its early stages and faces several challenges that need to be addressed for further growth.

Linh et al. (2015) focus on inventory management in a two-echelon model for perishable and substitutable products with multi-period lifetimes, defined lead times, and specific customer service levels. Their research adopts a multi-metric approach to evaluate the effectiveness of perishable inventory management within set targets.

1.5 Hypoteshes of the Study

1. H01 : Ther is no significant stock-out situation in restaurant due the increase in orders through online food delivery apps.

   H11: There is a significant stock-out situation in restaurants due to the increase in orders through online food delivery apps.

2. H02 : There is no wastage situation in the restaurants due to over-ordering or overlooking of food items.

1.6 Scope of the Study

This research aims to examine the impact of online food delivery apps on restaurant operations, focusing on how restaurants manage their inventories amid increasing customer demands. The study is conducted from the restaurant's perspective, analysing the advantages and challenges of partnering with third-party food delivery services. Geographically, the research is limited to Chennai, Tamil Nadu, and India. The findings will provide valuable insights for new restaurants, helping them optimize inventory management in the online food delivery era and assess the pros and cons of such partnerships to better meet customer expectations.

1.7 Limitations of the Study

1. **Small Sample Size** – The study is based on a limited sample, which may not provide a fully accurate representation of the influence of online food apps on the restaurant business.
2. **Geographical Limitation** – The research focuses only on Chennai, Tamil Nadu. As a result, the findings may not be applicable to other regions due to variations in lifestyle, consumer behavior, and regional differences.
3. **Limited Coverage of Food Delivery Apps** – Not all food delivery apps were included in the study, which may have led to incomplete information and analysis.

Despite these limitations, the study lays a foundation for further research, allowing future studies to address these gaps and provide a more comprehensive understanding of the topic.

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2. RESEARCH METHODOLOGY AND DATA

This exploratory study employs both quantitative and qualitative methods for data collection. The research analyses responses gathered from restaurants in Chennai, Tamil Nadu, to identify the benefits and challenges encountered in the process. The data is primary in nature and collected using a structured questionnaire that includes both closed-ended and open-ended questions. A convenient sampling method is used, with a sample size of 125 respondents. The study utilizes various research tools, including percentage analysis, correlation analysis, charts, the Chi-square test, and descriptive statistics, to interpret the findings.

3. DATA ANALYSIS AND FINDINGS

We conducted a survey with a sample of 125 respondents who partner with third-party online food delivery apps to deliver food to consumers.

Table. 1

Respondents on the Usage of Apps and their Impact on Business

Questions	Attributes	Frequency	Percentage
The extent of usage of apps	Always	62	50
	Quite of lot	50	40
	Very little	10	08
	Not much	03	02
Impact on business due to the apps	Great extent	46	37
	Quite a bit	57	46
	Very little	18	14
	Not much	**04**	**03**

***Source**: Calculate from primary data through field survey.*

Table 1 indicates that the majority of respondents (50%) always use third-party apps, while 40% use them frequently, 8% use them occasionally, and 2% use them rarely. The data also reveals that app usage has significantly influenced business performance. Specifically, 37% of respondents reported a great impact, 46% experienced a considerable impact, 14% observed a minimal impact, and 3% reported a negligible effect. To assess the relationship between app usage and its impact on sales, Pearson's correlation coefficient was calculated to determine the strength and significance of their association.

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Figure.1

Numbers of Food Delivery Apps the Restaurants are listed on

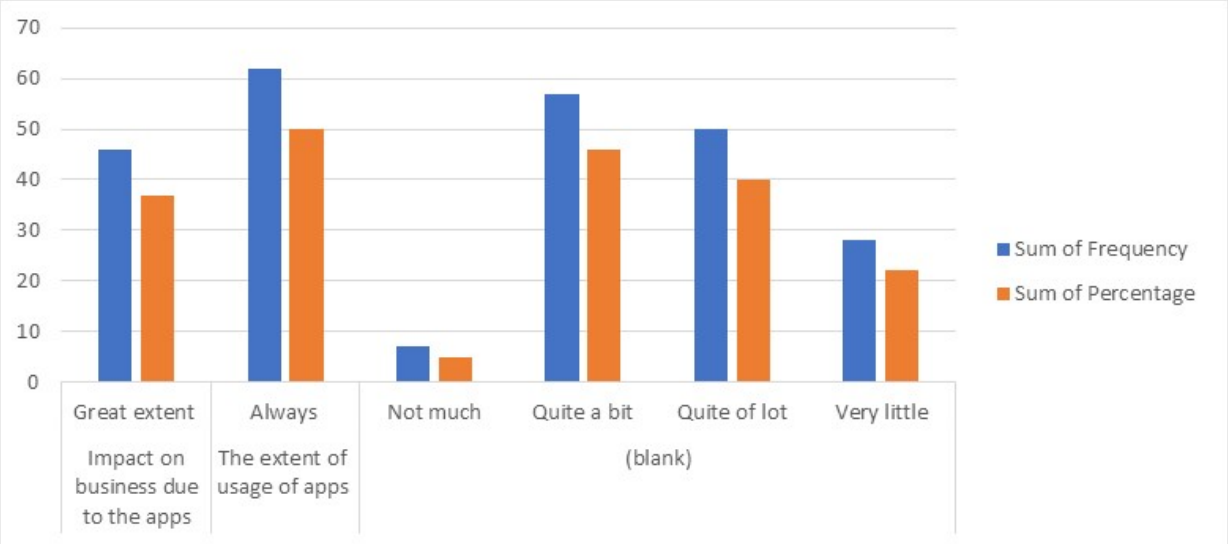

Table. 2

Recording the Inventory Levels of Raw and Packaged Food Items

Questions	Attributes	Frequency	Percentage
Reordering level of the raw food items	Daily	102	82
	2-3 days	19	15
	Weekly	04	03
	Monthly	0	0
Reordering level of the packaged food items	Daily	18	14
	2-3 days	67	54
	Weekly	35	28
	Monthly	5	4

Source: Calculate from primary data through field survey.

From the above, it can be seen that the maximum of the vendors i.e., 82% reorder their raw materials daily, 15% reorder every two or three days, and 3% reorder weekly. None of the vendors reorder the raw items monthly. For packaged food items, it can be seen that he maximum of the vendors i.e., 54% reorders every 2-3 days. 28% reorders weekly, 14% reorder daily, and 14% reordermonthly.

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Figure. 2

Recording the Inventory Levels of Raw and Packaged Food Items

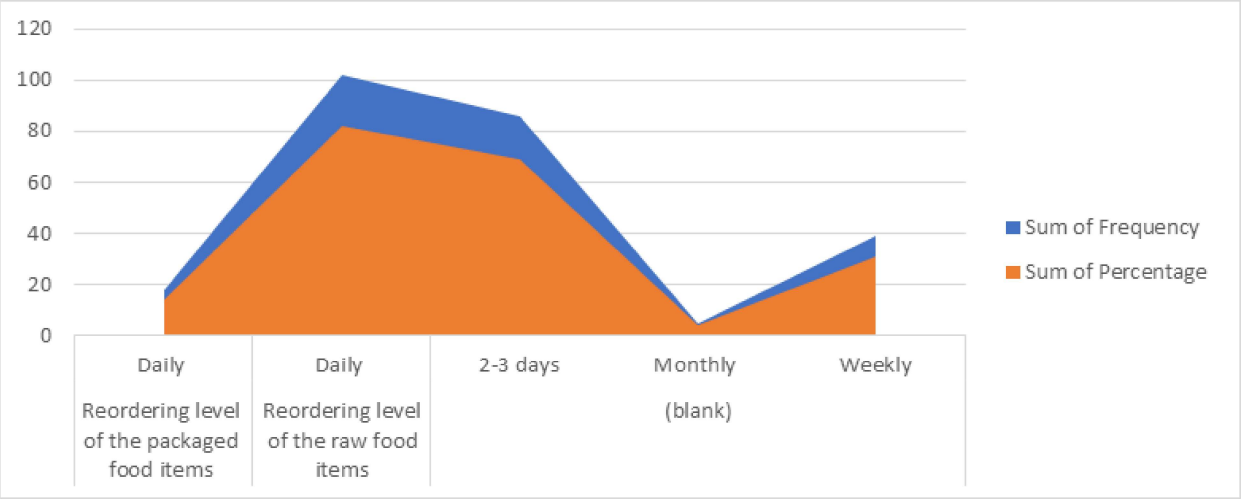

Table. 3

Storage of Items based on their Shelf Life

Questions	Attributes	Frequency	Percentage
Shelf life of raw food items	1 to 6	0	0
	6 to 12	25	20
	12 to 24	77	62
	More than 24	23	18
Shelf life of semi-finished food items	1 to 6	51	41
	6 to 12	63	50
	12 to 24	11	09
	More than 24	0	0
Shelf life of finished food items	1 to 6	42	34
	6 to 12	67	54
	12 to 24	13	10
	More than 24	03	02

Source: Calculate from primary data through field survey.

From Table 3, it is evident that most vendors maintain the shelf life of raw items between 12 to 24 hours, while semi-finished and finished food items are stored for 6 to 12 hours. Notably, none of the respondents keep semi-finished or finished food items for more than 24 hours, which is a commendable practice. This ensures that customers ordering online receive fresh and healthy meals, benefiting both restaurants and online food delivery platforms.

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The study examines whether the rise in online food delivery orders has led to a significant stock-out situation in restaurants. To test this, the null and alternative hypotheses are formulated as follows:

- **H01** : There is no significant stock-out situation in restaurants due to the increase in orders through online food delivery apps.
- **H11** : There is a significant stock-out situation in restaurants due to the increase in orders through online food delivery apps.

The calculated Chi-square value is **26.56**, which exceeds the critical value of **9.49** at a **5% level of significance** with **4 degrees of freedom**. Consequently, the null hypothesis is rejected, and the alternative hypothesis is accepted, indicating that stock-out situations do occur in restaurants due to the surge in online food delivery orders.

Additionally, the study investigates whether restaurants experience food wastage due to over-ordering of raw materials or overcooking. The hypotheses for this analysis are:

- **H02** : There is no wastage situation in restaurants due to over-ordering of raw materials or overcooking of food items.
- **H12** : There is a wastage situation in restaurants due to over-ordering of raw materials or overcooking of food items.

The calculated Chi-square value is **13.68**, which surpasses the critical value of **9.49** at a **5% level of significance** with **4 degrees of freedom**. As a result, the null hypothesis is rejected, and the alternative hypothesis is accepted. This confirms that restaurants do face food wastage problems due to excessive ordering of raw materials or overcooking.

Figure. 3

Storage of Items based on their Shelf Life

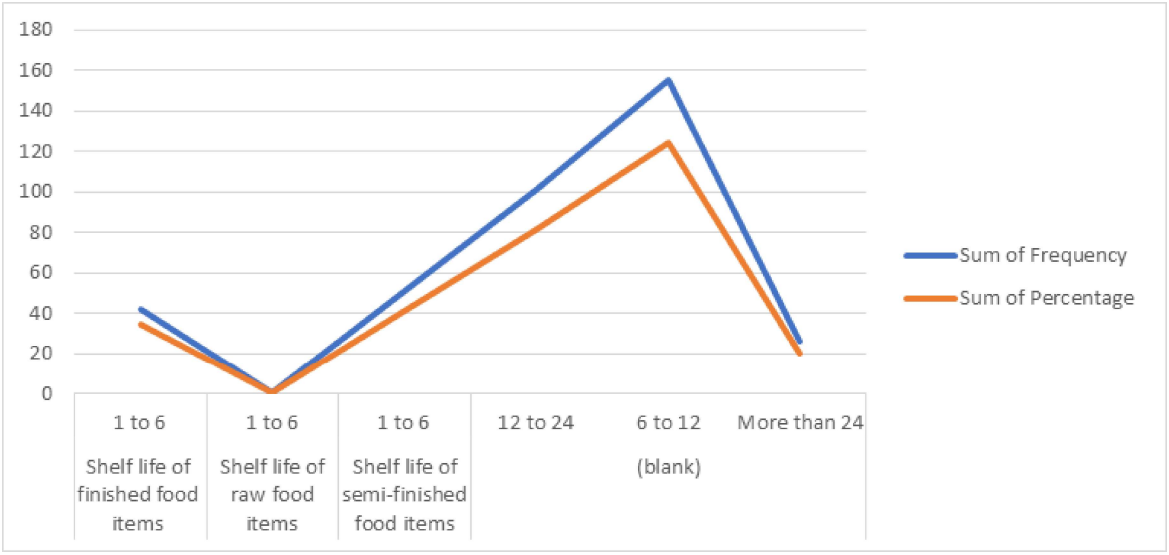

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Table. 4

Causes of Stock-Outs and Wastage

Questions	Attributes	Mean	SD
Reasons for stock-outs	Inaccurate data	3.4	0.65
	Failure to reorder timely	3.19	0.86
	Poor communication with supplier	2.5	0.77
	Not enough working capital	2.3	0.91
Reasons for wastage of food	Overstocking	3.07	0.83
	Over production of food	3.28	0.76
	Defected or low-quality items	2.62	0.96
	Spills	2.61	0.84

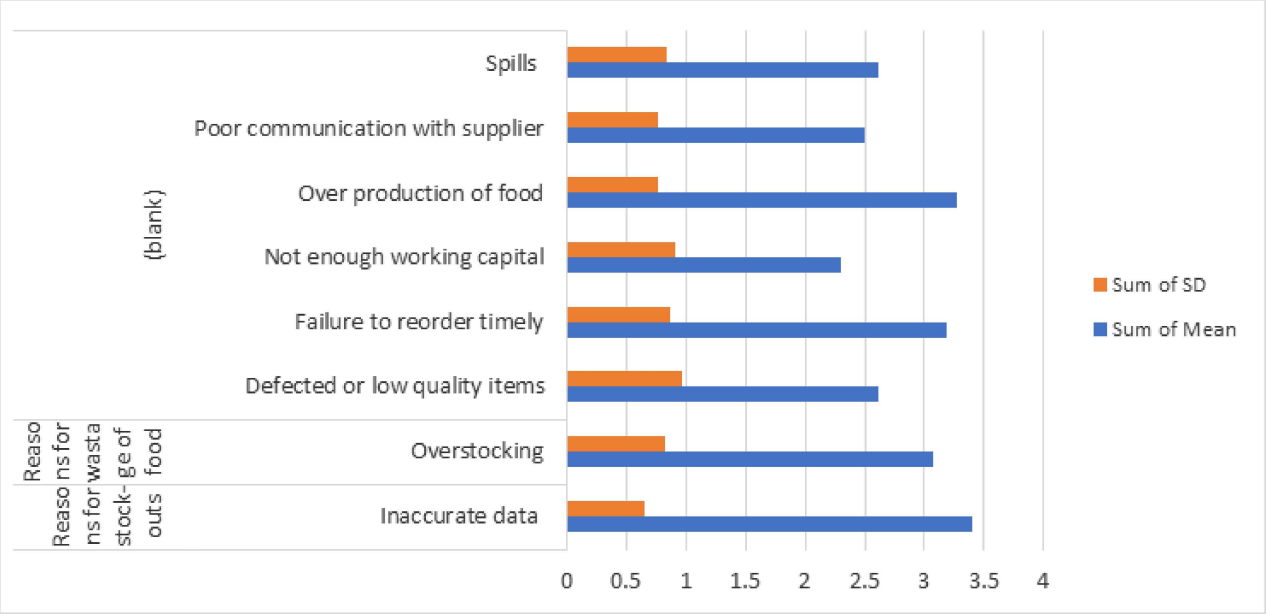
The data for this study was collected through a field survey and analyzed using descriptive statistics in MS Excel.

Table 4 indicates that the most significant challenge in inventory management is excess inventory, with a mean of 3.19 and a standard deviation of 0.78. This is followed by difficulties in tracking stock and challenges in identifying demand patterns.

Hypothesis testing reveals that restaurants experience both stock-out and wastage issues due to the influence of online delivery apps.

Figure. 4

Causes of Stock-Outs and Wastage



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RECOMMANDATIONS FOR INVENTORY MANAGEMENTIN CHENNAI

1. Many Chennai restaurants may not use an inventory management system, but implementing a proactive one is a valuable investment for any food business.
2. Regular inventory checks should be a priority, focusing on essential items, as health-conscious customers expect high hygiene standards.
3. Organize stock areas before inventory checks, discard expired items, and group similar products. Conduct inventory after closing or before opening.
4. Assess existing stock accurately before new purchases to minimize food wastage from overordering.
5. Define maximum and minimum storage levels to ensure fresh and consumable inventory.
6. Regular audits are essential to identify and remove damaged or low-quality items.

ISSUES

1. Online food delivery aggregators, once known for low commissions, have become a necessary but challenging element for restaurants.
2. Packaged deliveries often compromise food quality compared to freshly served meals.
3. A surge in online orders leads to delays that frustrate walk-in customers.
4. With many dining options available, retaining long-term customers has become increasingly difficult.
5. Discounts and extra benefits don't always ensure orders.
6. Delays frequently result in order cancellations and food wastage.
7. The rise of cloud kitchens—operating without wait staff or dining spaces—offers a more cost-effective model.

4. CONCLUSION

The restaurant industry and food delivery market have undergone significant transformations in recent years due to rapid urbanization and the continuous migration of people to cities. Ordering food online and dining at home has become a common trend, driven by the widespread use of smart phones and food delivery apps. This research paper explores how online food delivery platforms positively influence restaurant businesses. Additionally, it examines the inventory management strategies currently adopted by restaurants. To enhance efficiency in inventory management, the paper also provides recommendations that could benefit restaurateurs.

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AI - DRIVEN OPPORTUNITIES AND THREATS : EMERGING CHALLENGES FOR INVESTORS

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ABSTRACT

Artificial Intelligence (AI) is becoming a major player in the world of finance, changing the way people invest and make decisions. We see AI being used more and more in things like algorithmic trading, robots-advisors, portfolio management, and managing risks. This technology is making investing easier, more accurate, and more accessible for people all over the world. However, as great as that sounds, there are also some challenges that come with it, like data privacy issues, bias in algorithms, market instability, and ethical questions. These are things that need to be thought through and dealt with.

In this study, we're going to take a look at the good and the bad that AI brings to the investing world. We'll find out what opportunities it creates, what threats it brings, and what challenges investors face as they try to adapt to this new AI-focused financial world. We're also going to talk about how investors can balance using new technology with making responsible decisions so that they can manage their wealth sustainably.

In conclusion, AI is opening up all sorts of opportunities for improving investment strategies, but we shouldn't ignore the risks that come with it. Investors need to be careful and not rely too much on automation, and they need to be ready to adapt to new laws and regulations as they come in. At the end of the day, we need to find a way to use AI in finance that balances new ideas with being ethically responsible. That way, we can protect the stability of the market as well as the interests of investors.

Keywords:

Artificial intelligence, robo-advisors, portfolio management.

INTRODUCTION

The last few years, AI, or artificial intelligence, has gone from being a concept in movies to actually being used in our everyday lives. It's even been used in the investment world, by helping people manage their finances and make decisions. AI tools like algorithmic trading, robo-advisors, and predictive analytics have changed the game for investors. They can help them understand market trends better, see potential risks, and make smarter choices with their money. These tools work by using huge amounts of data to make decisions faster, more accurately, and more efficiently, giving investors a better chance to compete in the ever-changing market.

Of course, with new technology comes a new challenge. AI can have some issues like concerns about data privacy, biases in algorithms, and the chance of technical glitches. There's also the risk of major disruptions in the

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market. All these factors show how investing with AI comes with its challenges. Despite all this, AI has done a lot to improve how people invest and manage their money. It offers great potential for making money and lowering risks, but it's important to remember that it can also make things more complicated and uncertain. Investors, policymakers, and financial institutions need to be aware of both sides to make sure they use AI in a responsible way and avoid any big risks.

STATEMENT OF THE PROBLEM

The rapid advancement of artificial intelligence (AI) has truly changed the game for investors. With AI, investors now have access to incredible tools for making decisions based on data, optimizing their portfolios, and assessing risks. Technologies like algorithmic trading and robo-advisory platforms have opened up a whole new world of opportunities to make the markets more efficient, accurate, and profitable. But it's not all sunshine and rainbows. Integrating AI into investment practices does come with some challenges. For example, there are varying degrees of data privacy risks, algorithmic bias, and a lack of transparency in how decisions are made. Plus, there's the potential for systemic disruptions, which is a pretty big deal. These concerns have raised many questions for investors, regulators, and policymakers. Also, we don't yet have universally accepted regulatory frameworks and ethical guidelines, which make it even harder to adopt AI in the financial sector safely and sustainably.

This dual nature of AI as both an enabler of opportunities and a source of emerging threats creates a lot of uncertainty for investors. They have to balance the desire for innovation with the need for caution. For this reason, it's super important to study the role of AI in investment practices. We need to focus on finding out the opportunities it creates, the threats it brings, and the responses we need to make to ensure responsible and sustainable investor behaviour.

OBJECTIVES OF THE STUDY

1. To explore the opportunities created by Artificial Intelligence in investment decision-making, portfolio management, and wealth creation.
2. To identify and analyse the emerging risks and challenges associated with AI adoption in the financial and investment sectors.
3. To evaluate the implications of AI-driven technologies for investors, and suggest various cyber security precautions for investors

METHODOLOGY

The study is descriptive in nature. The study concentrated on how artificial intelligence acts as both an enabler of opportunities and at the same time a source of emerging threats. The study was undergone using secondary data from various published sources.

REVIEW OF LITERATURE

McKinsey & Company's State of AI Report 2024 examines the rapid growth of artificial intelligence adoption across industries, emphasizing both its opportunities and challenges. The report aims to identify where AI creates the most value, showing that organizations integrating AI into multiple business functions achieve significant improvements

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in productivity, efficiency, and innovation. It concludes that while AI promises major gains, many firms struggle to scale its use effectively, and success ultimately depends on responsible implementation, workforce training, and governance.

The Financial Stability Board's The Financial Stability Implications of Artificial Intelligence (2024) analyses how AI could affect global financial markets and institutions. Its main objective is to identify potential systemic vulnerabilities caused by widespread reliance on similar AI models, concentration of power among a few technology providers, and the risk of correlated market behaviour. The report concludes that although AI adoption can improve efficiency and resilience in financial services, it may also introduce new channels for contagion and volatility, requiring proactive monitoring, regulatory cooperation, and international standards.

CYBER SECURITY AND ITS SIGNIFICANCE FOR INVESTORS

Cyber security is all about keeping your systems safe from attacks and making sure your data is protected. With AI-driven investments becoming a thing, they're using a ton of data like your personal info, financial records, and even your transaction history. That's why cyber security is super important for these technologies to be safe and reliable for investors. But, with this tech, there are also new risks and threats that come with it in the investment world.

AI-powered cyber security tools can detect fraud, hacking attempts, and abnormal trading patterns faster than traditional systems. Investors can operate with more trust in digital platforms due to the robust cyber security protocols that safeguard sensitive information. Also, preventing large-scale breaches and cyber attacks, cyber security enhances overall market confidence, benefiting both retail and institutional investors.

By the way, weak or compromised cyber security exposes investors to identity theft, financial fraud, and misuse of personal data. Also, a successful cyber attack on a major financial platform could disrupt markets, creating widespread panic and losses. The more investors rely on AI-driven platforms, the more vulnerable they become to disruptions caused by technical failures or cyber attacks as well. Investors face uncertainty if cyber security standards are not uniformly enforced across platforms and jurisdictions.

RECENT TRENDS AND REGULATORY LANDSCAPE

- Phishing, ransomware, and API vulnerabilities remain top attack vectors in the financial sector (2024–2025).
- Regulators worldwide have introduced AI governance and cybersecurity compliance mandates.
- AI is also used defensively in anti-fraud detection and compliance monitoring.
- Financial firms face pressure to disclose cyber incidents transparently and enhance their cyber response capabilities.

EMERGING THREATS AND FUTURE CHALLENGES

- We might start seeing autonomous AI malware that can spread itself and learn to take advantage of new vulnerabilities without any human control.
- AI is being used in disinformation campaigns which can spread false financial news really quickly, and it could result in bank runs or crashes in the crypto market.

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- Supply chain attacks are increasingly using AI to identify weak spots in third-party vendors, and that creates a systemic risk.
- Financial institutions have to be ready for fast-evolving threats that are enabled by AI's ability to innovate attack vectors.

AI DRIVEN OPPORTUNITIES IN FINANCE AND INVESTMENT

In the world of finance and investment, AI is making waves as a game-changer, bringing forth a whole new level of efficiency and intelligence. Here are some ways it's doing so:

Enhanced Decision-Making through Predictive Analytics:

AI models are like super detectives for data. They sift through massive datasets, find hidden patterns, and make spot-on predictions about market movements. This gives investors a real advantage.

Algorithmic & High-Frequency Trading:

Think of AI-powered trading systems as speed demons of the trading world. They execute transactions in the blink of an eye, optimizing entry and exit points to minimize risks and maximize returns.

Personalized Wealth Management:

Robots-advisors and other AI tools are like having a financial advisor in your pocket. They create custom investment portfolios based on your individual risk appetite, goals, and the ever-changing market conditions.

Fraud Detection and Risk Management:

Keeping your money safe is a top priority, and AI is on the job. These systems detect anomalies and fraudulent activities in real time, ensuring safer transactions and lowering financial risks.

Sentiment Analysis for Market Insights:

Ever wonder what people are saying about a stock? AI tools can process news articles, social media chatter, and financial reports to gauge investor sentiment and offer valuable insights into stock trends.

Portfolio Optimization:

Machine learning models are like personal trainers for your investment portfolio. They continuously rebalance it by evaluating risk-return profiles, helping you achieve better diversification.

Access to Alternative Investments:

AI opens up a whole new world of investment opportunities. From crypto currencies to tokenized assets and decentralized finance, AI provides the necessary support for risk assessment.

Cost Efficiency:

By automating advisory and trading processes, AI reduces the need for human intervention, lowers transaction costs, and democratizes investment opportunities, making them more accessible.

Sustainability and ESG Investing:

If you're into responsible investing, AI can help you out. It analyses unstructured data to assess companies' ESG (Environmental, Social and Governance) performance, enabling more informed investment decisions.

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Global Market Accessibility:

With AI-driven platforms, investors have real-time access to international markets, making it easier to diversify across different geographies.

In short, AI is revolutionizing finance and investment, making it more efficient, personalized, and accessible for everyone.

AI DRIVEN CYBER THREATS

AI-Powered Phishing and Social Engineering

Cybercriminals use AI to craft highly personalized phishing emails, messages, and calls that mimic legitimate financial institutions or brokers, tricking investors into sharing sensitive information.

Deep fakes and Identity Theft

AI-generated deep fake videos and voices can impersonate CEOs, advisors, or fund managers, misleading investors into fraudulent transactions.

Automated Hacking Tools

AI enhances malware and intrusion techniques, enabling hackers to breach trading accounts, wallets, and investment platforms more efficiently.

Market Manipulation through Fake Data

AI can generate fake news, forge financial reports, or manipulate social media sentiment to influence stock prices and mislead investors.

Cryptocurrency & Blockchain Vulnerabilities

AI-driven attacks can exploit weaknesses in smart contracts, decentralized exchanges, or digital wallets, leading to large-scale thefts of crypto assets.

Insider Threat Detection Evasion

Hackers deploy AI systems to study fraud detection algorithms and find ways to bypass them, making investment platforms more vulnerable.

Data Privacy Breaches

AI can process and exploit leaked personal and financial data from investors, enabling targeted attacks and portfolio manipulation.

Denial of Service (DoS) Attacks on Trading Platforms

AI-powered botnets can overload trading systems, disrupt investor access, and cause missed opportunities or forced sell-offs.

AI in Pump-and-Dump Schemes

Fraudsters leverage AI to coordinate and automate pump-and-dump strategies in smaller-cap stocks or crypto markets, misleading retail investors.

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Adversarial AI Attacks

Malicious actors manipulate AI-powered robo-advisors or trading bots by feeding them biased or adversarial inputs, leading to poor investment decisions.

CYBER SECURITY PRECAUTION FOR INVESTORS

If you're looking to protect yourself and your investments online, there are some smart steps you can take. First, consider using strong passwords and maybe even a password manager to keep them all safe. Next, try enabling multi-factor authentication (MFA) on your accounts to add an extra layer of security. Also, be sure to practice secure browsing habits, like avoiding public Wi-Fi for sensitive transactions. Additionally, learn how to recognize suspicious emails and websites to avoid falling for phishing scams.Lastly, think about using AI-augmented threat detection tools to analyse user behaviour and catch any anomalies before they cause harm.These precautions can help keep your online investments safe and sound!

PROTECTING YOUR DIGITAL INVESTMENTS

- Securing online trading and investment accounts
- Monitoring account activity
- Using secure devices and updating software
- Importance of antivirus and firewalls
- Data backup strategies

STEPS TO REPORT CYBER FRAUD

Contact the National Cyber Crime Helpline or the National Cybercrime Reporting Portal. If you've lost money, report it immediately to your bank account, credit card, or digital wallet provider. Consider filing a first information report (FIR) at the nearest police station. For bank-related frauds, you can file a complaint with the Banking Ombudsman.

CONCLUSION

Artificial intelligence is changing the way investors look at the market. Investors now have great opportunities to make decisions on the market based on data from AI. AI is also helping investors with risk management and optimizing their portfolios. Although there are many advantages to AI, there are also some disadvantages like market volatility and algorithmic biases that investors need to be aware of. These disadvantages can make the market unpredictable and make investors lose money, but if you learn to use AI in a way that is right for your investments, it can help you gain a competitive edge and help you manage your money better. In conclusion, AI is very important to have in modern financial markets because of all the different ways it can help.

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A COMPARATIVE STUDY ON WORK-LIFE BALANCE AMONG WOMEN EMPLOYEES IN PUBLIC AND PRIVATE SECTOR BANKS IN THIRUVANANTHAPURAM DISTRICT, WITH SPECIAL REFERENCE TO THE ROLE OF ARTIFICIAL INTELLIGENCE

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ABSTRACT

The integration of Artificial Intelligence (AI) into banking operations has significantly transformed the work environment, influencing both efficiency and employee well-being. This study aims to conduct a comparative analysis of work-life balance among women employees in public and private sector banks in Thiruvananthapuram district, with a special focus on the role of AI in shaping work experiences. A sample of 110 respondents (55 from each sector) was selected using stratified random sampling. Both quantitative and qualitative approaches were employed to examine factors affecting work-life balance, including AI-driven workflow changes, working hours, job pressure, organizational support, and family responsibilities. Statistical tools such as independent sample t-test, Garrett ranking technique, and one-way ANOVA were used for data analysis. Findings suggest that women in public sector banks enjoy better work-life balance compared to private sector employees, partially due to structured workflows, job security, and supportive management. The study also highlights that AI adoption in private banks, while enhancing operational efficiency, can increase work pressure and digital availability, affecting employees' personal time. The research provides insights for policymakers and banking institutions to frame AI-integrated, gender-sensitive policies that foster a balanced work-life environment for women employees.

Keywords:

Work-life balance, Women employees, Public and private sector banks, Artificial Intelligence, Organizational support

INTRODUCTION

In the modern banking sector, maintaining a healthy balance between professional responsibilities and personal life is increasingly challenging, especially for women employees. The concept of Work-Life Balance (WLB) involves achieving harmony between work obligations and personal commitments to ensure overall well-being and productivity.

With the growing adoption of Artificial Intelligence (AI) in banking operations – such as automated customer service, AI-powered loan processing, data analytics, and chatbots – employees experience both opportunities and challenges. While AI can streamline tasks and reduce repetitive workload, it may also increase digital availability expectations, pressure to adapt quickly to technology, and constant performance monitoring.

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Public sector banks in Kerala generally provide structured working hours, job security, and moderate AI adoption, while private sector banks experience rapid AI integration alongside performance-based pressures and extended work hours. These contrasting environments influence work-life balance differently for women employees Thiruvananthapuram, a major administrative and commercial hub in Kerala, has a high concentration of public and private banks. This study compares the work-life balance of women employees in these banks, emphasizing the impact of AI adoption on their professional and personal life management.

REVIEW OF LITERATURE

Lakshmi & Nair (2025), in their study "Gender and Work-Life Dynamics in the Indian Banking Sector Post-Pandemic", explored how AI-driven hybrid work environments affect women employees in banking. The study found that while AI automation improved operational efficiency, it also blurred boundaries between personal and professional life. Women in private sector banks reported higher stress levels due to constant digital availability and performance monitoring. Public sector banks, with slower AI adoption and more structured workflows, enabled employees to maintain better work-life balance. The authors emphasized that supportive organizational policies are essential to mitigate the adverse effects of AI integration.

Pradeep&Sheela (2025), in "Impact of Organizational Support Systems on Work-Life Balance", highlighted that internal HR policies like flexible work hours, digital wellness initiatives, and AI-assisted tools significantly enhance work-life balance among female bankers. Their findings indicated that public sector banks, though traditionally rigid, provided better mentoring and AI support to reduce workload stress. Private banks, despite having advanced AI systems, often failed to provide adequate guidance, resulting in increased burnout and work-life conflict among women employees.

Anjali & Thomas (2024), in "Work-Life Balance and Job Commitment among Female Bankers in Kerala", compared stress and time management challenges between public and private sector banks. The research concluded that AI implementation in private banks increased workload due to digital monitoring and online customer handling beyond office hours. Public sector employees, with moderate AI adoption, experienced less stress and better balance. The study highlighted that supportive management, mentoring, and structured AI integration are critical in promoting employee well-being.

Mary & Vishnu (2024), in "Digital Banking Workload and Emotional Exhaustion among Female Bank Staff", focused on the emotional toll of AI-driven operations. Private sector women reported exhaustion from managing CRM software, chatbots, and mobile banking platforms outside working hours. Conversely, public sector employees faced lower pressure due to predictable schedules and gradual AI adoption. The study recommended digital boundary policies and AI training to help women manage work-life balance effectively.

Rajalakshmi& Joseph (2023), in "Organizational Climate and Work-Life Balance in Public and Private Sector Banks", emphasized the role of organizational culture in shaping work-life balance. Women in public banks benefited from structured workflows, mentoring, and peer support for AI adoption, whereas private bank employees experienced high accountability with minimal guidance. The research suggested that cross-sector learning and employee-friendly AI policies could enhance work-life balance.

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Sreeja &Arun (2023) investigated "Marital Status, Parenthood, and Work-Life Conflict among Bank Employees in Kerala". They reported that married women with children in private banks struggled with AI-enabled workloads and extended hours. Public banks offered better maternity benefits, childcare leave, and moderate AI integration, reducing work-life stress. The study stressed the importance of family-supportive AI policies to improve employee satisfaction and productivity.

STATEMENT OF THE PROBLEM

Women employees in the banking sector are increasingly exposed to dual pressures of professional responsibilities and family obligations. The adoption of Artificial Intelligence (AI) in banking has transformed operational processes, providing efficiency, automation, and accuracy. However, this technological advancement also presents unique challenges: increased digital workload, continuous online availability, performance monitoring through AI systems, and the need to constantly adapt to new technologies.

Public and private sector banks differ significantly in AI adoption, work culture, and flexibility. Public banks have structured workflows, moderate AI usage, and supportive policies, allowing women employees to maintain better work-life balance. Private banks, however, are characterized by aggressive AI integration, extended working hours, and performance-oriented monitoring, which often blurs personal-professional boundaries and increases stress levels.

In Thiruvananthapuram district, the growing presence of women in both sectors, coupled with rapid AI integration in private banks, makes it critical to understand how technology affects their work-life balance. Current literature emphasizes WLB issues broadly but lacks in-depth, district-level studies focusing on AI's impact. There is a pressing need to empirically analyze how AI-driven work environments, combined with traditional organizational structures, influence women employees' ability to manage personal and professional responsibilities. Understanding these dynamics can help policymakers and bank management develop AI-integrated, gender-sensitive policies to foster employee well-being, reduce burnout, and improve retention.

NEED OF THE STUDY

In today's rapidly evolving banking sector, the integration of Artificial Intelligence is fundamentally reshaping work culture, creating both opportunities and challenges for women employees. While AI has streamlined routine operations, enhanced efficiency, and reduced manual workload, it has simultaneously introduced new stressors, such as constant digital availability, continuous monitoring, and the pressure to adapt to rapidly changing technologies. Public and private sector banks differ markedly in the pace and manner of AI adoption, with public banks often implementing AI gradually alongside supportive policies, while private banks emphasize performance-driven AI integration with high workload expectations. Despite the widespread impact of AI on work environments, there is limited empirical research examining its influence on the work-life balance of women employees at the district level, particularly in socio-culturally distinct regions like Thiruvananthapuram. Understanding this interplay is crucial, as it can inform banks and policymakers in designing gender-sensitive AI integration strategies that not only optimize operational efficiency but also promote employee well-being, reduce burnout, and create a sustainable, balanced work environment for women in both public and private banking institutions.

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OBJECTIVES OF THE STUDY

- To examine the level of work-life balance among women employees in public and private sector banks in Thiruvananthapuram district.
- To analyze the role of AI in influencing work-life balance among women employees.
- To compare the factors affecting work-life balance, including AI workload, working hours, organizational support, and family responsibilities.
- To study the impact of demographic variables (age, marital status, dependents, and years of service) on work-life balance in the context of AI integration.

RESEARCH METHODOLOGY

Research Design : Descriptive and analytical design was used to study work-life balance and AI's impact.

Area of Study : Thiruvananthapuram district, Kerala.

Sampling Technique and Sample Size : Stratified random sampling was employed. The sample included 110 women employees (55 public sector, 55 private sector).

Sources of Data :

- **Primary:** Structured questionnaire with sections on AI usage, working hours, job pressure, organizational support, and family responsibilities.
- **Secondary:** Journals, articles, bank records, and official websites.

Tools for Analysis : Independent sample t-test, Garrett Ranking Technique, One-Way ANOVA.

Limitations :

- Study limited to Thiruvananthapuram district.
- Sample size of 110 may affect generalizability.
- Focused only on women employees, excluding male employees.

ANALYSIS AND INTERPRETATION

Table 1: **Demographic Profile of Respondents**

Variable	Category	Frequency (n=110)	Percentage (%)
Age	Below 25 years	18	16.4%
	25–35 years	36	32.7%
	36–45 years	34	30.9%
	Above 45 years	22	20.0%
Marital Status	Married	78	70.9%
	Unmarried	32	29.1%

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Sector	Public	55	50.0%
	Private	55	50.0%
Educational Level	Graduate	42	38.2%
	Postgraduate	58	52.7%
	Professional Degree	10	9.1%
Years of Service	<5	28	25.5%
	5–10	40	36.4%
	>10	42	38.1%
Number of Dependents	None	15	13.6%
	1–2	65	59.1%
	3+	30	27.3%

Primary Data

The demographic profile indicates that the majority of respondents (63.6%) are aged between 25 and 45 years, representing the prime stage of their professional careers and family responsibilities. This age group is likely to face significant challenges in balancing work and personal life. A large proportion (70.9%) of the respondents are married, indicating that most women are managing dual responsibilities of career and household, which can influence work-life balance (WLB). Equal representation from public and private sector banks (50% each) provides a balanced basis for comparative analysis. Educationally, over half of the respondents are postgraduates (52.7%), suggesting a highly qualified workforce capable of handling complex job demands. Regarding experience, 38.1% have more than 10 years of service, implying that a considerable portion of respondents are senior employees, possibly enjoying higher autonomy and job familiarity that can affect WLB positively. Most respondents (59.1%) have 1–2 dependents, indicating moderate caregiving responsibilities, while a smaller segment (27.3%) manages three or more dependents, highlighting potential additional stress affecting work-life balance.

Table 2: **Work-Life Balance Scores**

Sector	Mean Score	SD	N
Public Banks	3.92	0.60	55
Private Banks	3.35	0.72	55

Primary Data

t-test Value: 4.21, **p-value:** 0.000 (Significant at 0.05 level)

The comparison of mean WLB scores shows that women employees in public sector banks (Mean = 3.92, SD = 0.60) enjoy a significantly better work-life balance compared to those in private banks (Mean = 3.35, SD = 0.72). The t-test value of 4.21 with a p-value of 0.000 confirms that this difference is statistically significant at the 5% level. This indicates that structural and organizational factors, including fixed working hours, supportive policies, and moderate AI adoption, help public sector women manage their professional and personal responsibilities more effectively. Conversely, in private banks, AI integration has increased digital workloads, constant connectivity

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requirements, and performance monitoring, which exacerbate stress and reduce the ability to maintain a balanced life. The findings suggest that technological advancements like AI, while beneficial for operational efficiency, can have unintended consequences on employee well-being if not implemented with adequate support measures.

Table 3: **Factors Influencing WLB**

Public Sector	Garrett Score	Rank	Private Sector	Garrett Score	Rank
AI Integration & Support	3350	1	AI Workload & Digital Availability	3450	1
Working Hours	3000	2	Working Hours	3400	2
Job Pressure	2750	3	Job Pressure	3300	3
Organizational Support	2650	4	Organizational Support	2900	4
Family Responsibilities	2500	5	Family Responsibilities	2700	5

Computed Data

The Garrett ranking highlights distinct perceptions between public and private sector women employees regarding factors affecting WLB. In public banks, AI integration coupled with institutional support ranks highest (3350), reflecting that adequate guidance, training, and structured AI adoption enhance employee efficiency without compromising personal time. Working hours and job pressure follow in importance, while family responsibilities rank lowest, indicating that organizational factors outweigh personal responsibilities in influencing WLB.

In private banks, AI-related workload and digital availability rank highest (3450), signifying that women are most stressed by constant connectivity, task automation expectations, and digital performance monitoring. Working hours and job pressure are also significant stressors, while organizational support ranks low, indicating insufficient assistance in coping with AI-driven demands. Family responsibilities, although present, have less perceived impact compared to workplace and AI-related pressures. Overall, the data underscore the importance of supportive AI adoption practices in mitigating stress and enhancing WLB.

Table 4: **Impact of Demographics on WLB (ANOVA)**

Variable	F-value	p-value	Significance
Age	4.05	0.009	Significant
Marital Status	2.38	0.092	Not Significant
Number of Dependents	5.42	0.005	Significant
Years of Service	3.76	0.013	Significant

Computed Data

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The ANOVA results reveal that age ($F = 4.05$, $p = 0.009$), number of dependents ($F = 5.42$, $p = 0.005$), and years of service ($F = 3.76$, $p = 0.013$) significantly influence WLB. This suggests that younger employees or those with fewer dependents may find it easier to balance work and life, while employees with greater caregiving responsibilities face additional challenges. Experienced employees may have developed coping strategies or enjoy greater autonomy, which positively affects their WLB. Marital status ($p = 0.092$) does not show a statistically significant effect, indicating that whether an employee is married or unmarried alone does not determine work-life balance. These findings highlight the need for banks to consider employee demographics when designing policies, particularly for AI integration and workload management, to ensure equitable support and effective work-life management for all women employees.

FINDINGS

- Women in public sector banks enjoy better WLB than private sector employees.
- AI adoption positively supports WLB in public banks but increases stress in private banks due to constant digital monitoring.
- Working hours and job pressure are critical factors in private banks, whereas organizational and AI support is crucial in public banks.
- Demographics such as age, dependents, and years of service significantly influence WLB.

SUGGESTIONS

- Introduce flexible AI-integrated workflows, especially in private banks.
- Strengthen AI training programs and mentoring to reduce stress.
- Implement AI-assisted tools to reduce repetitive tasks and improve efficiency.
- Provide mental health and digital wellness programs.
- Consider WLB in performance appraisals alongside productivity.
- Promote family-friendly policies and flexible leave management.
- Encourage a culture of "digital boundaries" to protect personal time.

CONCLUSION

This study reveals that AI is reshaping the professional landscape for women employees in the banking sector. Public sector banks, with gradual AI adoption, structured work hours, and supportive management, allow women employees to achieve a higher level of work-life balance. In contrast, private sector banks, with rapid AI integration, performance-based monitoring, and extended digital workloads, place women under greater stress, affecting their personal time and overall well-being.

The research underscores that organizational support, including AI training, mentoring, and family-friendly policies, is crucial for mitigating the negative impact of AI on work-life balance. Demographic factors such as age, number of dependents, and years of service significantly influence employees' capacity to manage work and personal life, suggesting that tailored interventions are necessary.

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To ensure sustainable employee well-being, banks must implement AI in a way that reduces repetitive workload without increasing digital stress. Policies should emphasize flexible working hours, digital boundaries, mental health support, and family-friendly practices. By aligning technological advancement with gender-sensitive work policies, banks can enhance employee satisfaction, productivity, and retention while fostering a balanced work environment. This study provides actionable insights for both public and private sector banks in Thiruvananthapuram, highlighting the importance of integrating technology with human-centric organizational practices.

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DATA PRIVACY AND SECURITY CONCERNS IN AI: CURRENT CHALLENGES AND SOLUTIONS

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ABSTRACT

Data privacy and security have become critical issues in the context of rapid technological advancement, particularly with the proliferation of artificial intelligence (AI) and digital platforms. This paper reviews recent literature on data privacy and security concerns and explores contemporary breaches, regulatory responses, and consumer perceptions. Employing a mixed-methods approach, it presents a synthesis of recent statistics, documented incidents, and stakeholder attitudes. Results highlight key challenges posed by emerging technologies and emphasize the need for robust protective measures and transparent governance [5] [9]. Additionally, the paper examines the ethical implications of data collection and algorithmic decision-making, the role of corporate accountability, and the effectiveness of international data protection frameworks such as the GDPR and CCPA. It also discusses the impact of public awareness and digital literacy on privacy practices, along with the evolving strategies used by malicious actors to exploit system vulnerabilities. The findings underscore the urgency for cross-sector collaboration, continuous policy adaptation, and the development of AI systems with privacy-by-design principles to safeguard user data in the digital age.

Keywords:

Artificial Intelligence (AI), Data Breaches, Regulatory Responses, GDPR (General Data Protection Regulation), CCPA (California Consumer Privacy Act).

I. INTRODUCTION

Widespread digital transformation has exponentially increased both data generation and exposure to privacy and security threats. Consumers, businesses, and governments face unprecedented risks relating to unauthorized data use, tracking, and cyber attacks. In particular, evolving AI systems raise new challenges in safeguarding personal information. This paper explores current issues, public attitudes, and state-of-the-art solutions in data privacy and security.

The ongoing wave of digital transformation has revolutionized how data is generated, processed, and utilized across all sectors of society. With the proliferation of smart devices, cloud computing, social media platforms, and artificial intelligence (AI), an unprecedented volume of personal and organizational data is being collected and stored daily. While these advancements have brought immense benefits in terms of efficiency, personalization, and connectivity, they have also significantly increased exposure to data privacy and security threats.

Consumers, businesses, and governments now face mounting concerns over unauthorized access, misuse of personal data, algorithmic surveillance, and large-scale cyber attacks. The rise of data-driven business models has incentivized widespread data collection practices – often without full user awareness or consent. From targeted

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advertising to facial recognition technologies, personal information is frequently harvested, analyzed, and monetized, sometimes at the cost of individual rights and privacy.

Artificial intelligence, in particular, presents unique challenges. AI systems depend heavily on large datasets to train models, improve performance, and automate decision-making. However, this dependence introduces significant vulnerabilities, including the risk of data breaches, model inversion attacks, and bias amplification. Moreover, the opacity of many AI algorithms makes it difficult to audit how personal data is being used or to identify potential violations of privacy norms.

Amid these developments, public concern about data protection is growing. Surveys indicate that users are increasingly skeptical about how companies and governments handle their data, demanding greater transparency, control, and accountability. In response, regulatory frameworks such as the European Union's General Data Protection Regulation (GDPR) and California's Consumer Privacy Act (CCPA) have emerged to establish legal protections and define the responsibilities of data controllers and processors.

This paper aims to examine the current landscape of data privacy and security by reviewing recent literature, high-profile breaches, and regulatory responses. It also explores the attitudes of various stakeholders – consumers, technologists, policymakers – and evaluates cutting-edge technological and policy-driven solutions. By synthesizing quantitative data, qualitative insights, and case studies, the paper provides a comprehensive understanding of the multifaceted challenges and potential paths forward in securing data in the digital age.

II. LITERATURE REVIEW

The literature on data privacy and security reflects growing concerns across academic, corporate, and public spheres. Rapid technological advances– particularly in AI, cloud computing and the Internet of Things (IoT) – has exacerbated the challenges of safeguarding personal data. Recent studies underscore heightened public anxiety, systemic vulnerabilities, and the pressing need for updated regulatory and ethical frameworks.

1. Public Perception and Trust

Multiple surveys indicate a sharp decline in public trust regarding how organizations handle personal data. A 2023 global consumer privacy survey found that 73% of respondents are more concerned about their data privacy now than in previous years, while 64% believe their personal data is less secure than before. Many users report confusion about what data is being collected and how it is being used – especially on AI-driven platforms and wearable technologies. This lack of transparency has led to widespread calls for greater accountability and user control.

2. High-Profile Breaches and Systemic Vulnerabilities

Numerous studies highlight recent large-scale breaches that illustrate systemic weaknesses in data protection infrastructure. Incidents involving the exposure of billions of passwords, financial information, and sensitive communications have affected both public institutions and private companies.These breaches have reinforced concerns about the security of widely adopted platforms, including cloud-based services and connected devices.

3. Emerging Technologies and Privacy Risks

The adoption of AI, IoT devices, and biometric surveillance systems raises novel privacy concerns. AI models often rely on vast datasets for training, which can inadvertently include sensitive or identifiable information. Wearable

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devices and smart home assistants continuously collect personal data, sometimes without explicit user consent. Scholars argue that the boundaries of informed consent are being tested in these environments, and current regulatory models may not adequately address the nuances of algorithmic data processing.

4. Regulatory and Ethical Responses

In response to these challenges, researchers and legal experts have called for stronger data protection laws, improved enforcement mechanisms, and comprehensive ethical guidelines. The General Data Protection Regulation (GDPR) and California Consumer Privacy Act (CCPA) are frequently cited as foundational steps, but critics argue that enforcement is inconsistent and that global harmonization is lacking.Proposals include embedding privacy-by-design principles in AI systems, mandating algorithmic transparency, and creating independent oversight bodies to evaluate compliance and fairness.

III. METHODOLOGY

This study employs a mixed-methods approach, combining the strengths of both quantitative and qualitative research to provide a comprehensive understanding of data privacy and security challenges. The quantitative component involves analyzing recent breach statistics from 2024-2025, focusing on breach rates, affected data types, and their impact on individuals and organizations. This numerical data offers measurable and objective insights into the patterns and severity of breaches. Complementing this, the qualitative assessment explores consumer perceptions, attitudes towards data privacy, and an in-depth review of regulatory literature regarding governance, transparency, and consent mechanisms. This allows capturing the nuanced perspectives and evolving concerns of stakeholders that numbers alone cannot reveal.

Triangulation is a key methodological technique in this study, ensuring validity and reliability by integrating multiple data sources, methods, and perspectives. By cross-verifying quantitative breach data with qualitative insights from consumer surveys and regulatory reviews, the research mitigates biases inherent in single-method studies and achieves a richer, more robust interpretation. This structured integration offers a layered understanding that connects measurable trends to the underlying reasons, emotions, and policy contexts shaping data privacy dynamics today. Through this deliberate blend, the study aims to inform meaningful protective measures and policy adaptations addressing the complex landscape of data privacy in the digital age. Recent breach statistics highlight the persistent and escalating threats to data privacy and security, with global average breach costs reaching up to $10.22 million in the U.S. and 95% of breaches involving human error as of 2025. The healthcare sector has been particularly affected, reporting breaches that exposed records of more than 276 million individuals, including incidents involving ransom ware and unauthorized access to sensitive health information

1. Additional Key Points

- Supply chain and third-party breaches have increased considerably, comprising over a third of major incidents, underscoring vulnerabilities in interconnected business ecosystems.
- Detection speed has improved, driven by AI and zero-trust security models, with the average breach lifecycle dropping to 241 days in 2025.

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- The largest breach in recent history involved the exposure of 16 billion passwords, impacting users of services like Google, Facebook, Apple, and Telegram, and highlighting the risks posed by sophisticated malware.
- User attitudes remain cautious, with growing mistrust toward how organizations handle consent, transparency, and governance; surveys indicate public demand for stricter data protection policies and accountability.

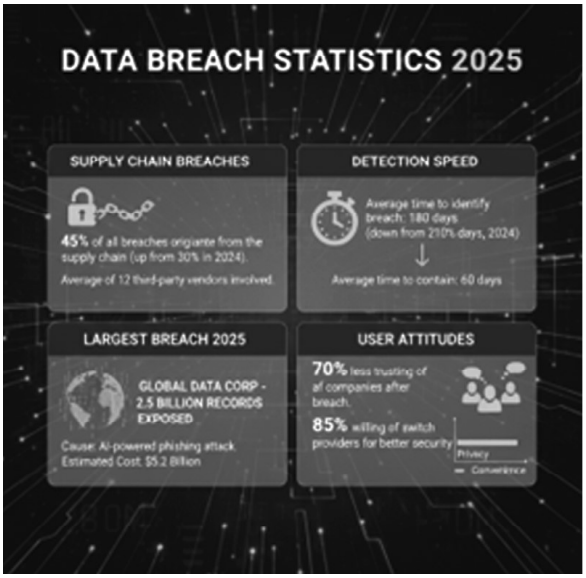

Fig1: Key Data Breach Trends and Challenges in 2025

Fig 1 shows the highlights major data breach trends in 2025, including rising supply chain attacks, faster detection through AI, a massive password exposure, and increasing public demand for stronger data privacy governance.

2. Governance And Consent Challenges

Despite technological advances, organizations face complex challenges in ensuring transparent data usage and obtaining meaningful consumer consent. Failure to address regulatory requirements or communicate privacy risks contributes to stakeholder anxiety and resistance, especially in critical and high-value sectors. Evidence from public surveys and breach investigations reveals persistent gaps in policy enforcement, secure infrastructure, and effective risk communication.

Fig 2: Data breach dynamics in 2024-2025

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Showing exponential increase in affected records and evolving attack vectors. Continuing, the mixed-methods approach allows for integration of these varied perspectives, offering both hard data and rich qualitative insights into the motivations, worries, and governance shortcomings shaping modern data privacy. By triangulating breach statistics, public sentiment, and policy literature, the study advances a fuller understanding of not only the technical scope of security failures but also the nuanced human and organizational elements driving responses, adaptation, and resistance in the face of rapidly evolving cyber threats.

IV RESULTS

- Over 16 billion passwords were exposed in the largest recorded data breach in 2025, affecting major platforms like Facebook, Google, Apple, and Telegram.
- 81% of surveyed consumers believe information collected by AI companies is used in ways that make them uncomfortable.
- 73% of consumers report increased concern over data privacy, and 64% say their data is less secure than before.
- Ransomware, phishing, and misconfigurations remain primary causes of unauthorized access and data loss.
- Regulatory coverage is improving, with 75% of the global population now forecasted to be protected by modern privacy laws by the end of 2024.

1. Expanded 2025 Data Privacy and Security Results

- 80% cite criminal activity (fraud, theft, data breaches) as their top concern with online data collection, while just 2% are primarily concerned with personalized advertising.
- Ransomware, phishing, and misconfigurations remain top drivers of unauthorized access and data loss, with phishing being involved in 80% of security incidents and organizations facing phishing attempts weekly or even daily. Human error contributes to roughly 60% of breaches.
- 78% think organizations must use AI only in ethical ways.

2. Key Statistics Bar Diagram

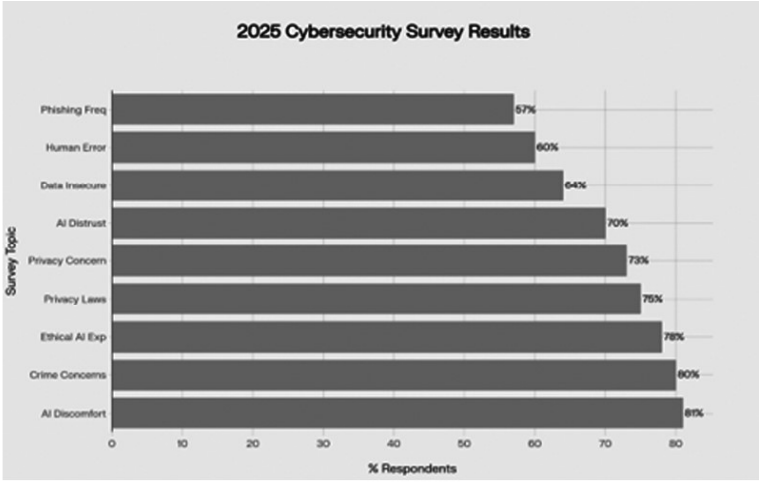

Fig 3: Key 2025 Data Privacy & Security Statistics

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V. DISCUSSION

Findings confirm that cyber security breaches are becoming more widespread and severe, reflecting inadequate technical controls and insufficient governance. AI is a major contributor to privacy anxiety due to opaque data handling practices and the risk of unauthorized data use [8][9]. Public distrust, manifest in surveys and market research, pressures organizations and governments to adopt more transparent, user-focused safeguards. Ethical frameworks, advanced access controls, and AI-specific regulation are essential for building trust and ensuring protection in the digital era.

VI. CONCLUSION

The research underscores that both technical innovation and policy intervention are necessary to address data privacy and security concerns. As breaches increase and technologies like AI expand, organizations must prioritize ethical data management and user-rights protection. Continued research, collaborative governance, and comprehensive consumer education are vital for creating a safer digital environment.

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AI IN MARKETING AND CONSUMER INSIGHTS IN JUTE PRODUCTS

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ABSTRACT

The integration of Artificial Intelligence (AI) in marketing has opened new opportunities for enhancing consumer insights, particularly in sustainable sectors such as jute products. As eco-friendly alternatives gain momentum, understanding consumer behavior becomes critical to promote jute-based goods effectively. AI-driven tools, including predictive analytics, sentiment analysis, and recommendation systems, enable businesses to collect, interpret, and utilize large volumes of consumer data. These technologies help in identifying purchasing trends, preferences for sustainable products, and market gaps, thereby allowing companies to design targeted campaigns and personalized experiences. AI-powered chatbots and virtual assistants further improve customer engagement by providing real-time support and product education, increasing brand loyalty for eco-conscious buyers. Moreover, image recognition and machine learning applications can assist in market segmentation, pricing strategies, and demand forecasting. For producers and marketers of jute products, AI facilitates better supply chain management, optimizing distribution networks and reducing costs. By merging sustainability with technological innovation, businesses can not only boost the competitiveness of jute products but also contribute to global environmental goals. Hence, AI serves as a transformative tool that bridges the gap between consumer expectations and sustainable market growth, ensuring that jute products reach the right audiences effectively and efficiently. The main highlight of this topic is AI enables predictive analytics, sentiment analysis, and personalized marketing strategies that strengthen consumer engagement with sustainable jute products. Integration of AI in jute marketing enhances supply chain efficiency, demand forecasting, and eco-conscious consumer targeting, boosting global competitiveness.

Keywords:

Artificial Intelligence (AI), Jute Products, Consumer Insights, Sustainable Marketing, Predictive Analytics.

INTRODUCTION

The global demand for sustainable and eco-friendly products has significantly increased in recent years, and jute has emerged as one of the most promising natural fibers in this movement. Jute products, such as bags, home décor, and packaging materials, are not only biodegradable but also affordable, making them highly attractive to environmentally conscious consumers. However, in today's competitive market, traditional marketing strategies are no longer sufficient to capture consumer attention and build strong brand value. This is where Artificial Intelligence (AI) plays a transformative role. AI-powered tools and techniques enable businesses to analyse consumerbehaviour, identify market trends, and personalize marketing campaigns with greater precision. By leveraging data analytics, machine learning, and predictive modelling, companies engaged in jute production and marketing can gain deep

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consumer insights, optimize pricing, improve product design, and enhance customer engagement. Thus, the integration of AI in the marketing of jute products not only supports the promotion of sustainable alternatives but also strengthens the competitiveness of the jute industry in the digital economy.

OBJECTIVES OF THE STUDY

1. To examine how artificial intelligence can enhance marketing strategies for jute products.
2. To analyse consumer behaviour and insights using AI tools in the jute industry.
3. To evaluate the role of AI in promoting sustainable and eco-friendly jute products in domestic and global markets.
4. To explore the effectiveness of AI-driven digital and social media marketing for increasing jute product demand.
5. To identify challenges and opportunities in adopting AI technologies in jute marketing.

REVIEW OF LITERATURE

Gera & Kumar (2023) conducted a systematic review of empirical research (2000–2021) in marketing journals, focusing on AI in consumer behaviour. Key themes included predictive analytics, recommendation systems, customer segmentation, personalization, and impacts on business performance.

Mariani (2022) in *AI in Marketing, Consumer Research and Psychology* draws connections between consumer psychology, marketing, and AI; emphasizing how sentiment analysis, natural language processing (NLP), and behavioral theory support the application of AI in targeting, positioning, and personalization.

NEED OF THE STUDY

This study is essential as the jute industry, despite being eco-friendly and sustainable, struggles to compete with synthetic alternatives and evolving consumer expectations. Integrating AI into marketing can enhance consumer insights, personalize strategies, and boost global competitiveness for jute products.

SCOPE OF THE STUDY

This study explores the use of Artificial Intelligence (AI) in marketing and consumer insights within India's jute industry. It focuses on AI tools like predictive analytics, customer segmentation, and social media analysis to improve promotion, demand forecasting, and brand visibility. The scope includes manufacturers, marketers, and consumers, emphasizing recent AI adoption in both domestic and export markets during the digital era.

STATEMENT OF THE PROBLEM

Despite being eco-friendly and versatile, the jute industry faces low global visibility, declining consumer interest, and strong competition from synthetic alternatives. Traditional marketing fails to address evolving consumer preferences and global trends.

Meanwhile, AI offers powerful tools for brand positioning, demand forecasting, and digital promotion. However, its use in the jute sector remains limited. Without adopting AI-driven strategies, the industry risks missing growth opportunities in domestic and international markets.

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RESEARCH METHODOLOGY

This study mainly uses secondary data to understand how AI is applied in jute marketing. Data sources include government and industry reports, academic research, online databases like Statista and JSTOR, and digital media. These sources provide insights into consumer trends, AI tools, and the jute sector's market performance.

SOCIAL MEDIA MARKETING IN JUTE PRODUCTS

Social media marketing has become one of the most effective tools for promoting eco-friendly products, including jute-based items. With the growing awareness of sustainability, platforms like Instagram , Facebook offer excellent opportunities to showcase the unique appeal of jute products such as bags, mats, handicrafts, and packaging. Through visually engaging content, businesses can highlight the natural, biodegradable, and stylish qualities of jute, attracting environmentally conscious consumers worldwide. AI-powered tools further strengthen social media strategies by analysing audience preferences, identifying trending hashtags, and optimizing post timings for maximum reach. Influencer collaborations and storytelling campaigns can connect jute products with lifestyle, fashion, and green living communities, creating a strong emotional appeal. Additionally, features such as targeted ads and analytics help small and medium jute enterprises to reach niche markets cost-effectively. By leveraging social media platforms, the jute industry not only gains visibility but also educates consumers about sustainable alternatives to plastic and synthetic materials. This approach transforms jute from a traditional fiber into a modern, eco-chic lifestyle product, bridging the gap between heritage and contemporary demand

JUTE PRODUCTS IN THE ERA OF AI

Jute, known as the "Golden Fibre", is widely used in making eco-friendly products such as bags, mats, carpets, ropes, handicrafts, packaging materials, and home décor items. Despite its versatility and sustainability, the jute industry often struggles with limited brand visibility, fluctuating demand, and stiff competition from synthetic alternatives. With the advancement of Artificial Intelligence (AI), the marketing and promotion of jute products can be transformed in the following ways:

1. **Consumer Insights:**
   AI tools like predictive analytics and machine learning can analyze consumer buying behaviour , preferences, and market trends to identify target customers for jute products.

2. **Personalized Marketing:**
   E-commerce platforms can use AI-driven recommendation engines to suggest jute bags, home décor, or handicrafts to customers based on past purchases.

3. **Social Media Marketing:**
   AI-powered tools can track social media conversations, hashtags, and sentiment analysis to measure how consumers perceive jute products and design better campaigns.

4. **Supply Chain Optimization:**
   AI can forecast demand, manage inventory, and optimize logistics for jute manufacturers and exporters, reducing wastage and costs.

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5. Product Innovation:

By studying consumer trends, AI can guide manufacturers to design modern, fashionable, and eco-friendly jute products appealing to younger generations.

CONSUMER PREFERENCES FOR JUTE PRODUCTS

1. Eco-friendliness

Consumers prefer jute products because they are biodegradable and recyclable. As a natural fiber, jute offers a sustainable alternative to plastic, helping reduce environmental pollution and supporting eco-conscious lifestyles.

2. Affordability

Jute bags, mats, and packaging materials are affordable compared to many synthetic options. Their cost-effectiveness makes jute products accessible to a wide range of consumers without compromising quality or sustainability.

3. Durability & Strength

Jute is known for its high strength and durability, making it perfect for bags, ropes, and packaging. These long-lasting properties ensure jute products can withstand heavy use over time.

4. Aesthetic Appeal

Modern consumers appreciate stylish and trendy jute products. Customized fashion bags and decorative items made from jute appeal to those seeking eco-friendly yet fashionable lifestyle choices.

5. Health & Safety

Being a natural fiber, jute is non-toxic and safe for everyday use. It does not contain harmful chemicals, making jute products healthy and environmentally friendly alternatives to synthetic materials.

CHALLENGES AND OPPORTUNITIES IN ADOPTING AI IN JUTE MARKETING

Adopting AI in jute marketing faces several challenges. Many producers, especially small-scale businesses in rural areas, lack the technical skills and digital infrastructure needed for AI implementation. High initial costs for AI tools and maintenance can be a major barrier. Additionally, the jute sector often struggles with poor data quality and availability, which is crucial for effective AI functioning. Resistance to change among stakeholders and difficulties integrating AI with existing supply chains and marketing systems further slow progress. Privacy concerns and potential algorithmic bias also raise ethical challenges that need careful attention.

Despite these challenges, AI offers many opportunities for the jute industry. AI tools can analyse consumer data to reveal preferences and trends, enabling personalized marketing that appeals to eco-conscious buyers. Predictive analytics help improve demand forecasting, reducing waste and optimizing production. AI also streamlines supply chain logistics, lowering costs and increasing efficiency. Customer engagement benefits from AI-powered chatbots and virtual assistants, which boost brand loyalty. Moreover, AI supports better market segmentation and product innovation, helping the jute sector compete globally while promoting sustainability and building consumer trust.

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CONCLUSION

The study highlights that the integration of Artificial Intelligence (AI) into the marketing of jute products has immense potential to strengthen the industry's competitiveness and sustainability. Jute, being an eco-friendly alternative to synthetic material, already holds global relevance; however, traditional marketing practices have limited its reach and consumer engagement. AI-powered tools such as predictive analytics, recommendation systems, and social media sentiment analysis can help jute manufacturers and marketers understand consumer preferences, forecast demand, personalize promotions, and expand into new markets. Adopting AI-driven strategies, the jute sector can modernize its marketing practices, improve supply chain efficiency and innovate product designs to meet changing consumer needs. Although challenges such as lack of awareness, cost of technology, and limited digital infrastructure persist, the long-term benefits of AI adoption outweigh these barriers. Therefore, embracing AI is not just an option but a necessity for the sustainable growth, global visibility, and future competitiveness of jute products.

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ARTIFICIAL INTELLIGENCE BASED FACE RECOGNITION USING DEEP LEARNING

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ABSTRACT

One modern technological advancement that is crucial to computer-based communication is face recognition. However, face recognition methods are quite sensitive; if the person's perspective changes, it becomes difficult to identify the original face. Recognizing each employee's face and storing the information in the form of attendance takes a long time in the current system. The suggested research project has employed deep learning-based face recognition based on artificial intelligence (AI) to get around this. It primarily uses Open CV in Python to enable an attendance automation system for numerous users that processes constantly and without lag. The employee's presence will only be recorded once in the database, even if they enter multiple times. Thus, our proposed system is efficient in terms of quick attendance when compared to the existing system.

Keywords:

Deep learning, CNN (Convolutional Neural Network), Haar cascade algorithm, Open CV, Face Recognition.

1. INTRODUCTION

Artificial Intelligence (AI) has become one of the most transformative technologies of the 21st century, enabling machines to perform tasks that traditionally required human intelligence. Among the various applications of AI, face recognition has emerged as a prominent and rapidly evolving field due to its wide range of uses in security, authentication, surveillance, healthcare, and human-computer interaction. Face recognition systems aim to automatically identify or verify individuals based on their facial features, offering a non-intrusive and highly effective biometric solution.

Traditional face recognition techniques relied heavily on handcrafted features such as Local Binary Patterns (LBP), Principal Component Analysis (PCA), and Linear Discriminant Analysis (LDA). While these methods achieved reasonable performance under controlled conditions, they often struggled with variations in lighting, pose, facial expressions, and occlusions. To overcome these limitations, Deep Learning (DL), a subset of AI, has revolutionized face recognition by learning robust and discriminative representations directly from raw image data.

Deep learning models, particularly Convolutional Neural Networks (CNNs), have demonstrated remarkable success in extracting hierarchical features that capture both local and global facial characteristics. Moreover, advanced architectures such as Siamese networks, FaceNet, and Transformer-based models further enhance recognition accuracy

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by effectively handling large-scale datasets and complex real-world scenarios. The integration of AI and deep learning in face recognition not only improves performance but also enables scalability and adaptability across diverse domains.

Given the growing importance of secure and efficient identity verification, AI-based face recognition systems are increasingly being deployed in critical areas such as mobile device authentication, border control, banking, and smart surveillance. However, challenges related to data privacy, bias, and computational requirements still need to be addressed. Nonetheless, deep learning continues to pave the way for more accurate, reliable, and ethical face recognition technologies.

The fields of modern technology are rapidly growing due to face recognition. Since the advent of computer vision technology, this has become a reality. Face recognition is a biometric technique that uses an open CV to identify a person's face. It takes a lot of time to manually take attendance for additional employees in a company using the current approach. When numerous employees are entered at once, the database cannot be stored more correctly with the facial recognition technology now in use.

The complexity of the current system is intended to be avoided by this suggested system. Face recognition has been widely employed and is currently gaining more demand. In order to identify an employee's face and enter it into a database, this study shows how facial recognition technology is developing on its own. In this case, AI- based facial identification is accomplished by integrating OpenCV in Python with deep learning to identify the faces of several individuals.

Deep learning is a machine learning technology that enables a computer to perform human tasks and gain a high degree of estimation for a variety of functions. Data engineers who are tasked with analyzing, gathering, and processing a variety of data find it to be of great assistance. This process is accelerated and made simpler via deep learning. Convolution neural networks in deep learning have been used to construct face recognition methods. CNN improves on the crucial face recognition strategy it has already developed. CNN consists of several layers, including a fully collected layer, a pooling layer, a convolutional layer, and a rectified linear activation function correction layer. CNN, a type of deep neural network, is widely used for optical image analysis because it can identify and categorize unique features in images. A face will be used as a process image by CNN, which will then assign consequences to several exposures and produce the final outcome. This suggested solution works well with Python's open CV. It is a top-notch tool for analyzing images and doing computer vision tasks. Here, we have identified the image's pixels and found the face using LBPH (local binary pattern histogram) techniques.

The HAAR cascade algorithm is employed in this suggested study to detect the faces of employees. In 2001, P. Viola and M. Jones made the initial introduction of this algorithm [1]. One of the effective methods for diagnosing faces is the HAAR cascade algorithm. This suggested job is provided more effectively in order to decrease the manual process and the amount of time required for each employee to recognize faces separately. in order to overcome the aforementioned obstacles.

The primary goal of this initiative is,

Even if there are several people entering at the same moment, it can still access attendance. Additionally, the database will only record the employee's presence once if they enter many times.

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The facial recognition technique identifies a person by comparing their face to others in the database.

Through the use of our suggested work, it provides an automated and dependable attendance system, reducing errors associated with manual processes.

The rest of the paper is designed to give a detailed:

Section I.Structure of the current works, which are discussed in Section II. The overview of the system is presented in Section III .A brief explanation of our work is given in Section IV. Experimental set up for multiple employees using deep learning is mentioned in section V. In section VI, the proposed work and existing work are differentiated regarding performance. Eventually, Section VII shows the conclusion of the work.

1. RELATED WORKS

Every employee's face in the company is captured in the current facial recognition job, and their data is stored on the server. In an effort to improve performance, a number of facial recognition methods for attendance have been developed. Jomon Joseph and K. P. Zacharia suggested an image processing-based system [2]. Since the frontal picture is what this system functions best with, it was unsatisfactory. Many researchers have recently been working on RFID (Radio-frequency identification)-based projects. This ID-based attendance system, which uses RFID and NFC (near field communication), was proposed by H. D. Rjeib [3].However, this technology is suspect to handle and is not as secure as a biometric system. Eigenface was used by Patil et al. to develop a face recognition system [4]. Baloch completed this task as well, achieving an 85% dependability rate [5]. However, the process of contrasting stances and lighting caused multiple reductions in identification rates, which is why this method failed.

Support Vector Machines (SVMs), which can be used for regression and classification, have also been employed by researchers. Additionally, they have shown 400 frontal images using SVM-based identification and verification techniques [6]. However, because this technique was unsuitable for large files, it was reduced.Furthermore, using facial recognition,Tharanga et al. have employed the Principal Component Analysis (PCA) technique for attendance. [7] However, the accuracy that results is only 68%. Because it primarily uses quantitative data and increases the amount of the data, this system was discontinued.

When compared to the current system, our suggested system is in conflict. With the aid of the CNN algorithm, which is effective for face recognition, we have employed a different version of deep learning for face recognition here. This project primarily uses OpenCV in Python to enable attendance automation systems for numerous users that process constantly and without delay.

1. System Overview

Anoverviewofourframeworkforfacerecognitionis given in Fig.1. Establishing an artificial intelligence managementsystem usingfacerecognition requiresa few stepstoreachthetarget. Thesestepsinvolve:

- Creationofadatabase
- Thearchitectureofthefacedetectionandface recognition modules
- Featureextraction

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a. Creation of a database

Training the database and the faces of every person in the company is the first stage. To make database training easier, multiple photos will be taken of a single employee. The surveillance camera is used to record the faces of the staff. The initial step after capturing a picture is to use preprocessing techniques. The image will be shrunk and the pixel rate will be decreased in the following phase. Lastly, a specific data collection will contain these pictures.

b. Face detection and face recognition modules

Typically, the Haar cascade method with open CV is used for face detection. This method is based on deep learning and targets several photoswith a Haar cascade function [20]. The object's minimum size by default is (30,30). In general, higher values identify fewer faces, but the image quality is excellent [21]. Figure 1 displays the Haar characteristics. The CNN method is then used to identify the observed faces for the next step. In essence, there are three steps in this process:

- Preparetrainingdata
- Trainfacerecognizer
- Prediction

2. Proposed System

Our proposed methodologyis motivated by Renetal. [8]and their face recognition technique. In the previous work of SVM, E. Osuna, R. Freund, and F. Girosi have used this algorithmas the classifying function [9]. The outline of

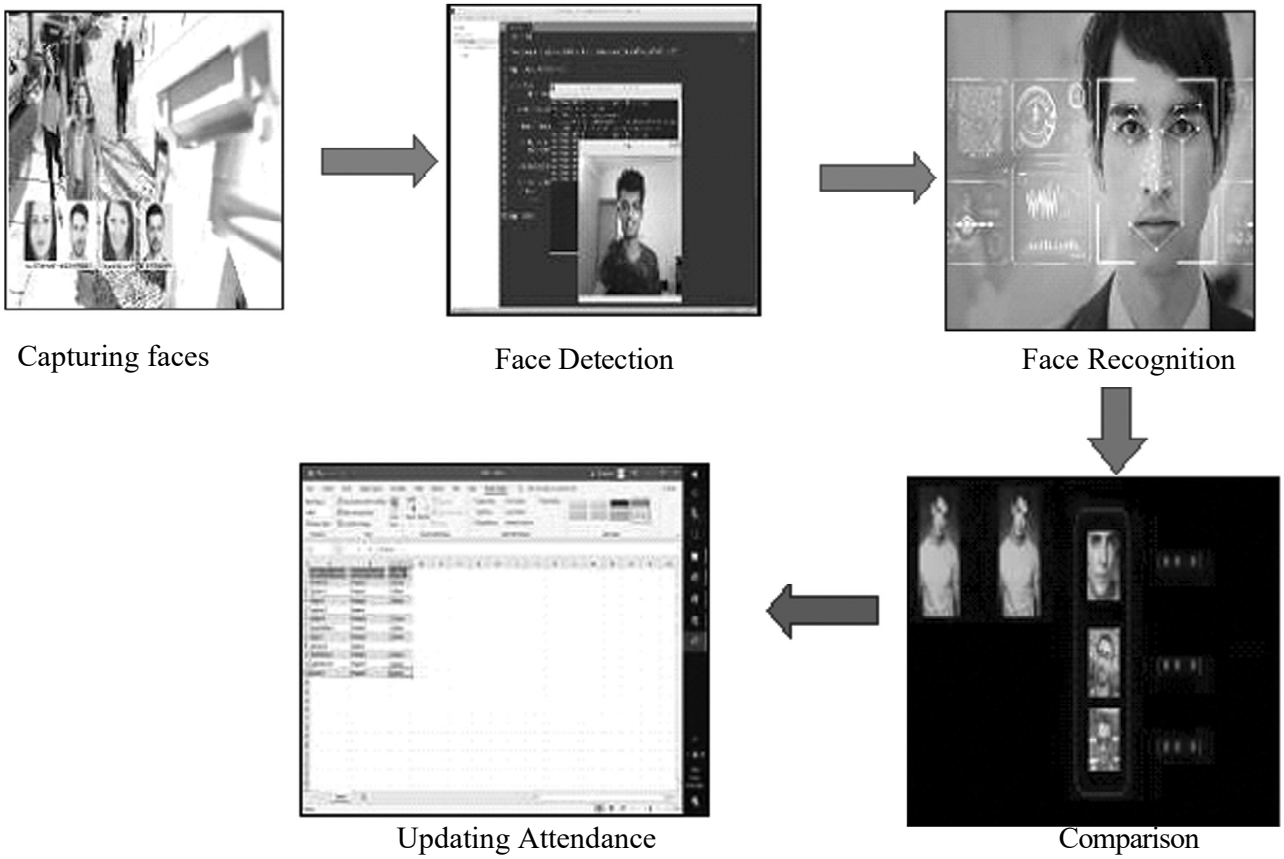

***Fig.1* Block Diagram of Proposed Work**

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The image contained in the data set is the first step. Subsequently, the values are produced by converting the local binary pattern histogram, or LBPH, into decimal numbers [22]. The training database and the identified face are compared during prediction. However, when people wear masks, our system is unable to identify their faces.

C. Feature extraction

The faces will be identified, and then their features will be retrieved. The stored database is contrasted with these extracted features. The presence and absence of the personnel are ascertained by identifying the matched traits. Lastly, for additional verification, the output is saved as an attendance database in the Excel sheet.

Our work is shown in Fig.2.The algorithms used in our paper are

- Deep learning
- Haarcascade
- CNN
- Open CV

A. Deep learning:

Deep learning has been rapidly progressing in recent years. It is a current specialization that brings out a universal interest in the area of artificial intelligence.The main reasons for the growth of deep learning in recent times are significantly expandedchip computing capacity, the dramatically dropped value of data processors, and the size able boost in machine learning [11]. Deep learning is useful for data engineers in the process of analyzing, collecting, and interrupting data.

ARCHITECTURE OF PROPOSED SYSTEM

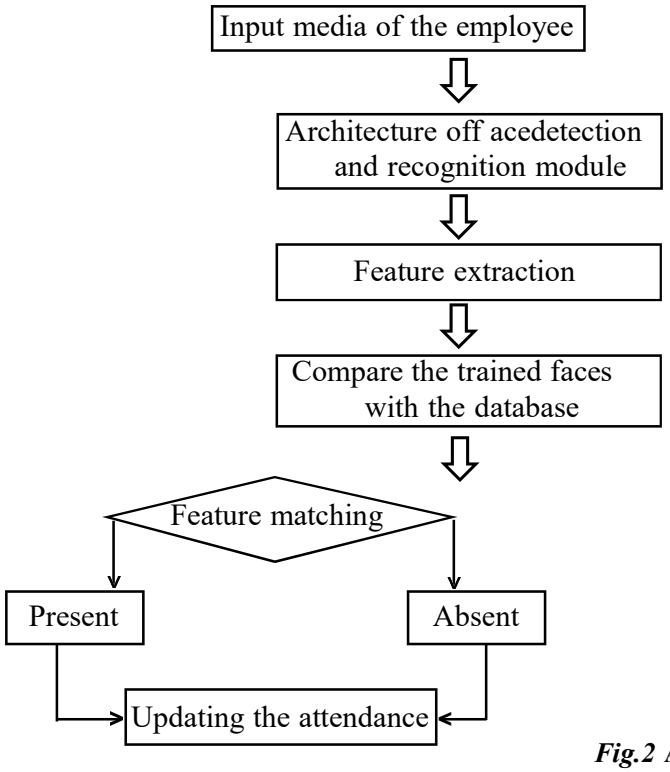

***Fig.2* Architecture of proposed system**

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This process is faster and easier when compared to machine learning. A new deep learning framework was extended by Google, Facebook, and other organizations for their acknowledgment. This technique was outlined with a set of machine learning automation that can be implemented by using the Haar cascade algorithm and theCNN algorithm

B. Haar cascade:

P. Viola and M. Jones, who presented an object detector framework utilizing Haar-like characteristics, served as the impetus for the Haar cascade's implementation. Even so, it can be used to identify facial variations that were first brought about by the use of face recognition. An open CV is used for this strategy. The common object locater framework has gained popularity and motivated the association to develop their object classifier with the aid of the open CV library. When using the Haar cascade approach to determine the subspace, this function of an open CV is useful. The database has to be centered for this approach to work. Because the Haar cascade algorithm uses an integral image and is a very fast computational feature, we have specifically used it in this proposed system to recognize faces from a specific distance in real-time applications. With the use of a cascade algorithm, these facial traits are effectively retrieved

Using the Haar cascade method and Haar-like features, this system takes pictures of employees and their databases. Three steps are among these features:The edge features are the first phase, followed by the line features and the four rectangle characteristics. Consequently, it is found that the Haar cascade method can identify the faces of several employees.

C. CNN algorithm

The CNN a lgorithm is the major method embraced in the area of face recognition, which is a type of deep learning model [16]. This algorithm is used in our proposed system as it has an overall accuracy of 95% and is capable of obtaining low-dimensional features because sometimes the preprocessed image may contain high-dimensional features.

$$Xkxy = n{-}1 \qquad (1)$$

It would be difficult to classify the input image directly [17]. Features can be extracted by using the sCNN algorithm [18].

$$\sum x = 0n{-}1t \qquad (2)$$

$$\sum y = 0\omega xyak{-}1(i{+}x)(\mathrm{j}{+}y)(3)$$

Initially, a normalized layer is used to reduce the time required, and a layer activation function is used to normalize the data. Finally, max pooling is used to preserve the extracted feature information [19]. Generally, the algorithm can spontaneously recognize the significant feature without manual supervision. Thi salgorithm is specially formulated to acquire knowledge of spatial hierarchies. The proposed CNN algorithm is designed using open CV, this varies based on the sequence of layers and performance of the system.

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III. EXPERIMENTAL SETUP AND RESULT

Forour experiment, westored the employee's database for training the faces in deep learning. For training, each employee's face takes 10 seconds so that all angles of the employee's face are trained accurately. A separate login is created for the admin to store the database.Once the admin is registered, he can train a number of faces. The employees' personal information is stored before capturing their faces for training. The image captured for testing is 480p and the minimum facial size is 300*300. We trained a convolutional neural network as shown in fig.3.

Fig.3 **Testing and training algorithm**

While testing the faces for attendance if any unauthorized person entersthe organization, the faces will be detected but they will not be recognized and it will intimate the admin by a sound.

Fig. 4 **Implementation of CNN algorithm**

When multiple employees enter continuously, their facesare detected one by one at a particular time and recognized by using the Haar cascade algorithm.With the help of the CNN algorithm, Haar features are recognized accurately. CNN encodes the output based on the featuresof the proposed memory network [24]. Because the CNN algorithm can detect the tampered face images through the feature extractors. Finally, by comparing the detected faces with the stored database, the employees' presence and absence are updated in the data set as shown in fig5.

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Fig.5 Updation of attendance

This proposed work is more efficient when compared with the existing work. In the future, we will do research on face recognition with masks for further challenging real-time frameworks.

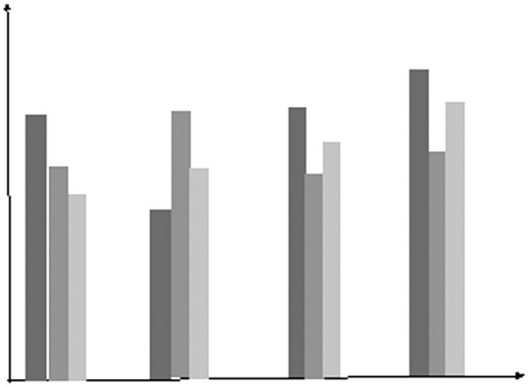
IV. DISCUSSION

In our proposed work, the CNN algorithm is sed for face recognition and the propagative adverse system for feature extraction. Different algorithms are used for face recognition and these algorithms are compared in terms of accuracy, scaling, and security asshown in Fig.6.

Table : 1 Comparing Efficiency

Algorithm	Accuracy	Scaling	Operationtime
[23]	High	Difficult	High
[20]	Moderate to low	Easy	Moderate
[22]	High	Normal	Low
Proposed system	Very high	Easy	Very low

We planned our project to be more accurate so that the inter connection between the system and the user will improve the accuracy of the system. In our work, the recognitionrate of the employee is accurate when compared to other algorithms.



By comparing the proposed system with the existing work,our proposed work significantly improves the rate of accuracy. The four algorithm presented in the fig.6 are in the same data set of recognition. The major advantage of

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our work is that it can recognize multiple faces at a time, where as previous work, canonly recognize individual faces at a time. For recognition of face there are certain conditions such as angle variation of head movement and different expressions. In that case, our proposed system gives higher efficiency when compared to [22] and [20]. The accuracy of [23] and [22] are high when comparing with [20] but our proposed system gives the overall high accuracy when compared to the existing work. The operational time and scaling of our proposed work is also quite accurate and satisfactory. Facesare trained in deep learning as shown in fig.

Fig.7 **Training faces using deep learning**

V. CONCLUSION

This paper performs with an algorithm called CNN for face detection and recognition, which can overcome the drawbacks of the existing system and traditional technique. It gives the expected results for the attendance management system with the help of computer vision.Through tremendous innovations, the reliability of face recognition technology for multiple attendance systems is notable for further implementation. The accuracy of our project is quite accurate when compared to the existing system. Our system ensures that even if one person enters multiple times his presence willbe marked only once inthe database.

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SUSTAINABILITY OF AI IN GLOBAL MARKET

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ABSTRACT

The Artificial Intelligence Boom of 2020 shasrapidly mad eitself an intergral part of new emerging technology but more so ever have become a part of the social zeitgeist. The recent attribution of AI in fields such as healthcare, computer science, and commerce etcetera has made significant socio-economic shift in the irrespective sectors. It has also made a large impact on the global finance and the allocations of our global 'limited' resources. In this paper we go through market trends, investment charts both in finance and resources; and their returns. By analyzing direct financial data suchas financial statements; company-level financial reports and market-level financial metric & indicators as well as historical reports, this study aims to find economic sustainability and long term viability of AI and AI- driven Industries; grounding the market reality of an emerging and a very promising technology. Our empirical results indicates that the current market prices exeeeds the fundamental values; the current market trend close lyresembles the speculative dynamics that characterized" The Dot Com" bubble of the 2000s. Further more, ourstudy also suggestenergy expenditure significantly contributing to production cost which in-turn affectively causes in being a major reason behind in revenue deficit while also affecting the oppurtunity cost of other sectors. In conclusion, the study demonstrates that the rapid expansion of AI in the past 5 years has carried signicant financial and energy implications which take part in AI's long-termvia- ability. Therefore, to ensure sustainable development and avoiding of major events of market correction, stakeholders must prioritize energy-efficient hardware, policy makers and industry leaders to integrate financial oversight whilst also aligning technological innovation with economic and environmental constraints. The AI Sector can transition from short-term hype to long-term sustainability.

Keywords:

AI, Finance, Stock Market, SaaS, Sustainability, Green Commerce

1. INTRODUCTION

Over the past 5 years we have seen an extreme boom in AI Technology. As the advancement of technology increases, scepticism of such new technology also becomes more apparent, be its technical backbone, infrastructure impact or financial. Currently AI can be segmented into two splits. Companies like OpenAI, Anthropic, Gemini, XAI who create, train, and deploy state-of-the-art AI models and the downstream applications like Perplexity, Klein, Manis, notion where you essentially apply the models into domains like web searching, coding, deep research, productivity, and more. In both cases while, backend processes; R&D, are a major cause of any technology, so it becomes the financial investment especially for an industry defining technology such as 'Artificial Intelligence'.

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2. DATA ANALYSIS

2.1 Technical Assessment

$$S_{IW}(y) = N_{IW} \times B_P \times T_B \times (1+g)^{y - y0} \quad (1)$$

Calculating indexed web crawled where $S_{IW}(y)$ is the estimate of the current stock of tokens in the indexed web in a given year y, N_{IW} is the number of unique web pages in the indexed web, B_P is the average number of bytes per web page, T_B is the average number of tokens per byte, and g is the estimated rate of growth of the total number of tokens.[a]

[a] *van den Bosch, A., Bogers, T., and de Kunder, M. Estimating search engine index size variability: A 9-year longitudinal study. Scientometrics, 107(2):839–856, Feb 2016. doi: 10.1007/s11192-016-1863-z.*

As of the current year, we have already effectively scraped and trained LLMs with nearly 95% of all available human created text [Villalobos et al., 2024]

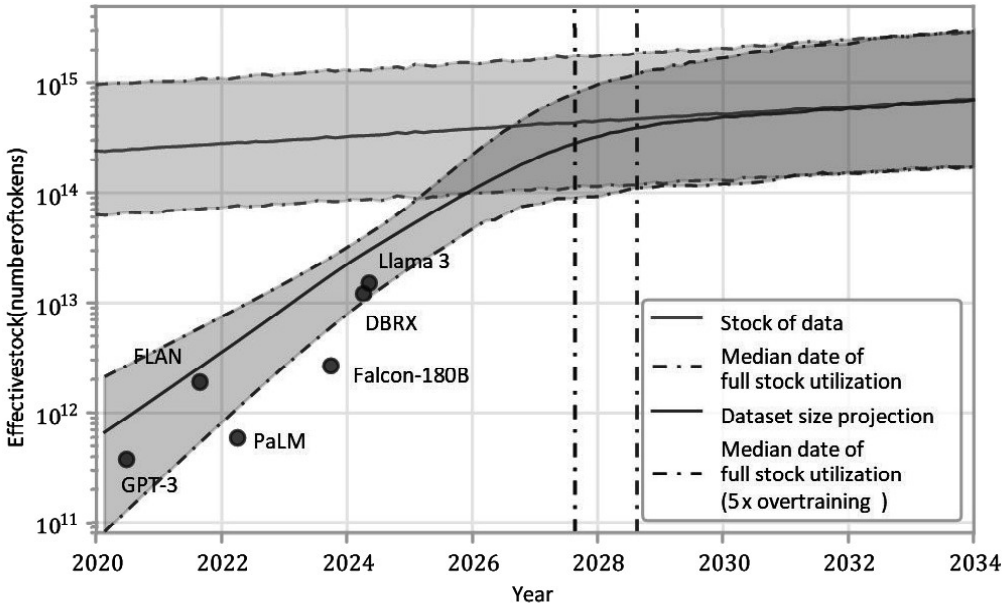

Figure 1. *Projections of the effective stock of human generated public text and dataset sizes used to train notable LLMs. The intersection of the stock and dataset size projection lines indicates the median year (2028), whence the stock is expected to be fully utilized if current LLM development trends continue. At this point, models will be trained on dataset sizes approaching the total effective stock of text in the indexed web: around 4e14 tokens, corresponding to training compute of <"5e28 FLOP for non-overtrained models. Individual dots represent dataset sizes of specific notable models[Villalobos et al., 2024].*

This includes all the text data out of the 33 billion terabytes of data in the internet[1], with estimated growth rate of 2-4% per year (1)

1 The digitization of the world from edge to core. Technical report, International Data Corporation, 11 2018. https://www.seagate.com/files/www-content/our-story/trends/files/idc-seagate-dataage-whitepaper.pdf.

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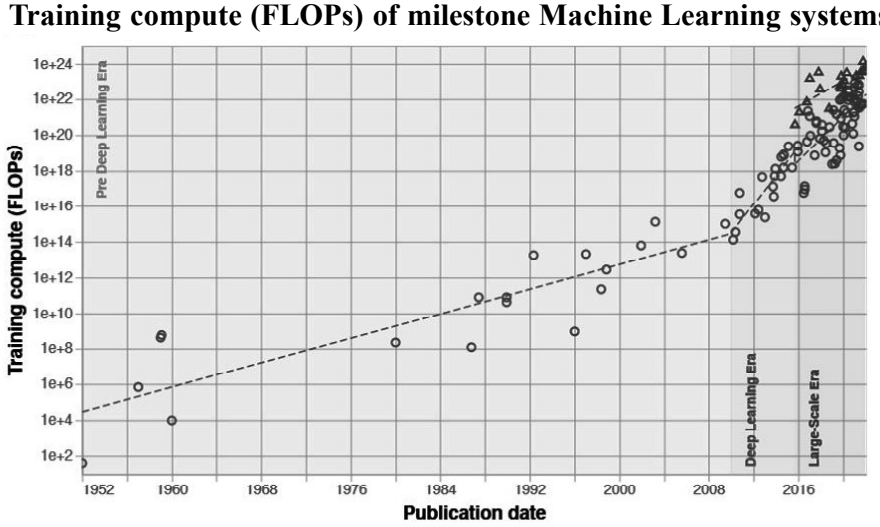

Figure 2. *Trends in n =* 121 *milestone ML models between 1952 and 2022. We distinguish three eras. Notice the change of slope circa 2010, matching the advent of Deep Learning; and the emergence of a new large-scale trend in late 2015.[Sevilla et al., 2022]*

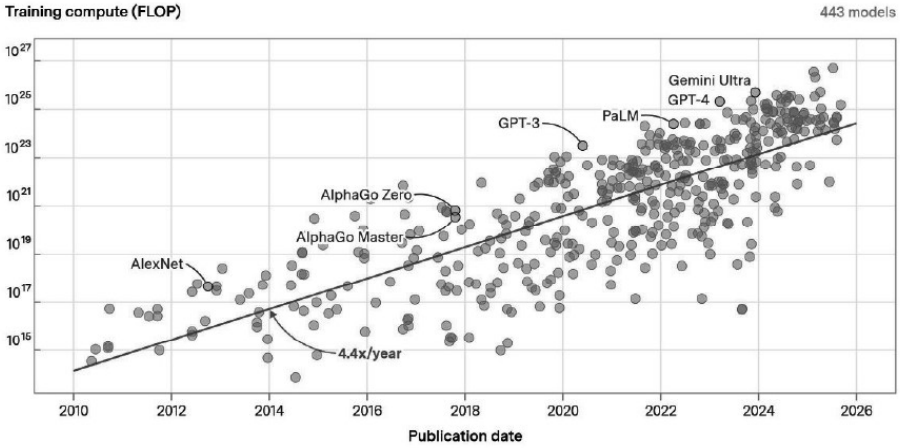

Figure 3. **Training compute of notable AI Models, 4.4x/year growth rate.**

In the above figure we can see a rapid increase in the ML computation, from doubling in computation every 20 months from 1952-2011. Post 2011-2022 it became 5.65 months. Currently the doubling rate on a large scale is at 10.7 months while the regular models are at 5.9 months[Sevilla et al., 2022]. At the current rate of advancement as per shown on Figure 2 is formulated over Figure 3, showing growth rate of 4.4x per year. Most of this growth comes from increased spending(seeS Section 2.3), although improvements in hardware have also played a role.

2.2 Energy Impact

A paper on *Green Recommender Systems* suggested that deep learning models consume, on average, eight times more energy than traditional models without achieving higher performance with default hyperparameters & the

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carbon footprint of recommender systems experiments has increased significantly, with experiments from 2023 emitting approximately 42 times more CO_2e when compared to experimental pipelines from 2013.[Wegmeth et al., 2025]

While AI technology doubles every half year (5-6 months). The energy consumption also seems to be taking a hit with more than doubling every year. It is also to be noted only half of total energy provided to such data centers actually goes to the machine, the half is of it being an overheads, cost of elements such as cooling takes an estimate of 40%[2]

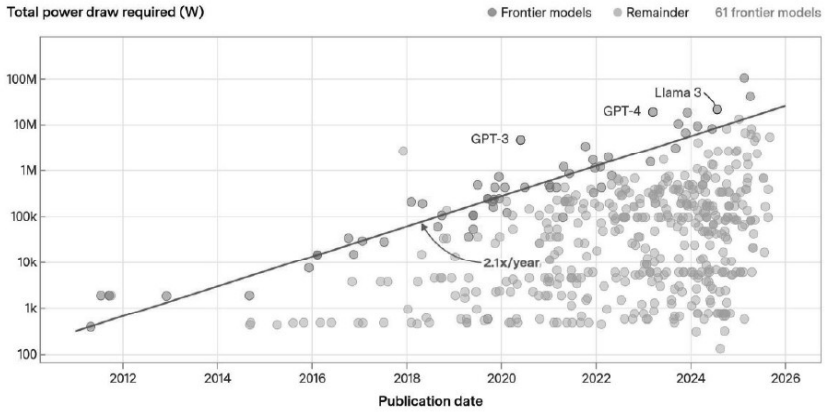

Figure 4. **Total power draw of AI,ML units, 2.1x Increase per year.**

Subsequently using the hardware data[3] and calculating the power draw, the above 4 shows that the power draw of such AI models are on an upward trajectory with the power requirements seems to be doubling every year.

$$W_I(t) = PUE \times S_O \times P_{gpu} \times Q \qquad (2)$$

where $W_I(t)$ is the total power draw, PUE is the power unit efficiency ratio[a], S_O is the server overhead, P_{gpu} is the power drawn per unit of gpu, Q being total quantity.aISO/IEC 30134-2:2016

If we break down the components of Breaking down the components of amortized hardware CapEx + energy, on average, 44% goes toward AI accelerator chips. The rest of the server (including markup) makes up 29% of the cost, while cluster level interconnect makes up 17%. R&D staff are a major component, making up 29–49% of the total% [Cottier et al., 2025].

SaaS Model; Software as a Service, is a model where software applications are deployed and hosted over using third party software/services over the internet. It is a new age of providing services and application software, while giving a constant feedback to the developer. It also provides flexibility in the form of scalability compared to traditional forms of production of goods and services. The overhead cost is only variable to the total man-power and a computer unit per person. AI Tech to be integrated as a SaaS requires a low cost of overhead, and unfortunately efficiency of Local LLMs are not on par with the global 'AI Clusters Data Center' large primary AI firms such as Open AI provides.

2 https://crsreports.congress.gov; R48646
3 https://resources.nvidia.com/en-us-dgx-systems/ai-enterprise-dgx?xs=489753

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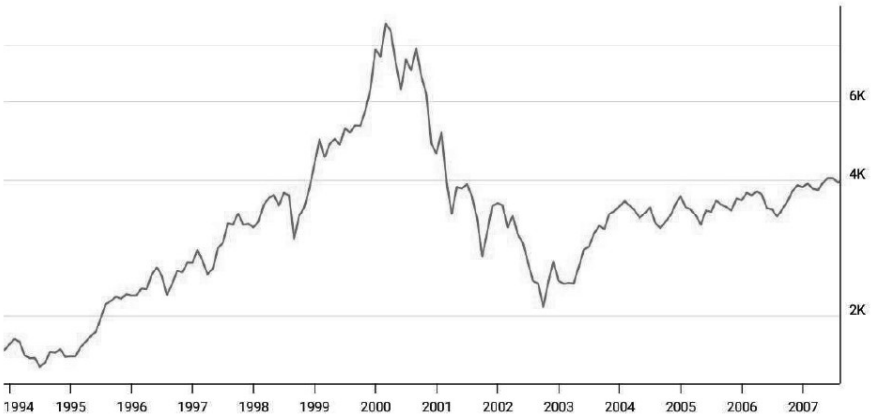
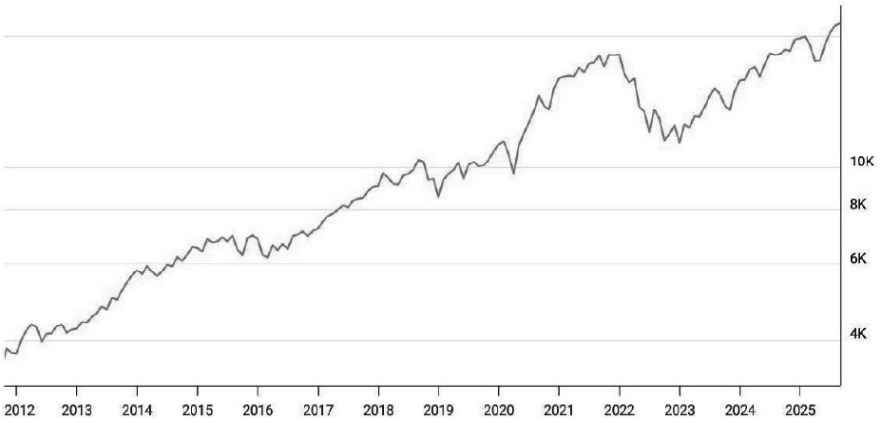
2.3 Financial Assessment

The global AI market size was USD 638.23 billion in 2024, calculated at USD 757.58 billion in 2025 and is expected to reach around USD 3,680.47 billion by 2034, expanding at a CAGR of 19.20% from 2025 to 2034[4].

The dot com bubble was a phenomenon of the late 90s, emerging from 1995-2000 where the rapid hype of new internet technology became so popular that every firm with a '.com' on their name would get shot up in valuation. Many major companies we know today became big during these times, some companies such as Qualcomm's stocks reached 20 times, from USD 4.1 on 1/1999 to USD 88 on 12/1999. We are seeing the same trend in the market valuation of AI companies, hardware developing and manufacturing company NVIDIA also had 10x increase in the market valuation in stocks[5] with USD 18 in 2022 and USD 180 in 2025 since the emergence of modern AI takeover.



(a) The Dot Com Era



(b) AI Era

4 https://www.precedenceresearch.com/artificial-intelligence-market
5 https://finance.yahoo.com/quote/NVDA/

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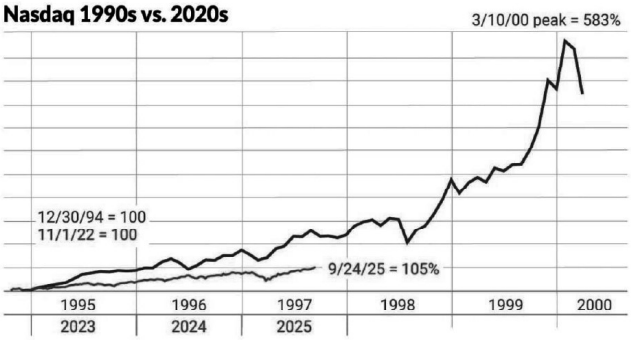
(b) AI Era



(a) Timeline equalized

Figure 5. **Comparison between AI & Internet Emergence Era.**

There is a concerning trend with both of these market data that seems eerily similar till the crash of the first figure. There were many factors of the crash, especially on the side of market hype which was perpetuated heavily by the public media leading into more investment, in turn creating a catch-33 situation.

3. REVIEW & CONCLUSION

As of 2025, data centers consume around 1.5% of the world's energy[6], which has been growing at the rate of 12%/year. With the current rate of progress it will only take a few years for a total stock deficit of energy, in-fact, with the example of the USA, the energy rate has made a significant rise in cost, after the Boom of AI.

China and the United States are the most significant regions for data centre electricity consumption growth, accounting for nearly 80% of global growth to 2030. Consumption increases by around 240 TWh (up 130%) in the United States, compared to the 2024 level.

In China it increases by around 175 TWh (up 170%). In Europe it grows by more than 45 TWh (up 70%). Japan increases by around 15 TWh (up 80%).

It is also to be noted that others have argued against the energy estimates, as non optimized deployments may shrewd the numbers[Oviedo et al., 2025], using historical facts such overestimation of internet energy infrastructure from 1999 said to be 50% which only got to be around 2%[7]. Although Pre-training and Training of Medium-Large scale models do hog up a lot of resources. As of now there has not been a major leap of advancement on the side of efficiency & the progress we've made isn't substantial enough for these to have a major impact in the industries. We are still on the trajectory that was set by us post 2021.

If we are looking at the current market valuation of these companies there is a considerable hype surrounding such and has shown signs of overinflated numbers. But it still has not sought out the change in valuation so fast that it can too volatile, since the 90s and early 2000s we have seen a lot of development not just on the Technological but also on the financial infrastructure, if there is a proper allocation of funds and resources which do not increase its input exponentially at the prospect of short-term gains.

6 https://www.iea.org/reports/energy-and-ai/energy-demand-from-ai

7 G. Kamiya and V. C. Coroam¢a, "Data Centre Energy Use: Critical Review of Models and Results"

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A recent study by the MIT on the State of AI in Business[8], 95% of start-up organizations are getting zero return. Only 5% of integrated AI pilots are extracting millions in value, while the vast majority remain stuck with no measurable P&L impact. LLMs Tools like Co-pilot, ChatGPT are explored or piloted by over 80 percent of organizations, and nearly 40 percent report deployment. But these tools primarily enhance individual productivity, not P&L performance. Although start-ups in general are very volatile, around 90% fail and 85% are always on the pendulum of doom for their first 3 years[9].

LLMs improvements are largely attributed to efficient hardware and equipment, alongside better attenuation of data processes in pre-training with increase in investment and material support. Generative pre-trained transformer Technology is still the core for modern LLMs and it has been the case since 2018, with 2020 GPT-3's RLHF being the last significant leap. Therefore, the gap in software is way bigger compared to the gap in infrastructure. And as it grows the more unstable the market of such technology may become.

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8 https://mlq.ai/media/quarterly_decks/v0.1_State_of_AI_in_Business_2025_Report.pdf

9 https://www.thestreet.com/technology/ai-85-pct-of-startups-will-be-out-of-business-in-3-years-major-investor-says

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ARTIFICIAL INTELLIGENCE IN MARKETING AND CONSUMER INSIGHT

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ABSTRACT

AI has emerged as a transformative force in the fields of marketing and consumer insights, revolutionizing how businesses understand and engage with their target audiences. This abstract outlines the pivotal role of AI in analyzing consumer behaviour, personalizing marketing efforts, and optimizing strategic decision-making. By leveraging advanced technologies such as machine learning, predictive analytics, and natural language processing, AI systems can process and interpret vast amounts of structured and unstructured data, including social media posts, customer reviews, browsing history, and purchase patterns. This capability enables marketers to move beyond traditional demographic segmentation to create highly nuanced and dynamic consumer profiles. AI-driven insights facilitate a deeper understanding of customer preferences, sentiments, and motivations, allowing for a more accurate prediction of future behavior and market trends.The application of AI in marketing are evident in several key areas. It enables hyper-personalization at scale, where marketing messages, product recommendations, and customer experiences are tailored to individual consumers in real time. AI automates repetitive tasks, such as data analysis, campaign management, and content generation, freeing up marketing teams to focus on higher-level creative and strategic initiatives. predictive analytics powered by AI allows businesses to forecast customer churn, optimize pricing strategies, and allocate resources more effectively to maximize return on investment (ROI).While the benefits are significant, the integration of AI also presents challenges, including ethical considerations related to data privacy, algorithmic bias, and the need for a human-in-the-loop to ensure meaningful customer connections. This abstract concludes that the strategic adoption of AI is not merely about technological implementation but about a fundamental shift toward data-driven, customer-centric marketing that enhances efficiency, personalization, and competitive advantage in the modern business landscape.

Keywords:

Marketing strategy, Consumer trust, Natural Language Processing (NLP), Customer journey optimization, Personalization

WHAT IS ARTIFICIAL INTELLIGENCE

Artificial Intelligence (AI) is a field of technology and science focused on creating computer systems and machines capable of performing tasks that typically require human intelligence. These tasks include learning, reasoning, problem-solving, understanding and responding to language, recognizing patterns, making decisions, and acting autonomously. AI systems use data and algorithms, primarily machine learning and deep learning, to improve their performance over time by identifying patterns and relationships in large amounts of data. AI applications range from virtual assistants,

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image and speech recognition, autonomous vehicles, personalized recommendations, to generative AI that creates new content like text, images, or videos. Fundamentally, AI enables machines to simulate human cognitive functions, enhancing efficiency and innovation across various domains

DIFFERENT TYPES OF ARTIFICIAL INTELLIGENCE

Artificial Intelligence (AI) can be categorized in several ways based on capabilities, functionalities, purposes, and underlying technologies. The main types are:

Based on Capabilities

Narrow AI (Weak AI): AI systems designed to perform specific tasks. They operate under limited predefined contexts and cannot generalize beyond their domain. Examples include voice assistants like Siri and Alexa, facial recognition software, and recommendation algorithms

General AI (Strong AI): A theoretical AI with human-level cognition capable of understanding, learning, and performing any intellectual task a human can. It remains unrealized but represents a future goal for AI development

Superintelligent AI: A hypothetical AI surpassing human intelligence across all domains including creativity and problem-solving. It is speculative and raises ethical issues.

Based on Functionalities

Reactive Machines: AI that responds to current inputs without memory of past experiences, such as IBM's Deep Blue chess program.

Limited Memory: AI systems that learn from past data to improve decision-making, common in self-driving cars and virtual assistants

Theory of Mind: Experimental AI aimed at understanding human emotions and mental states, still under research

Self-aware AI: Future AI with consciousness and self-awareness, theoretical at this stage.

Based on Purpose and Technology

Machine Learning: Enables systems to learn from data patterns without explicit programming; includes supervised and unsupervised learning

Deep Learning: A subset of machine learning using deep neural networks, excelling in image and language processing

Natural Language Processing (NLP): AI that understands and processes human language, powering chatbots and virtual assistants.

Generative AI: Creates new content such as images, music, and text using techniques like GANs and diffusion models

Robotics: AI combined with mechanical systems to perform physical tasks

Expert Systems: Rule-based AI mimicking human decision-making in specialized fields

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CONCEPTS OF AI IN MARKETING

Definition: AI in marketing involves using machine learning, natural language processing, and predictive analytics to automate, optimize, and personalize marketing activities

Consumer Insights: AI analyzes vast consumer data sets - both structured (transaction history, demographics)and unstructured (social media, reviews) - to extract patterns and preferences, enabling marketers to predict trends and behaviors.

APPLICATIONS OF AI IN MARKETING

1. Personalization at Scale

- AI tailors marketing content and recommendations to individual consumer preferences, creating hyper-personalized experiences.
- Platforms like Netflix and Amazon use AI-based recommendation engines to drive user engagement by analyzing viewing and purchasing data.

2. Predictive Analytical and Forecasting

- Marketers use AI to forecast demand, analyze consumer segments, and predict potential leads' conversion likelihood, enabling efficient allocation of resources
- AI-driven lead scoring models rank potential prospects based on behavioral data and engagement.

3. Automation of Marketing Tasks

- Content creation, email marketing, social media management, and ad campaign optimization are increasingly automated with AI tools.
- AI-powered chatbots and virtual assistants handle queries, recommend products, and complete transactions, enhancing consumer interaction.

4. Consumer Sentiment Analysis

- Natural language processing allows AI to track opinions, detect trends, and monitor brand perception in real-time across social platforms and review sites.
- Marketers adjust messaging based on automated insight from these analyses

5. Programmatic Advertising

- AI optimizes bidding for digital ads and tailors creatives to audience segments in real-time.

IMPACT ON CONSUMER INSIGHTS

- AI enables deep, granular segmentation by uncovering hidden patterns, motivations, and sentiments—far surpassing traditional demographic analytics.
- Brands gain the ability to fine-tune strategy on-the-fly for greater loyalty and engagement.

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CHALLENGES AND ETHICAL CONSIDERATIONS

Data Privacy: AI relies on vast consumer data, raising significant concerns about data security, consent, and transparency.

Trust and Authenticity: AI-generated content—especially through generative AI—can reduce perceived authenticity, impacting brand trust.

Skill Gap and Implementation: Marketers need new technical skills to fully leverage AI's potential, and organizations must invest in training and infrastructure.

EMERGING TRENDS AND FUTUREDIRECTIONS

Conversational Commerce: Voice and chat-based interfaces are streamlining purchase processes and content discovery

Generative AI: From automated ad copy to video production, generative AI speeds up creative processes and broadens content generation

Hyper-Personalization: AI is pushing the boundaries of one-to-one marketing, using real-time data to customize every touchpoint.

CONCLUSION

Artificial Intelligence is rapidly becoming the backbone of modern marketing, empowering brands to engage in smarter, more responsive, and data-driven strategies. Its ongoing adoption is expected to deepen consumer insights, automate workflows, and provide ever more personalized experiences. However, ethical data practices and continuous upskilling remain critical for sustained, responsible innovation.

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STOCK MARKET PREDICTION USING MACHINE LEARNING ALGORITHMS

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ABSTRACT

The stock market is influenced not only by historical data but also by external factors such as wars, political events, and global news. Traditional prediction models often fail to capture these complex dependencies. This paper proposes a hybrid prediction framework that integrates historical stock prices with event-based data, including war news and political operations, to improve forecasting accuracy. Using Python in Google Colab, Linear Regression the baseline machine learning algorithm is used to analyse both quantitative and qualitative inputs. News data is processed through sentiment analysis and merged with historical datasets to generate predictive features. The proposed approach is evaluated using performance metrics such as Mean Square Error (MSE). , demonstrating how the integration of external events enhances reliability compared to traditional models. The findings show that even a simple regression model can achieve better accuracy when enriched with news data. This research contributes to the growing field of AI in financial markets by showcasing a novel, event-aware prediction model with practical implications for investors and analysts.

Keywords:

Stock Market, Machine Learning, Linear Regression, Sentiment Analysis, Forecasting.

1. INTRODUCTION

The stock market is inherently volatile and influenced by a wide range of factors including economic trends, political events, and investor sentiment. Accurate prediction of stock prices is crucial for investors, policymakers, and financial institutions. While traditional statistical models primarily depend on historical data, such methods often fail to capture sudden market fluctuations caused by unpredictable global events. Machine learning algorithms, particularly linear regression and its extensions, have shown promise in enhancing prediction accuracy. This paper introduces a hybrid model that combines historical stock data with contextual features such as war news and political operations.

2. LITERATURE REVIEW

Numerous studies have explored stock market prediction using machine learning and deep learning techniques. Patel et al. (2015) demonstrated the fusion of machine learning methods for predicting stock indices. Fischer and Krauss (2018) applied LSTM networks for financial forecasting with promising results. However, most existing models primarily depend on historical and technical indicators, overlooking the impact of real-time news. Mittermayer and Knolmayer (2006) highlighted the significance of text mining in capturing market responses to news. This gap motivates the integration of news sentiment with historical data in this study.

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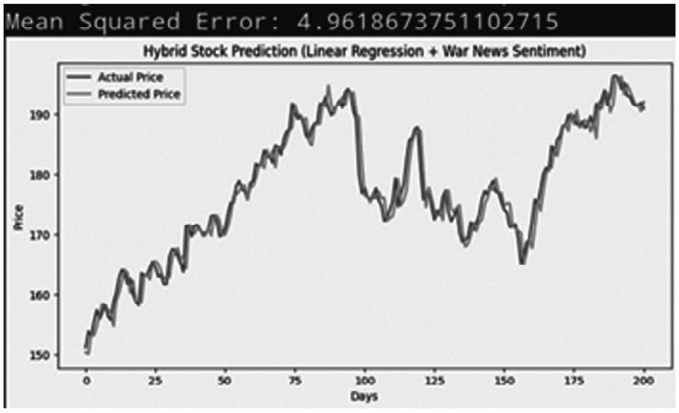
3. METHODOLOGY

The proposed hybrid model is designed to combine quantitative historical data with qualitative event-driven data to improve predictive performance. Historical stock data is collected from publicly available datasets such as Yahoo Finance. Political and war-related news is scraped from reliable news sources and preprocessed through natural language processing (NLP) techniques. Sentiment analysis is applied to classify news as positive, negative, or neutral. Feature engineering integrates these sentiments with numerical indicators such as closing prices, trading volume, and moving averages. Linear Regression serves as the baseline algorithm, implemented in Python within the Google Colab environment. Mean Squared Error (MSE) is used as evaluation metric.

4. RESULT AND DISCUSSION



Initial experiments indicate that the hybrid model outperforms traditional historical-only approaches. When war and political news features were included, the model exhibited a reduction in error metrics (MSE – 4.961), indicating improved predictive capability. The integration of event-based sentiment data captures hidden patterns often missed by statistical indicators alone. However, limitations exist, including potential biases in news sources and challenges in quantifying qualitative events. These findings suggest that while hybrid models enhance prediction accuracy, further research is required to generalize results across diverse markets.

5. CONCLUSION AND FUTURE SCOPE

This paper proposed a hybrid model for stock market prediction that integrates historical data with sentiment derived from war and political news. By employing Linear Regression in Python on Google Colab, the approach demonstrates improved accuracy compared to conventional models. Future work will explore advanced machine learning techniques such as LSTM networks and ensemble models, as well as expand the dataset to include global news. The proposed framework has significant implications for investors and analysts, enabling more reliable decision-making in volatile market conditions.

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THE ROLE OF ARTIFICIAL INTELLIGENCE IN ENHANCING E-COMMERCE

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ABSTRACT

The rapid advancement of Artificial Intelligence (AI) has significantly transformed the landscape of e-commerce, reshaping the businesses interact with consumers, manage operation and optimize decision-making. This research explores the multifaceted role of AI in e-commerce, focusing on key applications Such as personalized recommendations, dynamic pricing inventory management, Customer Service automation and Fraud detection. By integrating machine learning, natural language processing and predictive analytics. AI technologies enhance uses experiences, increase operational efficiency and drive revenue growth. The paper also discusses the Challenges associated with AI adoption, including data privacy concerns, algorithmic bias, and the need for transparent Al governance the findings under Score the growing necessity for e-commerce businesses to embrace AI to remain competitive in a fast evolving digital economy.

Keywords:

Artificial Intelligence, E-commerce, Inventory Management, Customer Behavior, Service Efficiency.

INTRODUCTION

The modern Information age brings along new Possibilities, Software and technological innovation usable in marketing and shopping. New technologies force companies to be more Creative. Technologies help increase the efficiency, quality and cost-effectiveness of Services provided by businesses. Contemporary creativity is based primarily on the development of information and communication technologies, which have a major impact on the development of the business environment. The effectiveness of information and communication technologies depends investment on Several factors, Such as human Capital and an appropriate Combination of e-commerce solution.One sector when the digital transition and importance of e-commerce are Particularly Pronounced is retail!, where digital tools Such as websites, replace or complement Physical commerce.

OBJECTIVES OF THE STUDY:

1. To find out the major role of artificial intelligence in e-commerce.
2. To find out the major challenges of using AI in e-commerce.

METHODOLOGY:

This research paper is totally based on Secondary data. The secondary date were gathered from official statistical source as well as published books, journals, research papers, magazines and newspapers.

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ROLE OF ARTIFICIAL INTELLIGENCE IN E-COMMERCE:

1. **Personalized Product Recommendation:**

   It's easier than ever to collect and process Customer date about their online shopping experience. Artificial intelligence is being used to offer personalized product recommendations based on Past customer behavior and look alike customer. Websites that recommence items you might like based on previous purchase use machine learning to analyze your purchase history. Retailers reply on Machine learning tocaphre data, analyze it, and use it to deliver a personalized experience, implement a marketing Campaign, optimize pricing and generate Customer insights.

2. **Pricing optimization:**

   AI enabled dynamic pricing is a strategy of Changing your Product Price based on Supply and demand. With access to the right data. Al tools can Predict when and what to discount, dynamically Calculating the minimum discount necessary for the Sale.

3. **Enhanced Customer Service:**

   With virtual assistants and Chat bot technology, you can deliver appearance of higher touch. Customer support, while these bots are not completely self-reliant, they facilitate Simple transactions, leaving live support agent able to force or more Complex issues. Virtual agents also have the advantage of being available 24/7, 50 low level questions and issues can be addressed at any time of day, without making your customer wait.

4. **Customer segmentation:**

   Access to more business and customer data and processing Power is enabling e-commerce operation to understand their customer and identify new trends better than ever. In an insight from Accenture, they write. "AI System" Can explore highly complex and varied options for customer engagement Very quickly and continuously optimize this Performance as more data becomes available. This mean, marketers can set Parameter and allow the A1 to optimize and learn to achieve precision.

5. **Smart logistics:**

   Machine learning Predictive Powers shine in logistics, helping to forecast transit times, demand levels and Shipment delays. Smart logistics or intelligent logistics is all about casing real-time information through Sensors, RFID tags and the like, for Inventory management and to better forecast demand. Machine learning system become smarter over time to build better predictions for their supply chain and logistics function.

6. **Sales and demand forecasting:**

   A recent Mckinsey report suggests that investment y real-time customer analytics will continue to be important to monitor and react to shifts in Consumer demand that can be harnessed for price optimization or targeted marketing.

7. **Supply Chain Optimization:**

   AI can optimize to supply chain by analyzing data from various Sources including Suppliers, Warehouses and transportation Systems. This helps businesses Streamline operation, reduce costs and improve delivery efficiency.

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8. Fraud detection:

AI algorithms can detect patterns and anomalies in red time helping to identity and prevent fraudulent activities such as payment fraud and account hacking. This enhances Security and builds trust among customer.

CHALLENGES OF USING AL IN E-COMMERCE:

a) Data Privacy and security:

AI Systems require vast amours of use data, raising concerns about data collection, storage, and usage. Businesses must comply with data protection regulations such as GAPR to maintain trust .

b) Algorithmic Bias:

AI Systems can hinder and perpetuate biases present in training data, leading to unfair of discriminatory practices. This can negatively impact customer experiences and damage brand reputation.

C) High Implementation Cost:

Developing and integrating AI technologies involves substantial financial investment in infrastructure, software and skilled personnel. Small and medium enterprises may struggle with these costs.

d) Lack of transparency:

Many AI models, especially deep learning system fraction as 'black boxes' making it difficult to understand how decisions are made. This lack of explainabilty can hinder accountability and trust.

e) Dependence on quality data:

The effectiveness of Al depends heavily on the quality and divercting of the data it processes, Poor data quality can lead to inaccurate insights and flawed decision.

f) Job displacement:

Automation of certain roles, such as customer Service or Logistics can lead to job displacements, raising ethical and social concerns that businesses must address responsibly.

IMPACT OF AG IN E-COMMERCE INDUSTRY.

i) Revenue Growth & Profitability:

a) A2 powered dynamic pricing can boost profit margins by up to 25%

b) A2 driven personalized recommendation account hr 35% of Amazons revenue

ii) Customer Engagement & conversion:

a) AI driven personalized marketing leads to a 20% increase in sales.

b) AI driven e-mail campaigns result in a 23% higher Conversion rate.

c) AI powered visual search boosts Conversion rates by 15%.

iii) Operational efficiency:

a) AI powered chat bots can save e-commerce companies up to $ 8 billion annually by 2022.

b) Al driven fraud detection Systems: Can reduce fraudulent transactions by 40%.

c) AI powered customer Service response are 99% accurate in e-Commerce

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iv) Customer retention & Churn Reduction:

a) AI driven predictive analysis, can reduce customer Churn by 35%

b) AI driven customer Segmentation increases marketing ROI by 30%

v) Inventory and supply chain Reduction:

a) AI driven predictive analytics. can reduce customer churn by 35%

b) AI driven market forecast can reduce inventory cost by upto 50%

CONCLUSION:

AI is revolutionizing e-commerce by enhancing personalization, optimizing operation and transforming the online shopping experience. From personalized product recommendation and virnealassistants to inventory management and fraud detection. AI- powered solutions and reshaping the e-commerce landscape. The integration of Al technologies empowers business to deliver seamless and tailored experiences, improve customer engagement, and loyalty, and drive growth in the competitive e-commerce market. As AI continues to evolve, we can expect even more exciting advancements that will further transform the further of e-commerce, providing increasingly personalized and intuitive shopping experiences for customers worldwide.

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THE ROLE OF AI IN FRAUD DETECTION AND CYBER SECURITY FOR ONLINE TRANSACTIONS

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ABSTRACT

The rapid proliferation of online transactions across e-commerce, banking, and digital payment platforms has increased exposure to fraud and cyber threats. Fraudulent activities such as identity theft, account takeover, and payment fraud not only cause substantial financial losses but also erode consumer trust. Traditional rule-based fraud detection systems often fail to detect sophisticated, evolving fraud patterns. This paper explores the transformative role of Artificial Intelligence (AI) in enhancing fraud detection and cyber security in online transactions. We review state-of-the-art AI techniques including machine learning, deep learning, and hybrid models and their application in real-time fraud detection systems. Challenges such as data imbalance, privacy issues, and adversarial attacks are examined. Through evaluation metrics and case studies, we analyze the effectiveness of AI-based solutions and their deployment in commercial environments. Furthermore, the paper discusses future research directions including explainable AI, privacy preserving techniques, and the integration of block chain with AI for secure online transactions. The study underscores AI's potential to build resilient cyber security frameworks that protect both consumers and enterprises in the digital economy.

Keywords:

Artificial Intelligence, Fraud Detection, Cyber security, Online Transactions, Machine Learning, Deep Learning, Data Privacy.

INTRODUCTION

In the digital era, the convenience of online transactions has brought a parallel rise in cyber threats and fraudulent activities. From phishing attacks and identity theft to unauthorized transactions and data breaches, cyber security threats have become more complex and widespread. Traditional security systems are increasingly inadequate in coping with these sophisticated threats. This has led to the growing integration of Artificial Intelligence (AI) in fraud detection and cyber security. For computer science students, understanding how AI is revolutionizing this space is not only academically enriching but also essential for future innovation and career readiness.

As digital payment platforms, online banking, and e-commerce systems continue to expand, so does the volume and complexity of cybercrime. Attackers now use advanced tools and tactics, often powered by AI themselves, to exploit vulnerabilities in online systems. The dynamic and constantly evolving nature of these threats makes it difficult for static, rule-based security systems to keep up, leading to financial loss, reputational damage, and legal implications for individuals and organizations alike.

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Objectives

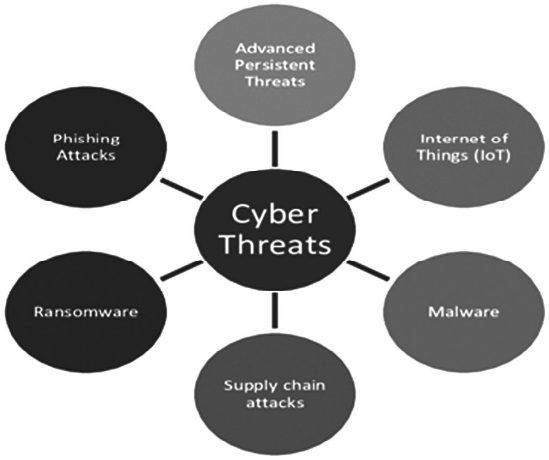
1. To identify common types of cyber threats and frauds in online financial transactions.
2. To learn about AI techniques used in fraud detection.
3. To investigate the challenges, limitations, and ethical concerns of using AI in cyber security.

Research Methodology

This study involves a literature review, expert interviews, and analysis of fraud datasets to identify cyber threats and AI techniques. It also examines challenges, limitations, and ethical concerns through case studies and qualitative data from cyber security professionals.

UNDERSTANDING ONLINE TRANSACTION FRAUD AND CYBER SECURITY THREATS

Online transaction fraud and cyber security threats have become major concerns in today's digital economy. As more financial activities shift to online platforms, cybercriminals exploit vulnerabilities to commit fraud, steal sensitive data, and disrupt services. Common threats include phishing, identity theft, account takeovers, malware, and fake websites designed to trick users into revealing personal information. These attacks often bypass traditional security systems, leading to financial losses and compromised user trust. Understanding these threats is essential for developing effective security measures. With the rise of sophisticated cyber-attacks, advanced technologies like Artificial Intelligence are increasingly used to detect, prevent, and respond to online fraud.



- ***Advanced Persistent Threats (APTs):*** These are covert cyberattacks where an attacker gains unauthorized access to a network and remains undetected for an extended period, aiming to steal sensitive data, conduct espionage, or sabotage critical systems. APTs are typically well-funded and use sophisticated techniques, often targeting national governments and large corporations.
- ***Phishing Attacks:*** These are social engineering attacks where cybercriminals trick individuals into divulging sensitive information (like passwords or credit card numbers) or downloading malware by masquerading as a trustworthy entity in electronic communications (e.g., emails, texts, websites).
- ***Internet of Things (IoT):*** IoT security risks arise from the vulnerabilities in the connected devices and networks of the Internet of Things, making them susceptible to attacks due to issues like weak authentication, unencrypted data transmission, and outdated firmware, leading to potential data breaches, unauthorized access, and operational disruptions.
- ***Malware:*** This is an umbrella term for malicious software designed to disrupt, damage, or gain unauthorized access to computer systems, networks, or users. Examples include viruses, worms, Trojans, ransomware, spyware, and adware.

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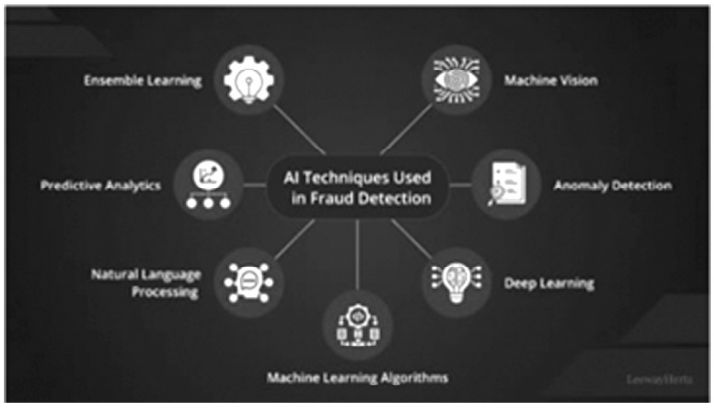
- ***Supply chain attacks:*** These attacks exploit third-party dependencies in an organization's supply chain (e.g., software vendors, hardware components) to infiltrate a target's system or network. Attackers compromise a trusted external partner or product to gain access to the ultimate target.
- ***Ransomware:*** This is a type of malicious software that encrypts a victim's files or systems, making them inaccessible, and demands a ransom payment (often in cryptocurrency) in exchange for a decryption key to restore access.

THE ROLE OF ARTIFICIAL INTELLIGENCE IN FRAUD DETECTION

Artificial Intelligence (AI) plays a pivotal role in transforming fraud detection by enabling systems to move from traditional, rule-based approaches to dynamic, data-driven decision-making. Unlike static systems that rely on predefined rules and thresholds, AI-powered fraud detection systems can learn from historical data to identify complex patterns, correlations, and anomalies in real-time. Machine learning algorithms, such as decision trees, neural networks, and support vector machines, are trained on large datasets of legitimate and fraudulent transactions. These models then use this training to evaluate new transactions and flag those that appear suspicious. This allows AI to detect previously unknown types of fraud, adapt to evolving threats, and significantly reduce the time it takes to identify malicious activity.

AI TECHNIQUES USED IN FRAUD DETECTION

AI techniques in fraud detection leverage machine learning, deep learning, and data analytics to identify suspicious patterns and anomalies in financial transactions. These methods enable faster, more accurate detection of fraudulent activities, reducing losses and enhancing security in digital financial systems.



- ***Ensemble Learning :*** Ensemble learning combines multiple machine learning models (like decision trees or neural networks) to improve overall prediction accuracy and robustness in fraud detection. This can involve techniques such as boosting, bagging, or stacking, where diverse models are trained and their predictions are combined to make a more reliable decision on whether a transaction or activity is fraudulent.
- ***Machine Vision :*** Machine Vision, or Computer Vision, uses algorithms to "see" and interpret visual data. In fraud detection, this can involve analyzing images of documents (e.g., passports, driver's licenses) to detect signs of tampering, identify inconsistencies, or verify identities against databases to prevent identity fraud or document forgery.

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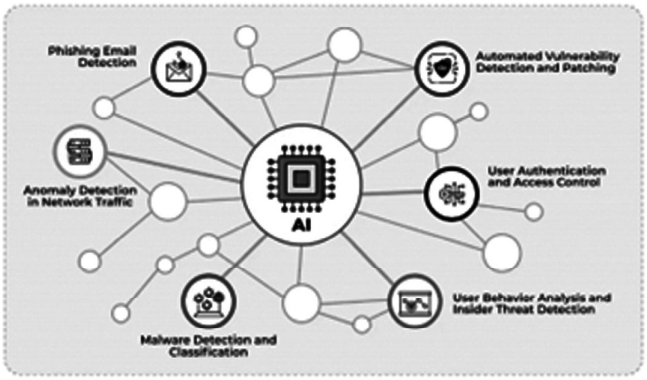
- ***Anomaly Detection:*** Anomaly Detection focuses on identifying unusual patterns or behaviors in data that deviate significantly from the norm, flagging potential fraudulent activities that don't fit established patterns. This is crucial for detecting new or evolving fraud schemes that might not be caught by rule-based systems.
- ***Deep Learning:*** Deep Learning, a subset of machine learning, employs artificial neural networks with multiple layers to learn and recognize complex patterns from vast amounts of data. In fraud detection, deep learning models can analyze various data points, including transaction details, user behavior, and network information, to identify sophisticated fraud schemes with high accuracy.
- ***Machine Learning Algorithms:*** Machine Learning Algorithms are the core of AI-powered fraud detection, enabling systems to learn from data and improve their performance over time without explicit programming. Various algorithms, like logistic regression, decision trees, or random forests, are trained on historical data to classify transactions as legitimate or fraudulent based on identified patterns.
- ***Natural Language Processing (NLP):*** NLP allows AI systems to understand, interpret, and process human language. In fraud detection, NLP can be used to analyze text-based data like emails, social media posts, or customer service interactions to detect phishing attempts, identify suspicious language patterns, or monitor for signs of social engineering attacks.
- ***Predictive Analytics:*** Predictive Analytics uses historical data and statistical algorithms to forecast future outcomes and identify potential fraud before it occurs. By analyzing patterns in past fraudulent and legitimate activities, predictive models can assess the likelihood of future fraud events, enabling proactive prevention measures and risk management

AI IN CYBER SECURITY APPLICATIONS

Artificial Intelligence (AI) is increasingly used in cyber security to enhance the detection, prevention, and response to cyber threats. AI-powered systems can analyze vast amounts of data in real-time to identify unusual patterns, detect intrusions, and respond to attacks automatically. Techniques such as machine learning, natural language processing, and anomaly detection help in recognizing malware, phishing attempts, and network breaches with high accuracy. AI also enables predictive threat intelligence, allowing systems to anticipate and prevent attacks before they occur. By continuously learning and adapting, AI significantly strengthens cyber security defenses, making digital environments more resilient against evolving and complex cyber threats**.**



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- ***Anomaly Detection in Network Traffic***

  Anomaly detection helps identify unusual or malicious network behavior. Recurrent Neural Networks (RNNs) process sequential data like network logs to detect deviations from normal patterns. They flag threats such as DDoS attacks or data leaks in real-time, adapting to changing traffic to enhance network security and reduce response time.

- ***Malware Detection and Classification***

  Convolution Neural Networks (CNNs) analyze binary files to detect malware. Trained on datasets of both benign and malicious files, CNNs learn patterns associated with threats. They classify new files quickly and accurately, enabling early detection and prevention of attacks, even as malware variants evolve to bypass traditional systems.

- ***User Authentication and Access Control***

  AI enhances access control using CNNs, RNNs, and Graph Neural Networks (GNNs). CNNs handle biometric data like fingerprints, RNNs monitor user behavior, and GNNs map relationships between users and resources. Combined, they create layered, intelligent authentication systems that detect unauthorized access and reduce the risk of data breaches.

- ***Phishing Email Detection***

  RNNs and CNNs help detect phishing emails. RNNs analyze text for suspicious patterns, while CNNs examine embedded images or logos. Together, they identify phishing attempts by evaluating both visual and textual content, increasing detection accuracy and protecting users from scams, identity theft, and malware installations through email.

- **User Behavior Analysis and Insider Threat Detection**

  RNNs monitor user activity patterns, while GNNs model network relationships to detect anomalies. When real-time behavior deviates from expected norms, the system flags potential insider threats. This approach helps organizations detect risky actions early and take proactive measures to secure sensitive data and internal systems.

- ***Automated Vulnerability Detection and Patching***

  RNNs and CNNs automate the discovery of software vulnerabilities. RNNs scan source code for risky patterns, while CNNs review configuration files for security flaws. This AI-driven process suggests patches or corrections, reducing the time to fix issues and helping maintain secure, up-to-date systems with minimal manual intervention.

CHALLENGES, LIMITATIONS, AND ETHICAL CONCERNS OF USING AI IN CYBER SECURITY

The integration of AI in cyber security presents several significant **challenges**. One of the primary difficulties lies in the complexity of evolving cyber threats. Attackers continuously develop new tactics that can bypass AI-based defenses, requiring constant updates and retraining of AI models. Additionally, AI systems can generate false positives or negatives, leading to either unnecessary alerts that overwhelm security teams or missed threats that compromise systems. The reliance on large volumes of quality data for training these AI models is another hurdle, as incomplete or biased datasets can degrade the system's effectiveness.

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LIMITATIONS

AI in cyber security are also notable. While AI can automate threat detection and response, it lacks true understanding and intuition, which human experts provide. AI models can be vulnerable to adversarial attacks, where malicious actors intentionally manipulate inputs to deceive the AI system. Furthermore, AI tools can be resource-intensive, requiring significant computational power and infrastructure, which may not be feasible for all organizations. The dependency on AI could also create a false sense of security, leading some organizations to under invest in other critical cyber security practices.

ETHICAL CONCERNS

It arises around privacy, accountability, and transparency in the use of AI for cyber security. AI systems often analyze vast amounts of user data, raising questions about consent and data protection. There is also the issue of bias in AI algorithms, which can lead to unfair treatment or discrimination in automated decisions. Accountability becomes murky when AI-driven decisions cause harm or fail to prevent breaches—determining responsibility between human operators and AI developers is complex. Lastly, transparency is critical but challenging, as many AI models operate as "black boxes," making it difficult to explain their reasoning or decisions to stakeholders, thus complicating trust and regulatory compliance.

CONCLUSION

AI plays a vital role in enhancing fraud detection and cyber security in online financial transactions. While AI techniques improve threat identification and response speed, challenges such as evolving cyber attacks, data quality, and resource demands persist. Limitations like vulnerability to adversarial attacks and overreliance on AI highlight the need for human oversight. Ethical concerns around privacy, bias, and accountability must be carefully addressed to build trust and ensure responsible AI use. Overall, integrating AI with traditional cyber security measures offers promising advancements but requires ongoing evaluation and ethical vigilance.

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IMPACT OF DIGITAL BANKING DURING EMERGENCIES

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ABSTRACT

Digital banking has emerged as a crucial financial tool in times of crisis, providing uninterrupted access to funds, secure transactions and efficient distribution of resources. During emergencies such as pandemics, natural disasters and sudden financial shocks, digital banking services - including mobile banking, Unified Payments Interface (UPI), internet banking and e-wallets - enabled individuals and governments to manage financial needs effectively. The COVID-19 pandemic highlighted its importance by facilitating contactless payments, enabling direct benefit transfers (DBT) to vulnerable populations and reducing dependence on physical cash. Despite these advantages, challenges such as limited digital literacy, lack of internet access, and rising cyber security risks hindered its full potential, especially among daily wage earners and rural communities. This study emphasizes both the opportunities and obstacles of digital banking in emergencies, highlighting the need for stronger digital infrastructure, inclusive financial literacy programs, and robust cyber security measures. Strengthening these areas will ensure that digital banking remains a reliable and inclusive lifeline during future emergencies.

Keywords:

Digital Banking, Emergencies, UPI, Financial Inclusion, COVID-19, Cashless Economy, Financial Literacy.

INTRODUCTION

In recent years, digital banking has emerged as a transformative force in the global financial system, providing faster, safer, and more convenient financial services. The reliance on digital banking becomes particularly critical during emergencies, such as natural disasters, pandemics, and economic crises. In such situations, traditional banking services are often disrupted, leaving individuals and businesses vulnerable (World Bank, 2022). Digital banking helps bridge this gap by enabling uninterrupted access to funds, online transactions, and financial support systems. Moreover, it promotes financial inclusion by ensuring that even marginalized groups can engage in secure financial activities without depending on physical infrastructure (RBI, 2023). Understanding the impact of digital banking during emergencies is essential for policymakers, financial institutions, and the public to enhance resilience and ensure economic stability in times of crisis.

DIGITAL BANKING

According to **Singh and Kaur (2019)**, digital banking is "the automation of traditional banking services that allows customers to access financial products and services online through electronic devices."

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World Bank (2020) explains digital banking as "the provision of financial services via digital channels including mobile phones, internet, and cards, ensuring accessibility and efficiency for customers."

DIGITAL BANKING SOLUTIONS FOR BUSINESSES AND INDIVIDUALS

Digital banking services have evolved into various forms to provide customers with convenient, secure, and efficient financial access. The following are the major types of digital banking services:

1. ***Internet Banking***. Customers access banking services through official websites to perform tasks such as fund transfers, loan applications, and bill payments (Reserve Bank of India [RBI], 2023).
2. ***Mobile Banking***. Mobile applications enable users to make instant transactions, check balances, and use QR codes for payments (World Bank, 2022).
3. ***Automated Teller Machines (ATMs).*** ATMs are among the earliest forms of digital banking, providing round-the-clock cash withdrawals, deposits, and balance inquiries (RBI, 2023).
4. ***Electronic Fund Transfer Systems***. Services such as National Electronic Funds Transfer (NEFT) and Real-Time Gross Settlement (RTGS) allow secure transfer of funds across banks (World Bank, 2022).
5. ***Point of Sale (POS) Systems***. POS terminals enable cashless payments using debit cards, credit cards, and mobile wallets (RBI, 2023).
6. ***Unified Payments Interface (UPI).*** UPI allows instant money transfers through mobile phones using virtual IDs and QR codes without requiring detailed account information (RBI, 2023).
7. ***Digital Wallets and Prepaid Cards***. Applications such as Paytm, Google Pay, and PhonePe store digital money, enabling users to make seamless online and offline transactions (World Bank, 2022).
8. ***Electronic Bill Payment Systems***. Customers can pay electricity bills, water bills, taxes, and subscriptions directly through digital channels (RBI, 2023).
9. ***Chatbots and AI-Based Services***. Many banks now use artificial intelligence to provide 24/7 support for queries, transactions, and financial planning (World Bank, 2022).
10. ***Digital Lending Platforms.*** Customers can apply for loans, credit cards, and equated monthly installment (EMI) services without visiting bank branches (RBI, 2023).

NECESSITY OF DIGITAL BANKING IN DAILY LIFE

Digital banking has become an essential part of everyday life, providing convenience, speed, and security in financial transactions. Unlike traditional banking, which requires physical visits to branches, digital banking enables people to access their accounts, transfer funds, and pay bills anytime and anywhere. This 24/7 accessibility saves time and effort, making financial management more efficient (Kaur & Singh, 2019).

In daily life, digital banking supports common needs such as paying electricity bills, recharging mobile phones, buying groceries, purchasing bus or train tickets, and shopping online. With the rise of Unified Payments Interface (UPI) and mobile wallets, even small transactions can be done instantly without the need for cash (Verma, 2021).

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Furthermore, digital banking ensures safety during emergencies. For instance, sudden hospital expenses, urgent money transfers, and online purchases of necessities can be handled immediately through mobile apps or internet banking. This makes financial services not only faster but also more reliable in critical situations (Sharma, 2022).

In addition, digital banking promotes a cashless economy, reduces paperwork, and brings transparency to financial transactions. For elderly people and those living in remote areas, it reduces the need for frequent bank visits by enabling home-based financial services (Patel, 2022).

Thus, digital banking is no longer optional but a necessity in modern daily life, ensuring financial inclusion, convenience, and resilience.

DIGITAL BANKING AS A LIFELINE IN EMERGENCIES

Digital banking has become a lifeline in times of emergencies, offering quick, reliable, and accessible financial solutions when traditional systems may fail or become unavailable. Whether during pandemics, natural disasters, wars, or sudden medical needs, digital banking ensures that individuals can access and transfer funds without visiting physical branches.

HEALTH AND PANDEMIC EMERGENCIES.

During the COVID-19 pandemic, digital banking played a crucial role in reducing the need for physical contact. Customers used mobile apps, online banking, and UPI-based transactions to pay hospital bills, buy medicines, and order essential items without exposing themselves to health risks (Kaur & Singh, 2019).

NATURAL DISASTERS.

In natural disasters such as earthquakes and floods, banking infrastructure may be disrupted. Digital banking enables people to continue transactions using mobile devices, receive government aid directly into accounts, and manage urgent financial needs (Reddy & Thomas, 2020).

WAR TIME AND CONFLICT SITUATIONS.

During wars or conflicts, cash shortages and banking restrictions often arise. Digital platforms provide a safe means of transferring funds across regions and purchasing essential goods through online stores, ensuring survival even when physical economies collapse (Ali & Khan, 2021).

DAILY NECESSITIES DURING EMERGENCIES.

In urgent situations, such as paying transportation fares, utility bills, or grocery expenses, digital banking ensures seamless transactions. This allows people to focus on safety and recovery instead of searching for cash (Verma, 2021).

Thus, digital banking not only ensures continuity of financial services but also strengthens resilience, making it a true lifeline in emergencies.

HURDLES IN IMPLEMENTING DIGITAL BANKING

While digital banking has transformed financial services, its implementation faces several significant hurdles. These challenges affect banks, customers, and policymakers and must be addressed for effective adoption.

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1. **Technological Infrastructure**

   Digital banking requires robust IT infrastructure, including secure servers, fast internet, and reliable software platforms. Inadequate infrastructure, especially in rural areas, can hinder seamless banking operations (Kaur & Singh, 2019).

2. **Cybersecurity Concerns**

   The risk of hacking, phishing, malware attacks, and data breaches is a major hurdle. Banks must invest in advanced security measures to protect sensitive customer information and maintain trust (Sharma, 2022).

3. **Digital Literacy**

   Many customers, particularly the elderly and rural populations, lack the necessary digital skills to use online banking services. This limits the reach and effectiveness of digital banking (Patel, 2022).

4. **Regulatory and Compliance Issues**

   Implementing digital banking requires adherence to financial regulations, KYC norms, and cybersecurity guidelines. Navigating these legal requirements can be complex and time-consuming for banks (Reddy & Thomas, 2020).

5. **Resistance to Change**

   Some customers and even bank staff prefer traditional methods due to habit, mistrust of digital systems, or fear of fraud. Overcoming this mindset is essential for successful digital banking adoption (Verma, 2021).

6. **Operational Challenges**

   Frequent system downtime, software bugs, and transaction failures can disrupt services, especially during peak periods or emergencies, creating user dissatisfaction (Ali & Khan, 2021).

APPROACHES TO ENHANCE DIGITAL BANKING USAGE

Digital banking has revolutionized financial services, but it faces several challenges, including cybersecurity threats, lack of digital literacy, limited technological infrastructure, and user resistance. To overcome these hurdles, banks and policymakers must implement multiple strategies. Strengthening cybersecurity through encryption, two-factor authentication, and regular system audits builds trust and protects sensitive customer data (Sharma, 2022). Promoting digital literacy, particularly among the elderly and rural populations, helps users navigate mobile banking, online transactions, and digital wallets effectively (Patel, 2022). Enhancing technological infrastructure, such as reliable servers, cloud-based platforms, and uninterrupted internet connectivity, ensures smooth operations even in remote regions (Kaur & Singh, 2019). Simplifying banking processes with user-friendly interfaces and streamlined KYC procedures reduces operational complexity and encourages wider adoption (Reddy & Thomas, 2020). Additionally, transparent communication about security, privacy policies, and strong customer support fosters trust, while incentives like cashback, rewards, and reduced transaction fees motivate users to embrace digital banking services more frequently (Verma, 2021; Ali & Khan, 2021). Collectively, these strategies enable banks to overcome challenges and enhance the accessibility, efficiency, and reliability of digital banking.

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CONCLUSION

Digital banking has proven to be an indispensable tool during emergencies, providing quick, secure, and accessible financial services when traditional banking systems may be disrupted. During crises such as pandemics, natural disasters, wars, or sudden medical needs, digital platforms enable instant fund transfers, bill payments, and online purchases, reducing dependency on physical branches and cash transactions. It also promotes financial inclusion by reaching rural populations and vulnerable groups who might otherwise struggle to access banking services. Despite challenges such as cybersecurity risks, limited digital literacy, and technical issues, the benefits of digital banking - convenience, efficiency, and resilience—highlight its critical role in ensuring continuity of financial operations during emergencies. Strengthening infrastructure, enhancing digital literacy, and building customer trust will further enhance the impact of digital banking, making it a reliable lifeline in times of crisis (Kaur & Singh, 2019; Sharma, 2022; Verma, 2021).

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ARTIFICIAL INTELLIGENCE FOR ACCURATE LUNG CANCER DETECTION FROM CT SCANS IN THE MEDICAL FIELD

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ABSTRACT

Lung cancer remains one of the leading causes of cancer-related deaths worldwide. Early and accurate detection of lung cancer from chest CT scans significantly improves patient outcomes. Recent advancement in Artificial Intelligence (AI), especially Deep Learning (DL), has become a powerful tool in medical imaging for the accurate detection of lung cancer. Computed Tomography (CT) scans are the primary imaging modality for screening and diagnosis.AI techniques perform automated **segmentation** of lung regions, **detection** of suspicious nodules, and **classification** of nodules into benign or malignant categories. AI models such as **U-Net, SegNet, and TransUNet** can automatically segment the lungs and highlight suspicious nodules.AI systems use **object detection models** (e.g., Faster R-CNN, YOLO, 3D CNNs) to locate nodules within CT images.**Convolutional Neural Networks (CNNs)** and **Vision Transformers (ViTs)** can classify nodules into **benign or malignant** categories with high accuracy. This helps to avoid unnecessary biopsies and reduces patient stress. This paper proposes an end-to-end Artificial Intelligence framework that combines (1) robust **pre-processing**, (2) semantic **segmentation** to delineate lung regions and lesions, (3) **classification** to determine malignancy probability, and (4) object-**detection** to localize suspicious nodules. We integrate modern Convolutional Neural Network (CNN) architectures with attention mechanisms and multi-scale features to handle variable nodule sizes and image artifacts. These approaches significantly reduce the chances of missed diagnosis, assist radiologists with decision support, and enable early intervention strategies. The findings suggest that AI serves as a powerful assistive technology, offering consistent, accurate, and efficient analysis, ultimately improving patient outcomes in the clinical field.

INTRODUCTION

Lung cancer accounts for nearly one-fifth of all cancer-related deaths globally. According to the World Health Organization (WHO), early detection of lung cancer remains the most effective strategy for reducing mortality rates. Chest CT scans have become the standard imaging modality for early diagnosis due to their high sensitivity in detecting pulmonary nodules. However, manual interpretation of CT scans is time-consuming and subject to inter-observer variability, which can lead to misdiagnosis. Recent progress in Artificial Intelligence (AI) and Deep Learning (DL) offers promising avenues for accurate, consistent, and automated lung cancer detection.This paper presents a

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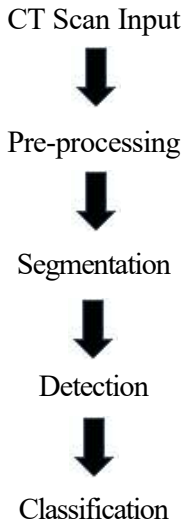
comprehensive overview of AI-driven approaches for lung cancer detection, including segmentation, classification, and object detection. It also proposes an integrated framework that combines these steps for improved clinical decision-making.

BACKGROUND AND RELATED WORK

DL has revolutionized medical imaging by enabling machines to learn hierarchical features directly from input data (CT scan images) [4]. The workflow of AI in lung cancer detection is shown in Figure 1. and the three essential steps are:

- **Segmentation:** Identifying lung regions and separating nodules from surrounding tissues. U-Net, SegNet, and TransUNet [2] have been widely used for this purpose.
- **Detection:** Locating suspicious nodules within the lungs using models such as Faster R-CNN, YOLO, and 3D CNNs.
- **Classification:** Determining whether detected nodules are benign or malignant. CNNs and Vision Transformers (ViTs) provide state-of-the-art performance in this task.

Figure 1. **Workflow of AI in Lung Cancer Detection**



PROPOSED AI FRAMEWORK FOR LUNG CANCER DETECTION

The proposed framework integrates the following essential components which shows in Figure 2.:

1. **Pre-processing:** Enhancing CT scan images by applying noise reduction, normalization, and resizing to ensure consistent input.
2. **Segmentation:** Using deep learning models like U-Net and TransUNet to delineate lung regions and highlight nodules.
3. **Detection:** Applying object detection architectures such as Faster R-CNN and YOLO to localize nodules within the segmented lung regions.

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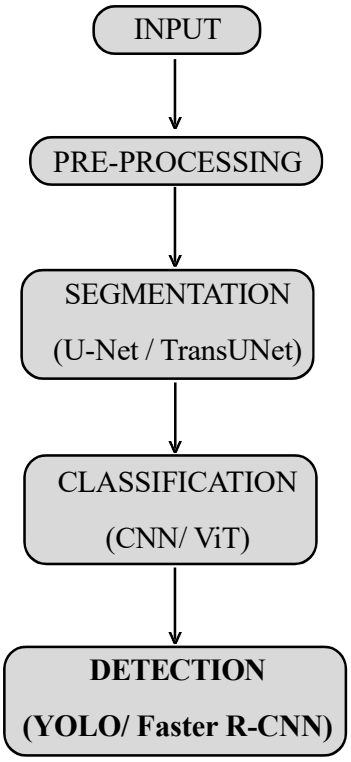
4. **Classification:** Employing CNNs and Vision Transformers for malignancy prediction, improving decision-making accuracy.

The novelty of the proposed approach lies in combining attention mechanisms with multi-scale feature extraction to handle nodules of varying sizes, shapes, and imaging artifacts. This integration improves the robustness and clinical applicability of AI-based lung cancer detection [3].

Figure 2. **Deep Learning-based Architecture for Lung Cancer Detection**



RESULTS AND DISCUSSION

AI-powered lung cancer detection offers several benefits:

- ***Accuracy and Consistency:*** AI systems reduce inter-observer variability and human error.
- ***Early Diagnosis:*** Early identification of malignant nodules enables timely treatment and improved survival rates.
- ***Efficiency:*** Automated systems reduce radiologists' workload and provide faster analysis.
- ***Decision Support:*** AI serves as a second reader, offering confidence scores and malignancy probabilities to aid clinical decisions.

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Table 1. **Comparison of AI Models for Lung Cancer Detection**

Model	Task	Accuracy	Strengths	Limitations
U-Net	Segmentation	~92%	Precise lung boundary delineation	Sensitive to artifacts
TransUNet	Segmentation	~95%	Attention-based feature learning	Requires large datasets
Faster R-CNN	Detection	~90%	High detection sensitivity	Computationally heavy
YOLO	Detection	~88%	Fast real-time detection	May miss tiny nodules
CNN + ViT	Classification	~93–96%	Robust malignancy classification	Needs balanced dataset

Recent clinical studies demonstrate that combining segmentation, detection, and classification achieves sensitivity and specificity above 90%. However, challenges remain in terms of dataset availability, interpretability of AI models, and integration into clinical workflows.

CONCLUSION

Artificial Intelligence represents a transformative advancement in lung cancer detection from CT scans. The integration of pre-processing, segmentation, detection, and classification into a unified framework significantly improves diagnostic performance. Future research should focus on explainable AI (XAI), federated learning for multi-centre data sharing, and clinical trials to validate AI systems in real-world settings. By addressing these challenges, AI can become an indispensable tool in modern oncology, ultimately reducing mortality and improving patient outcomes.

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ARTIFICIAL INTELLIGENCE IN BANKING AND FINANCIAL SERVICES

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ABSTRACT

Artificial Intelligence (AI) is increasingly shaping the financial services industry by improving operational efficiency, enhancing decision-Making and driving innovation. AI techniques such as machine learning, deep learning, and natural language processing are applied in diverse areas including fraud detection, credit risk assessment, algorithmic trading, portfolio optimization, and customer service automation. Financial institutions leverage AI to analyze large volumes of structured and unstructured data in real time, enabling more accurate forecasting and personalized services. However, the integration of AI also presents challenges related to data security, ethical considerations, algorithmic bias, and regulatory compliance. This paper explores the role of AI in financial services, highlighting its benefits, risks, and implications for the future of the global financial system. Artificial Intelligence (AI) is changing the way financial services work. Banks and financial institutions now use AI for fraud detection, loan approvals, customer service, and stock market predictions. AI helps analyze huge amounts of data quickly and provides accurate insights, making financial decisions easier and faster. It also improves customer experience through chatbots and personalized services. At the same time, AI raises concerns about data privacy, security, and fairness. Overall, AI is becoming an important tool that is shaping the future of banking and finance.

Keywords:

Artificial Intelligence, Financial Services, Machine Learning, Risk Management, Data Analytics.

INTRODUCTION

"Artificial Intelligence is typically defined as the ability of a machine to perform cognitive functions we associate with human minds, such as perceiving, reasoning, learning, interacting with the environment, problem solving, and even exercising creativity". However, Artificial Intelligence (AI) is a combination of advanced computational technologies in varying degrees of maturity.

AI IN FINANCIAL SERVICES

There are also a range of improvements in the way communications, customer support, and recruiting and asset management take place throughout financial sector. Today, for example, stock investing and finance is all about technical skills and divine luck. Yet in the future, with the aid of sentiment analysis, crowd sourced data and algorithms, we will be able to handle money in a much different way. The Different AI application in Banking and Financial Services are:

Customer Support and Marketing

a) Chatbots: Self-learning programs for intelligent conversations with humans over chat or audio; Available 24×7 and very easy to use but require long time for training.

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b) Robo-Advisors for Financial Products: Online platforms that use algorithms to offer financial advice reinvest dividends, automatic portfolio creation and re-balancing of the portfolio etc. This require minimal to zero human intervention.

c) Personalized Financial Services: Robo-advisors to monitor customer goals and suggest stocks or bonds to buy/sell; Gives personalized attention to customers irrespective of their risk appetite.

d) Smart Wallets: Intelligence added to mobile wallets for smart services like chat, booking of bus tickets, cab, events, movies, utility bill payments, etc.

e) Emotion AI: A branch of AI to enable machines to detect human emotions with advanced facial and voice recognition technologies.

Security and Compliance:

a) Fraud Detection and Prevention: Minimize need to add continuous manpower to detect and block security attacks. These platforms use machine learning to automate the process.

b) Compliance Monitoring: Use AI to examine lengthy documents and flag potential issues in seconds, which would otherwise take many hours.

c) Intelligent QRC: A new segment of Artificial Intelligence companies that specialize in helping companies remain compliant, e.g. ensure no document is missed out while filing something, do risk mitigation by monitoring customer behaviour from empirical data.

Back-End BPM

a) Robotic Process Automation: The use of software robots to take over high volume, back-office processes and repetitive tasks to save time, enhance efficiency, and increases accuracy.

b) Algorithmic Trading: AI for high-frequency trading where inputs are taken from multiple financial markets to make investment decisions in milliseconds. Reports suggest that over 70% of trading worldwide today is being managed by algorithms.

c) Investment Research: AI to guide investors on stock picking decisions. It can help cover more companies in exchanges all over the world, do their research and portfolio management.

d) Human Resources: AI to save hiring manager's time in various recruitment processes e.g. engage with new recruits, shortlist resumes from social media sites, pre-screen candidates over chat, determine candidate drop out chances, etc.

OBJECTIVE OF THE STUDY

Following are the important objectives of the present study.

1. To study about Artificial Intelligence in Banking and Financial Services in perceptions of clients or consumers.
2. To study the areas and the application where the Artificial Intelligence is being used by the Banking and Financial Services.
3. To Study about Banking and Financial Services for using Artificial Intelligence is to offer customized Product.

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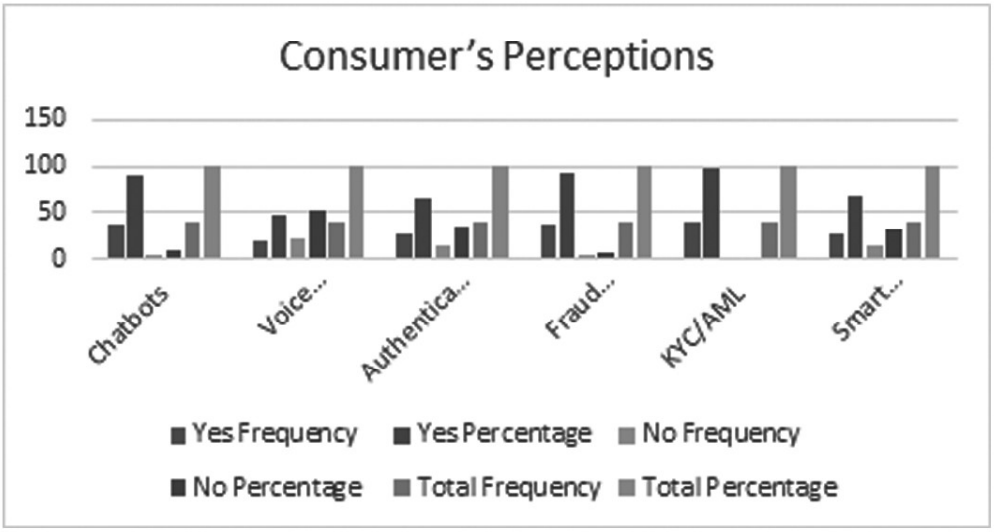
SCOPE OF THE STUDY

Study of Artificial Intelligence in Banking and Financial Services in specific private banks and private institutions is constrained to client benefits as it were.

DATA AND METHODOLOGIES

The data gathered is Primary and Secondary data, which is qualitative data, which was further analyzed in order to draw conclusions and suggestions. The Primary data was gathered through a survey on artificial intelligence in banking and financial services. A questionnaire was drafted for the survey and random sampling was done. The secondary data collection was done through internet which includes web, e. magazines, research papers, e-books, newspapers etc.

Figure 1 **– Consumer's Perception about AI**



The above figure shows the consumer's perceptions about Artificial Intelligence in Banking and Financial Services which is determine most of the respondents strongly agree with Artificial Intelligence applications user friendly.

Table 1 **Multiple Response Analysis**

Useful Applications of AI	Yes		No		Total	
	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage
Chatbots	36	90	4	10	40	100
Voice Assistants	19	47.5	21	52.5	40	100
Authentication and biometrics	26	65	14	35	40	100
Fraud detection and Prevention	37	92.5	3	7.5	40	100
KYC/AML	39	97.5	1	2.5	40	100
Smart Wallet	27	67.5	13	32.5	40	100

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The above table shows that the frequency analysis for evaluating the useful applications of AI in Banking and Financial Services revealed that 90% of respondents says Chatbots applications of AI is very useful in BFS, 52.5% of respondents says Voice Assistants is not useful in BFS, 65% of respondents says Authentication and Biometrics is very useful, 92.5% respondents says fraud and detection and prevention is used to secure the data, 97.5% respondents says applications of KYC /AML is very useful to provide documents and other details to submit in BFS and 67.5% respondents says Smart Wallet applications in AI handling cashless Transactions in this generation.

CONCLUSION

Artificial Intelligence has numerous advantages to offer for the financial segment. Based on the findings, it can be concluded that Artificial Intelligence in Banking and Financial Services satisfying their clients or consumer's needs. Banking and Financial Services consumers have good awareness about Artificial Intelligence applications. Adoption of Banking and Financial Services AI in applications was highest followed by KYC/AML, Chatbots and Security Compliance and also helping to fulfil the customer demand faster and easier. The consumers more commitment from representatives to the banking and financial services by giving development innovative preparing to improve the AI procedures in the workplace. It is also being used to meet regulatory compliance, detect fraud, and assess individual creditworthiness.

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EMPOWERING CONSUMER INSIGHTS: AI-DRIVEN MARKETING WITH THE PERSPECTIVE OF WOMEN CONSTABLES

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ABSTRACT

Artificial Intelligence (AI) in marketing is defined as the application of machine learning, data analytics, and predictive algorithms to understand consumer behavior and enhance decision-making. This extends beyond traditional marketing approaches to include real-time personalization, predictive insights, and automated engagement with consumers. AI not only transforms how businesses connect with their customers but also provides deeper insights into consumer needs and preferences. The involvement of women constables as a focused study group brings a unique perspective, as they represent a segment with distinct occupational roles, challenges, and consumer behavior patterns. The main objective of this study is to explore how AI-driven marketing tools can capture and analyze the consumer insights of women constables, both as professionals and as consumers. A structured questionnaire was used to gather primary data from 120 women constables. The data was analyzed using the Weighted Score and Garett Rank method. The results highlighted significant variations in consumer expectations, purchasing behavior, and satisfaction levels among women constables, emphasizing the potential of AI in addressing niche consumer segments more effectively.

Keywords:

Artificial Intelligence (AI), Consumer Insights, Women Constables, AI-Driven Marketing

INTRODUCTION

Artificial Intelligence (AI) has revolutionized the field of marketing by enabling businesses to analyze vast datasets, predict consumer behavior, and deliver personalized experiences that go beyond traditional approaches. In an era of intense competition, the ability to capture and interpret consumer insights in real time has become crucial for organizations seeking sustainable growth. One emerging area of interest is the study of niche consumer groups, whose behaviors and preferences are often overlooked in mainstream research. Women constables represent such a segment, as their professional responsibilities in law enforcement, coupled with their socio-economic and lifestyle factors, significantly influence their purchasing behavior and decision-making processes. Their daily routines, characterized by discipline, stress, and irregular schedules, create unique patterns of consumption that merit deeper exploration. Despite their growing role in the workforce, women constables remain underrepresented in consumer research, leaving a gap in understanding their specific needs and expectations. By integrating AI-driven marketing tools, businesses can gain valuable insights into this group, identify trends in their consumer behavior, and design strategies that are both inclusive and effective. This study aims to bridge the gap by leveraging AI to analyze consumer insights among women constables, thereby highlighting the role of technology in advancing both marketing and inclusivity.

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REVIEW OF LITERATURE

1. AI in Marketing and Consumer Insights

Smith and Johnson (2021) emphasized that Artificial Intelligence (AI) has transformed traditional marketing by enabling businesses to analyze large datasets, predict consumer behavior, and create personalized marketing strategies. Their study highlighted the role of AI tools such as machine learning algorithms and predictive analytics in understanding consumer preferences and improving customer engagement. They noted that AI allows marketers to segment consumers more precisely and tailor communication, leading to higher satisfaction and loyalty. This research underscores the potential of AI in providing actionable insights for niche consumer groups.

2. Women as a Unique Consumer Segment

Kumar and Reddy (2020) explored the consumption patterns of working women and identified that professional responsibilities, socio-economic status, and lifestyle significantly influence purchasing behavior. Their study found that women in disciplined professions, such as law enforcement, have distinct preferences and face unique challenges as consumers, including time constraints, safety concerns, and limited access to certain services. The findings suggest the need for targeted marketing strategies that consider these factors.

3. AI and Niche Consumer Behavior

Patel and Mehta (2022) examined the application of AI in understanding niche consumer segments, emphasizing that underrepresented groups are often overlooked in mainstream marketing research. The study demonstrated that AI-driven analytics can reveal hidden patterns in behavior, preferences, and satisfaction levels, which traditional surveys may fail to capture. This indicates that AI has the potential to enhance inclusivity in marketing by addressing the specific needs of marginalized or specialized consumer groups.

STATEMENT OF THE PROBLEM

Consumer research has traditionally focused on broad demographic groups such as age, income, or gender, often overlooking niche segments with distinct needs and behaviors. Women constables represent one such underexplored group whose professional demands, work environment, and lifestyle choices directly influence their consumer behavior. Despite their increasing numbers and contributions in the field of law enforcement, little attention has been given to understanding their consumption patterns, preferences, and challenges as consumers. Traditional marketing approaches fail to capture these nuanced insights, resulting in generalized strategies that do not adequately address their needs. Moreover, there is a lack of studies that integrate technology-driven tools, such as Artificial Intelligence (AI), to examine consumer behavior in this segment. The absence of focused research not only limits businesses from reaching this group effectively but also perpetuates a gap in inclusive marketing strategies. Therefore, the problem lies in the insufficient exploration of women constables as consumers and the lack of application of AI-driven marketing analytics to understand their unique expectations, satisfaction levels, and purchasing behavior. Addressing this problem can contribute to more effective marketing strategies while ensuring that women constables, as a niche consumer group, are represented and valued in consumer research.

Objectives of the Study

1. To examine the consumer behavior and purchasing patterns of women constables.
2. To identify the challenges and expectations of women constables as consumers.
3. To analyze how AI-driven marketing tools can be applied to capture and interpret consumer insights from this segment.

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RESEARCH METHODOLOGY

The study adopts a descriptive research design to analyze the consumer insights of women constables with the help of Artificial Intelligence (AI) in marketing. A total of 120 women constables were selected as the sample size for this study using a systematic random sampling method to ensure representativeness. Primary data was collected through a structured questionnaire, designed to capture information on consumer behavior, purchasing preferences, satisfaction levels, and challenges faced by women constables as consumers. Secondary data was gathered from published journals, articles, reports, and online resources to support the study framework.

For analysis, statistical tools such as the Weighted Score method and the Garett Ranking method were employed to rank the factors influencing consumer behavior and to measure the level of satisfaction. AI-based analytical techniques were integrated conceptually to highlight how machine learning and predictive algorithms can enhance the interpretation of consumer insights. The data was tabulated and analyzed systematically to derive meaningful conclusions and identify patterns specific to this segment. The methodology ensures that the findings are reliable, valid, and provide actionable insights for businesses seeking to implement AI-driven marketing strategies tailored to women constables.

SIGNIFICANCE OF THE STUDY

The study holds significant value as it sheds light on the consumer behavior and preferences of women constables, a largely underexplored segment in marketing research. By integrating AI-driven marketing insights, the research highlights how advanced technologies can help businesses better understand niche consumer groups, identify trends, and tailor products and services to meet specific needs. The findings can assist marketers in designing inclusive and effective strategies that consider the unique professional and personal challenges of women constables, thereby improving customer satisfaction and engagement. Additionally, the study contributes to academic literature by bridging the gap between technology, marketing, and gender-focused consumer research, providing a foundation for further studies on underrepresented consumer groups. Overall, this research emphasizes the practical and theoretical importance of leveraging AI in marketing to create more informed, data-driven, and socially inclusive strategies.

RESULTS AND DISCUSSIONS

1.ConsumerPreferences

The Weighted Score method revealed the priority of different product categories for women constables.

Product Category	Weighted Score	Rank
Personal Care Products	450	1
Health & Fitness Products	420	2
Professional Attire	395	3
Leisure & Lifestyle	310	4
Electronics & Gadgets	275	5

Source: Computed Data

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The analysis reveals that women constables have distinct consumer preferences shaped by their professional responsibilities and lifestyle. The Weighted Score for product categories shows that personal care products, health and fitness items, and professional attire are the top priorities. This indicates that convenience, quality, and safety are crucial factors influencing their purchasing decisions. The preference for online platforms highlights the need for time-efficient shopping options due to their demanding schedules.

2. Challenges Faced

Weighted scores highlighted the main challenges**:**

Challenge	Weighted Score	Rank
Time Constraints	460	1
Product Accessibility	430	2
Price Sensitivity	390	3
Lack of Awareness	310	4

Source: Computed Data

The challenges faced, ranked through the Weighted Score method, show that time constraints are the most significant barrier, followed by product accessibility and price sensitivity. This suggests that despite willingness to engage as consumers, women constables face practical limitations in accessing suitable products and services.

3. Satisfaction Levels (Garett Ranking)

Service/Category	Score	Rank
Online Shopping Options	82	1
Professional Gear	78	2
Health & Fitness Products	70	3
Leisure & Lifestyle Items	55	4

Source: Computed Data

The Garett Ranking of satisfaction levels indicates that while they are highly satisfied with online shopping and professional gear, leisure and lifestyle products receive lower satisfaction scores. This points to gaps in customization, availability, and relevance of products targeting this niche group.

Overall, the results demonstrate that **AI-driven marketing has strong potential** to bridge these gaps. By analyzing data and predicting behavior, AI can provide personalized recommendations, improve product availability, and enhance satisfaction for women constables, ensuring that this niche consumer segment is better understood and served.

SUGGESTIONS

1. Adopt AI-Powered Personalization: Use AI tools to recommend products and services that match the specific preferences and needs of women constables.

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2. Improve Accessibility: Make essential products and services easily available through both online and offline channels to overcome time and location constraints.
3. Design Women-Centric Products: Develop products that cater to the professional and lifestyle needs of women constables, especially in health, fitness, and professional gear.
4. Targeted Marketing Campaigns: Implement AI-driven marketing strategies to reach women constables effectively, considering their work schedules, consumption patterns, and digital engagement habits.

CONCLUSION

The study reveals that women constables exhibit unique consumer behavior and preferences shaped by their professional responsibilities and lifestyle. They prioritize personal care, health and fitness products, and professional attire, while facing challenges such as time constraints, limited product accessibility, and price sensitivity. Satisfaction levels are higher for online shopping and professional gear but lower for leisure and lifestyle products, indicating gaps in availability and relevance. The findings highlight the potential of AI-driven marketing to address these gaps by providing personalized recommendations, optimizing product placement, and enhancing engagement with this niche consumer segment. By leveraging AI, businesses can design more targeted, inclusive, and effective marketing strategies that improve satisfaction and loyalty among women constables, demonstrating the importance of integrating technology with consumer insights to better understand and serve underrepresented groups.

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THE ROLE OF ARTIFICIAL INTELLIGENCE IN RESHAPING FINANCIAL SERVICES AND DIGITAL COMMERCE

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ABSTRACT

Digital commerce sectors, redefining how businesses operate, interact, and deliver value to customers. This study explores the dual dimensions of opportunities and challenges that AI brings to modern commerce, with a particular focus on banking, fintech, and digital financial ecosystems. AI applications, such as robo-advisory, algorithmic trading, fraud detection, credit scoring, and personalized financial services, are reshaping operational efficiency and enabling greater financial inclusion. Furthermore, AI-driven chatbots and recommendation systems enhance customer experience, where predictive analytics improve risk management and investment decisions. Despite these advantages, AI adoption in financial services faces significant challenges, including data privacy concerns, algorithmic bias, regulatory uncertainty, and ethical dilemmas. This study emphasizes the need for transparent, explainable AI models and robust regulatory frameworks to build trust and ensure responsible innovation. By critically analyzing opportunities and limitations, this study highlights the pivotal role of AI in shaping the future of financial services and digital commerce, thereby offering insights for policymakers, financial institutions, and fintech innovators.

Keywords:

Artificial Intelligence, Financial Services, Fintech, Digital Commerce, Innovation and Regulation

INTRODUCTION

Artificial Intelligence (AI) has evolved from a futuristic concept to a practical and indispensable tool in modern commerce. The integration of AI into financial services has accelerated with the growth of fintech firms, digital payments, and online banking platforms. According to the PwC (2022), the global financial services sector is expected to derive significant business value from AI applications, estimated to contribute more then USD 1.2 trillion by 2030. AI technologies, particularly machine learning, natural language processing, and predictive analytics, enable organizations to streamline operations, enhance decision-making, and provide personalized services at scale.The digital commerce landscape has also undergone a remarkable transformation due to AI. With online platforms handling millions of transactions daily, AI ensures efficiency, security, and tailored customer experiences. In this context, the present study examines the **role of AI in reshaping financial services and digital commerce**, highlighting both **opportunities** and **challenges**, and suggesting pathways for responsible adoption.

LITERATURE REVIEW

The academic and professional literature underscores the disruptive potential of AI in financial services. Brynjolfsson and McAfee (2017) describe AI as the "second machine age," capable of performing cognitive tasks once considered

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unique to humans. In financial contexts, Arner, Barberis, and Buckley (2016) emphasize the synergy between AI and fintech as the foundation of "FinTech 3.0," wherein machine intelligence drives innovation in payments, lending, and asset management.

Recent studies show that AI enhances risk management and fraud detection. Ghosh (2020) pointed out that AI models can analyze large volumes of real-time transaction data and detect anomalies faster than traditional systems. Similarly, Li et al. (2021) highlight the role of AI in credit scoring, where alternative data sources such as mobile phone usage patterns and digital transactions, broaden financial inclusion. However, challenges persist in the future. O'Neil (2016) warned of algorithmic bias, where discriminatory outcomes arise if AI systems are trained on biased data. In addition, Zetzsche et al. (2020) stressed the need for robust regulatory frameworks, as financial AI applications often outpace existing legal safeguards. This literature suggests that, while AI offers immense benefits, its risks cannot be ignored.

OBJECTIVES

To study how Artificial Intelligence is changing financial services and digital commerce by improving customer experience, efficiency, and financial inclusion.

To examine the main challenges in using Artificial Intelligence, such as data privacy, bias, and regulation, and suggest possible solutions.

OPPORTUNITIES OF AI IN FINANCIAL SERVICES AND DIGITAL COMMERCE

- ✓ ***Enhancing Customer Experience***

  AI-powered chatbots and virtual assistants provide 24/7 customer services, thereby reducing wait times and operational costs. Platforms such as Bank of America's "Erica" and HDFC's "EVA" illustrate how conversational AI delivers personalized banking support. AI-driven recommendation systems can also tailor product offerings enhance customer loyalty.

- ✓ ***Fraud Detection and Risk Management***

  Financial fraud remains a critical concern, particularly in digital commerce. AI algorithms can identify unusual transaction patterns in real time and prevent cybercrime. Predictive analytics also improves portfolio risk assessment, reducing the likelihood of defaults and market losses.

- ✓ ***Credit Scoring and Financial Inclusion***

  Traditional credit systems exclude individuals without formal banking history. AI-driven credit models use alternative data, such as utility payments and mobile transactions ,enabling greater financial inclusion. This is particularly relevant in developing economies where a significant population remains unbanked.

- ✓ ***Robo-Advisors and Wealth Management***

  AI-based robot advisors democratize investment services by providing low-cost, data-driven financial advice. Investors gain access to diversified portfolios and real-time market updates without requiring human advisors, thus making wealth management more accessible.

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- ✓ ***Algorithmic Trading and Market Insights***

  AI systems process vast amounts of financial data within milliseconds, thus supporting algorithmic and high-frequency trading.AI enhances portfolio optimization and market predictions by identify patterns that are invisible to human traders.

- ✓ ***Operational Efficiency and Cost Reduction***

  Financial institutions leverage AI for back office automation, including KYC verification, compliance checks, and documentation. This reduces manual errors, saves time, and enables employees to focus on strategic tasks.

CHALLENGES OF AI IN FINANCIAL SERVICES AND DIGITAL COMMERCE

- ✓ ***Data Privacy and Security Risks***

  Heavy reliance on customer data makes AI-driven financial systems vulnerable to cyberattacks. Unauthorized access or data leaks can undermine consumer trust and lead to severe financial loss.

- ✓ ***Algorithmic Bias and Ethical Concerns***

  AI systems may unintentionally discriminate between loan approval and hiring decisions. Lack of transparency in decision making the so-called "black box" problem raises ethical concerns and demands explainable AI (XAI).

- ✓ ***Regulatory and Compliance Issues***

  Financial regulators face challenges in keeping pace with AI-driven innovations. The absence of global standards creates inconsistencies in compliance, leaving firms uncertain of their legal obligations.

- ✓ ***Technological Dependence and Systemic Risks***

  Over-reliance on AI in financial markets may create systemic vulnerability. For instance, errors in trading algorithms can trigger flash crashes and destabilize the entire markets.

- ✓ ***Talent and Infrastructure Gaps***

  AI adoption requires skilled professionals in machine learning, data science, and cyber-security. The shortage of expertise, combined with high infrastructure costs, restricts smaller firms from implementing AI solutions.

CONCLUSION AND POLICY IMPLICATIONS

Artificial Intelligence is undeniably reshaping financial services and digital commerce. From fraud detection to robot advisors, AI provides unmatched opportunities for efficiency, innovation, and inclusion. However, challenges related to privacy, bias, and regulation a cannot be overlooked.

The way forward requires a balanced approach:

- ✓ Investment in explainable and ethical AI to enhance transparency.
- ✓ Development of global regulatory frameworks to manage AI adoption responsibly.
- ✓ Collaboration between governments, financial institutions, and fintech firms to promote financial inclusion.

By aligning innovation with accountability, AI can serve as the cornerstone for building a resilient, inclusive, and sustainable financial ecosystem.

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BALANCING INNOVATION WITH ETHICS FOR SUSTAINABLE COMMERCE IN THE AI ERA

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ABSTRACT

In the contemporary world, trade is being revolutionized by Artificial Intelligence (AI), which contributes to enhancing customer interactions, automating supply chains, and enabling new business models. Yet the spillover of AI at a fast pace also generates ethical issues like privacy, bias, transparency, and accountability. Further, advancements in commerce must act in accordance with and reflect back the social and environmental agendas that involve sustainable commerce. This paper discusses how companies can reconcile innovation with ethics while constructing sustainable business in the AI era of business. This study is guided by principles for responsible innovation and trustworthy AI, current international ethical issues, showing how fairness, accountability, and inclusivity emerges. By the use of case studies from retail, finance, and logistics, it addresses how AI can be used ethically and sub stantially yet be competitive in AI-commerce. It concludes that good governance and stakeholder partnership is required to make us confident that AI improvement will be beneficial to our overall long-term well-being, as well as that of the planet.

Keywords:

Artificial Intelligence (AI), Sustainable Commerce, Ethics, Responsible Innovation, Accountability.

1. NEED FOR THIS STUDY

With the development of AI, a force that has the potential to boost the world economy by trillions of dollars, the digital revolution has entered a new stage. AI is expected to contribute up to $15.7 trillion to the global economy by 2030 [1]. However, a fundamental paradox characterizes this transformational power: while AI promises efficiency, it also poses serious ethical problems, such as the potential to reinforce prejudices, undermine data privacy, and obscure accountability[2]. Commerce needs to resolve this conflict if it is to be sustained.

2. DIFFICULTIES AND CONSEQUENCES IN THE ETHICAL ASPECTS OF AI-POWERED TRADE

The extensive use of AI has brought up a new category of moral dilemmas with significant business and social repercussions, resulting in real-world, palpable effects[3].

2.1. Algorithmic Bias

When AI systems generate unfair or biased outcomes because of human biases contained in their training data, this is known as algorithmic bias[4]. This may appear as algorithmic bias, human judgment bias, or data bias. Biased AI can produce discriminatory results with serious and expensive business repercussions in delicate areas like insurance, credit scoring, and hiring.

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2.2. The Privacy Paradox

The discrepancy between consumers' professed concerns about data privacy (e.g., 86% of Americans express worry) and their actual data-sharing practices, such as accepting privacy terms without reading them, is known as the "privacy paradox" [5, 6]. Cognitive biases (such as optimistic bias and hyperbolic discounting) and purposefully intricate deceptive design tactics for privacy management are the causes of this behaviour, which is not apathy.

The "Trust Gap," in which companies overestimate customer confidence by an average of 11 percentage points, is fuelled by this discrepancy. Eighty percent of US consumers expect their personal information to be utilized in an uncomfortable way when AI systems process more data [6]. This significant "Trust Gap" [7], which results from communicative, moral, and technical failures, was validated by a study conducted with the London School of Economics. The discrepancy has a detrimental effect on company performance, resulting in missed opportunities and resource waste.

Table 1. **The "Trust Gap" Caused by AI and Its Effect on Business**

Trust Gap	Causes	Result
Absence of Openness	Users are unaware of the AI's decision-making or prediction process.	Scepticism results from users' unwillingness to trust or depend on the output of a system they cannot audit or explain.
Fairness, Bias, and Inadvertent Repercussions	Unfair or discriminatory hiring, lending, or law enforcement outcomes are caused by biased training data.	Harms a brand's reputation, draws regulatory attention, and sparks public outrage—particularly when the AI is perceived as putting business goals ahead of people's welfare.
Data Security and Privacy Issues	prominent data breaches and the alleged commercial exploitation of personal data.	Innovation is hampered by customers' reluctance to divulge the data required for customized, valuable AI services.

2.3. The Crisis of Accountability - The "Black Box" Issue

It is challenging to determine how and why a certain choice was reached because complex AI algorithms are "black box" in nature[8]. The fundamental question of who is responsible-the developer, the business, or the end-user is brought up by this lack of explainability, which makes it practically impossible to assign blame when a system does harm.

3. THE BUSINESS CASE FOR RESPONSIBLE AI FROM A STRATEGIC PERSPECTIVE

A strategic necessity that generates both material and immaterial economic value is ethical AI. It is now a key factor in long-term business success rather than a cost center.

3.1. The Return on Investment in AI Ethics

The benefit of AI ethics cannot be adequately measured by the conventional ROI calculation. Ethical AI practices reduce legal costs, spur innovation, and increase operational efficiency by guaranteeing data quality and model

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robustness, according to the "The Return on Investment in AI Ethics " framework, which contends that ethical investments produce layered returns, including direct financial returns, intangible value, and strategic gain from an operational standpoint. A strategic advantage is this proactive approach.

4. AN ETHICAL AI GOVERNANCE AND COMPLIANCE FRAMEWORK

Organizations must have a strong, workable structure for governance and compliance in order to traverse the ethical terrain, going beyond aspirational ideals.

4.1. The Changing Environment of Regulation

The first comprehensive, risk-based legal framework for AI in the world is the EU AI Act. It divides the risk of AI systems into four groups: low, high, limited, and unacceptable[9]. The Act's Annex III identifies high-risk industries, such as AI applications in key infrastructure, employment, education, and law enforcement [10]. Like the GDPR, this rule has worldwide ramifications and establishes a de facto standard for ethical AI. But this also results in a complicated and disjointed regulatory environment.

4.2. Putting Responsible AI into Practice

Transitioning from abstract ideas to tangible, quantifiable activities is necessary for effective AI governance. The C-suite, not simply technical teams, must be committed to the process from the top down and integrate it early in the AI lifecycle. The use of quantitative measures to assess ethical performance is essential. Examples of these metrics include audit scores for ethical standard compliance, transparency scores (like model card adoption rates), and bias detection scores (like demographic parity)[11]. New tools are being developed to help with these initiatives, such as AI Fairness 360.

A useful guide for converting these ideas into quantifiable business KPIs is given in the table 2.Lastly, ongoing human judgment and supervision are essential components of any strong framework.AI should be used to supplement human intellect, not to replace it, with human decision-makers in the loop and ongoing oversight to make sure they are operating as intended[12].

Table 2. **Imp Important Ethical Guidelines and Their Business Indicators**

Guidelines for Ethics	**Business Metrics**
Fairness and Transparency	Open communication with stakeholders, truthful marketing, and accurate financial reporting.
Responsibility	Measurable performance measurements, proactive error handling, and distinct lines of accountability.
Environmental Responsibility	activities to reduce carbon emissions, waste reduction, and sustainable resource management.
Social Accountability	Participation in the community, encouragement of moral supply chains, and enhancement of societal welfare.
Adherence to Regulations	following the law and industry norms, keeping an eye out for any changes to the law, and staying out of trouble.
Focus on the Customer	prompt customer service, customer satisfaction surveys, and high-quality goods and services.

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5. THE AI-SUSTAINABILITY NEXUS

Integrating AI with sustainability goals presents a special chance to improve an organization's ESG performance by achieving favorable social, environmental, and financial outcomes[13]. By automating data collecting and increasing supply chain visibility, artificial intelligence's computing capacity streamlines resource-intensive sustainability reporting. Teams may concentrate on "real-world impact," including strategy change and lowering emissions, thanks to this efficiency.

But there's a catch: depending too much on AI-generated results runs the danger of being inaccurate or deceptive. The speed and size of AI can amplify errors, lead to context errors, or draw conclusions based on incomplete facts. This risk emphasizes the continued need for human judgment and oversight to guarantee that the technology produces precise, morally good sustainability results, avoiding "greenwashing" and preserving stakeholder confidence.

6. CONCLUSION

The future of commerce belongs to organizations that embrace a human-centric and principle-driven approach to AI. The challenges of algorithmic bias, the privacy paradox, and the accountability crisis are fundamental threats to consumer trust and long-term commercial viability. Evidence shows that ethical AI is not a regulatory checkbox but a strategic imperative that drives a new form of value. By adopting a framework of Holistic Return on Ethics and actively bridging the "Trust Gap," businesses can build brand loyalty and create a powerful market differentiator. The regulatory landscape, particularly the EU AI Act, is forcing a re-evaluation of how AI is developed and deployed. The path forward requires embedding governance early, establishing quantifiable metrics, and ensuring that human oversight remains central. The most successful organizations of the AI era will be those that have the foresight and courage to make ethics the foundation of their innovation.

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AI IN FINANCIAL SERVICES AND FINANCIAL TECH WITH SPECIAL REFERENCE TO SBI IN THIRUVATTAR AREA

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ABSTRACT

Artificial Intelligence (AI) is revolutionizing the landscape of financial services, offering transformative opportunities for efficiency, innovation, and customer experience enhancement. This research paper provides a comprehensive examination of the role of AI in financial services, exploring its applications, challenges, and future trends. Beginning with an overview of AI fundamentals and its historical evolution in finance. It investigates the drivers behind the widespread adoption of AI in financial institutions, including its potential to enhance decision-making, automate processes, and mitigate risks. AI implementations across various domains within the financial industry, from algorithmic trading and fraud detection to customer service and regulatory compliance. The paper discusses ethical and regulatory considerations surrounding AI adoption, emphasizing the importance of transparency, fairness, and accountability in AI-driven decision-making processes. Furthermore, it explores emerging technologies such as deep learning and explainable AI, offering insights into their potential applications and implications for the future of financial services. Recommendations and best practices are provided for financial institutions seeking to navigate the complexities of AI adoption, address ethical and regulatory challenges, and leverage AI-driven solutions to drive innovation and create value. The paper concludes with a call to action for further research and collaboration in advancing the responsible and impactful use of AI in financial services, shaping the future of finance in the digital age.

Keywords:

Artificial Intelligence, Financial Services, AI Adoption challenges

INTRODUCTION

The digitalization of financial services – from the advent of ATMs (automated teller machines) and online banking to the widespread use of mobile apps – transformed the industry from all perspectives: providers, customers, employees, regulators and other stakeholders. Artificial intelligence (AI) is poised to have at least as profound an impact, albeit with important differences. The digital era started in the mid-1980s and is broadly considered to have run for three to four decades. AI has, in fact, been around a lot longer; however, the introduction and widespread adoption of generative AI (genAI) and its increased accessibility two years ago have had a seismic effect on technology and business. Its potential to automate and augment tasks throughout the operating models of most organizations quickly established it as one of the most transformative technologies the world has ever seen. Banking, insurance, capital markets and payments are among the areas in which its impact is expected to be most pervasive

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STATEMENT OF THE PROBLEM

Today we are almost living in the robotic world. Every thing is now converted as a smart one . it is a need for the financial Institutions to a need for the financial Institutions to become more smarter than other Fin.tech applications. It is a need of the hour to introduce AI in SBI to provide financial Information assistance for their Product and Services for every 24* 7 hrs for their customer. In this point of view this study is made.

OBJECTIVES

- To know the Socio Economic condition of the respondent.
- To Identify the Scope of Financial Technology in SBI bank using AI.
- To Identify the Facilities provide by SBI bank with the help of AI.
- To offer findings Suggestion and Conclusion.

SAMPLING

The study attempts to measure the marketing in Marthandam. So the sample respondents for the study were drawn from the people living in rural area especially in Marthandam. The village panchayat truly represents the rural setting in our country. The list of marketing in Marthandam were collected from the industrial centre in Marthandam.

METHODOLOGY

Primary and secondary data have been collected from different sources and used for analysis.Secondary data required for the study have been collected from the various publications from newspaper, magazines and other study materials and various reports of the Government of India.Primary data were collected through a well-structured interview schedule structured by the researcher in consultation with the experts in the field.

STATISTICAL TOOLS

Statistical tools like, Percentages, ranking technique,and charts have been used for analysis in the study.

DATA PROCESSING

The researcher collected data from marketers in Marthandam through interview schedule. The collected data is codified to facilitate further analysis through computers.

Table No : 1 **Gender Classification**

Sl.No	Gender	No.of Respondent	% of Respondent
1	Female	15	75
2	Male	5	25
	Total	20	100

Source: Primary Data

The above table has been classified on the basis of Gender Classification. Out of 20 respondents 15 respondents are from the category Yes and remaining 5 respondents are from the category No.

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It is highlighted that more number of respondent are from the gender classification Female.

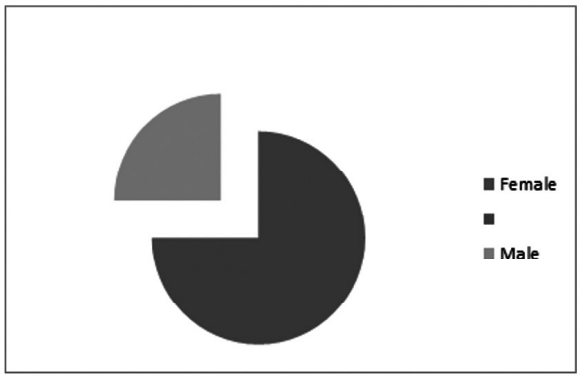

Table No : 2 **Age Wise Classification**

Sl.No.	Age	No.of Respondent	% Of Respondent
1	21-30	2	10
2	31-40	5	25
3	41-50	8	40
4	Above 51 years	5	25
	Total	20	100

Source: Primary Data

The above table has been classified on the basis of Age Wise Classification. Out of 20 respondents 2 respondents are from the age wise classification 21-30 years, 5 respondents are from the age wise classification 31-40 years, 8 respondents are from the age wise classification 41-50 years and 5 respondents are from the age wise classification above 51 years.

It is highlighted that majority are from the age group category 41-50 years.

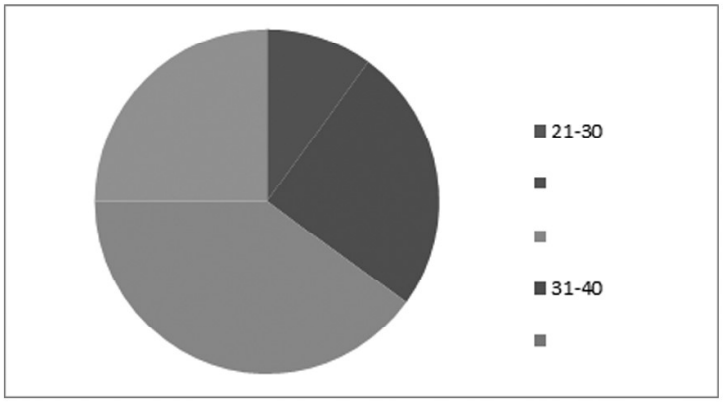

Table No : 3 **Educational Qualifiaction**

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Sl.No	Education	No.of Respondents	% of Respondents
1	Illiterate	2	10
2	Sslc	10	50
3	Hsc	5	25
4	Graduates	2	10
5	Others	1	5
	Total	20	100

Source: Primary Data

The above table has been classified on the basis of Educational Classification of the respondents. Out of 20 respondents 2 respondents are from the category illiterates, 10 respondents are from the category SSLC, 5 respondents are from the category Hsc, 2 respondents are from the category graduates and 1 respondent are from the category others.

It is highlighted that majority of the respondent are from the category SSLC.

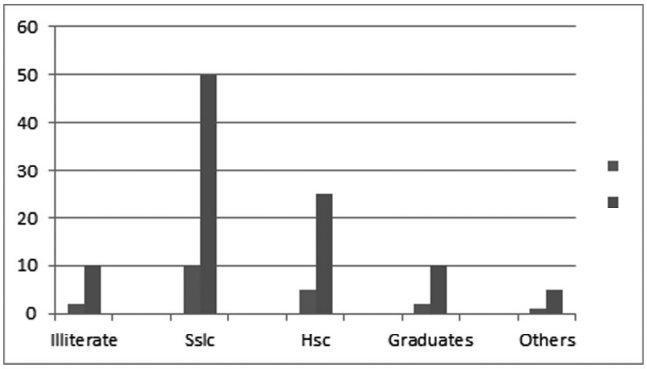

Table No: 4 **Processing Bank A/C**

Sl.No.	Particulars	No.of Respondent	% of Respondent
1	Yes	19	95
2	No	1	5
	Total	20	100

Source: Primary Data

The above table has been classified on the basis of Processing Bank A/C.Out of 20 respondents 19 respondents are from the category Yes and remaining 1 respondent are from the category No.

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It is highlighted that more number of respondent are from the category Yes.

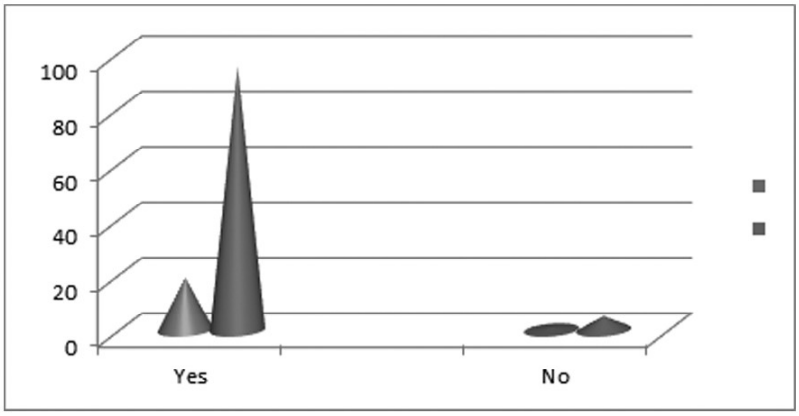

***Table No : 5* Awareness Of Ai In Bank**

Sl.No.	Particulars	No.of Respondent	% of Respondent
1	Yes	15	95
2	No	5	5
	Total	20	100

Source: Primary Data

The above table has been classified on the basis of Awareness of AI in Bank. Out of 20 respondents 15 respondents are from the category Yes and remaining 5 respondents are from the category No.

It is highlighted that more number of respondent are from the category Yes.

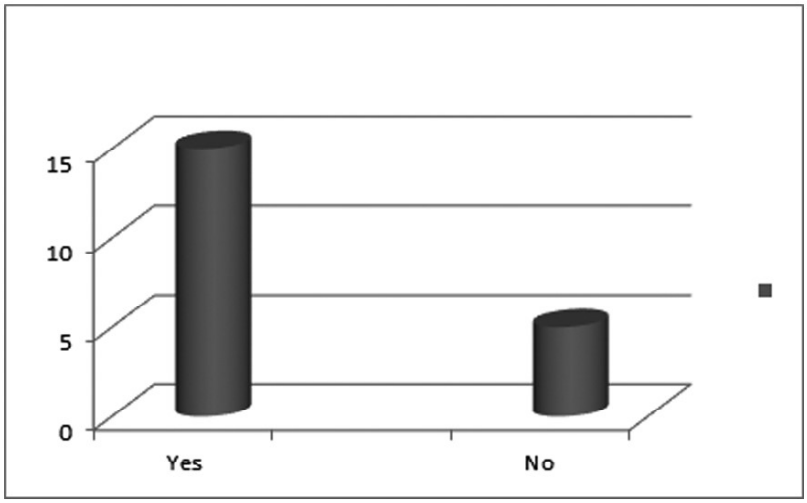

***Table No: 6* Facilities In Ai**

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Sl.No.	Particulars	No.of Respondent	% of Respondent
1	Customizing Services & Products	2	10
2	Identifying Risk & Fraud	5	25
3	Streamlining Operation	4	20
4	Regulation Services	3	15
5	Privacy Policy	6	30
	Total	20	100

Source: Primary Data

The above table has been classified on the basis of Facilities in AI.Out of 20 respondents 2 respondents are from the category customizing services & products, 5 respondents are from the category identifying risk & fraud, 4 respondents are from the category streamlining operation, 3 respondents are from the category regulation services and 6 respondents are from the category privacy policy.

It is highlighted that more number of respondent are from the category Privacy Policy.

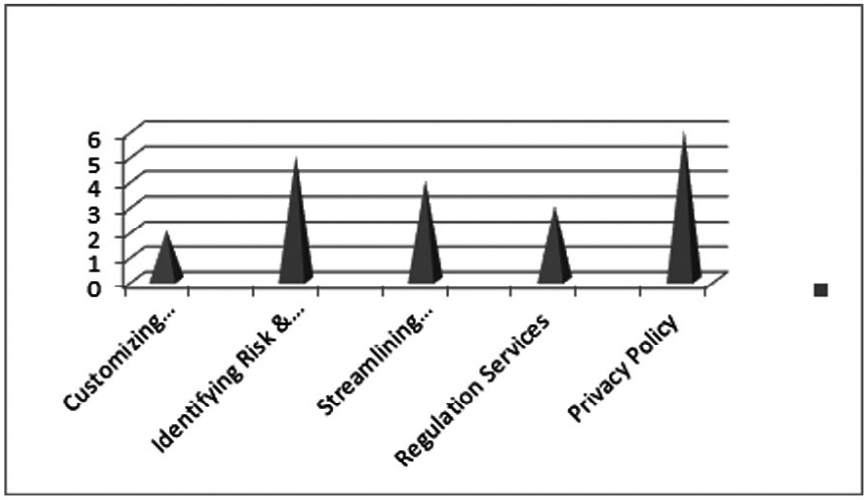

Table No: 7 **Facing Problem In AI**

Sl.No.	Particulars	No.of Respondent	% of Respondent
1	Yes	3	15
2	No	17	85
	Total	20	100

Source: Primary Data

The above table has been classified on the basis of Facing Problem in AI.Out of 20 respondents 2 respondents are from the category Yes and remaining 17 respondent are from the category No.

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It is highlighted that more number of respondent are from the category Yes.

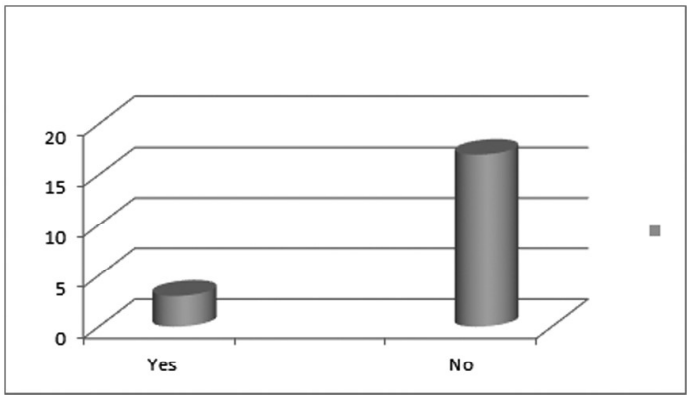

***Table No : 8* Facing Problem In Ai**

Sl.No.	Particulars	No.of Respondent	% of Respondent
1	Automation	6	30
2	Accuracy	5	25
3	Efficiency	3	15
4	Speed	4	20
5	Innovation	2	10
	Total	20	100

Source: Primary Data

The above table has been classified on the basis of Facing Problems in AI. Out of 19 respondents 6 respondents are from the category automation, 5 respondents are from the category accuracy, 3 respondents are from the category efficiency, 4 respondents are from the category speed and 1 respondent are from the category innovation.

It is highlighted that more number of respondent are from the category Automation.

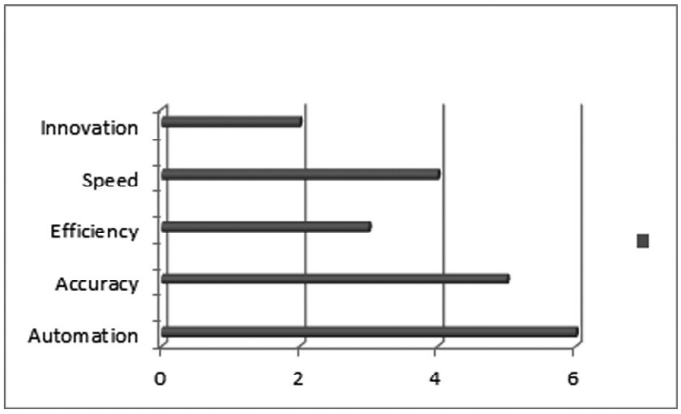

***Table No: 9* Cyber Security Awarness**

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Sl.No.	Particulars	No.of Respondent	% of Respondent
1	Yes	18	95
2	No	1	5
	Total	19	100

Source: Primary Data

The above table has been classified on the basis of Cyber Security Awarness.Out of 19 respondents 18 respondents are from the category Yes and remaining 1 respondent are from the category No.

It is highlighted that more number of respondent are from the category Yes.

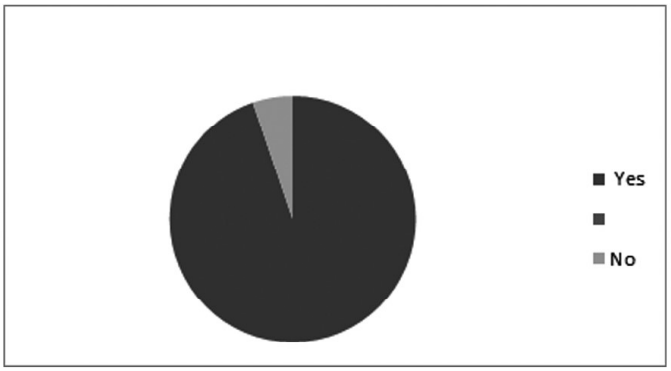


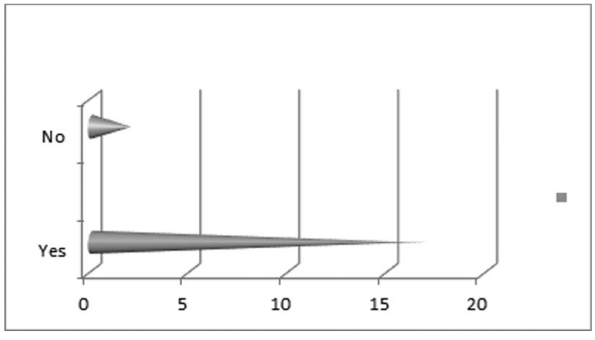
Table No: 10 **Satisfaction Level**

Sl.No.	Particulars	No.of Respondent	% of Respondent
1	Yes	17	89
2	No	2	11
	Total	19	100

Source: Primary Data

The above table has been classified on the basis of Satisfaction Level. Out of 19 respondents 17 respondents are from the category Yes and remaining 2 respondent are from the category No.

It is highlighted that more number of respondent are from the category Yes.



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FINDINGS

- ✓ It is highlighted that more number of respondent are from the gender classification Female.
- ✓ It is highlighted that majority are from the age group category 41-50 years.
- ✓ It is highlighted that majority of the respondent are from the category SSLC.
- ✓ It is highlighted that more number of respondent are from the category Yes.
- ✓ It is highlighted that more number of respondent are from the category Yes.
- ✓ It is highlighted that majority are from the category privacy policy.
- ✓ It is highlighted that more number of respondent are from the category Yes.
- ✓ It is highlighted that more number of respondent are from the category Automation.
- ✓ It is highlighted that more number of respondent are from the category Yes.
- ✓ It is highlighted that more number of respondent are from the category Yes.

CONCLUSION

Artificial intelligence (AI) is rapidly transforming the financial services sector by enhancing operational efficiency, improving risk management, and enabling personalized customer experiences. The adoption of AI in areas such as fraud detection, credit scoring, algorithmic trading, and customer service has shown significant benefits for both institutions and clients. However, the study also highlights several challenges, including data privacy concerns, algorithmic bias, regulatory compliance, and the need for skilled professionals to manage AI systems. These challenges underscore the importance of a balanced approach that combines technological innovation with ethical, transparent, and responsible practices.

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THE ROLE OF ARTIFICIAL INTELLIGENCE IN ONLINE SHOPPING: PROSPECTS AND PROBLEM

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ABSTRACT

Artificial Intelligence (AI) is transforming the online shopping experience by enabling businesses to better understand customer behavior, predict trends, and provide personalized services.AI technologies, including machine learning, natural language processing, and data analytics, allow e-commerce platforms to analyze vast amounts of consumer data, leading to more accurate product recommendations, dynamic pricing, and efficient inventory management. Chatbots and virtual assistants powered byAI provide 24/7 customer support, improving engagement and satisfaction. Visual search tools further enhance the shopping experience by allowing users to find products using images rather than text. Despite these benefits, the integration of AI in online retail presents several challenges. The high cost of implementingAI solutions can be a barrier for small and medium-sized businesses. Additionally, automation may lead to job displacement in certain sectors. This paper explores the prospects of AI in shaping online shopping, highlighting its potential to create more personalized, efficient, and interactive experiences, while also addressing the problems and ethical considerations associated with its use. Understanding these dynamics is essential for businesses seeking sustainable growth in the e-commerce sector.

Keywords:

Artificial Intelligence (AI), Online shopping, Customer behavior, etc.,

INTRODUCTION

Online shopping has become an essential part of modern life, offering consumers the convenience of purchasing goods and services anytime and anywhere. The rapid growth of e-commerce has been supported by advancements in digital technologies, with Artificial Intelligence (AI) emerging as one of the most influential tools in shaping this sector. AI enables businesses to collect, process, and analyze vast amounts of customer data to better understand consumer behavior and purchasing patterns. Through techniques such as machine learning, natural language processing, and predictive analytics, companies are able to enhance customer satisfaction and gain a competitive advantage. In addition, AI-powered solutions such as chatbots, virtual assistants, and visual search tools provide personalized and efficient shopping experiences.

Moreover, AI is transforming the way businesses interact with customers by making online platforms more intelligent, interactive, and responsive. Recommendation systems used by companies like Amazon and Netflix are prime examples of how AI can influence consumer choices and increase sales. At the same time, businesses are adopting AI-driven inventory management and fraud detection systems, ensuring smoother operations and secure transactions. These innovations not only improve customer trust but also strengthen the overall e-commerce ecosystem.

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OBJECTIVES OF THE STUDY

1. To examine how Artificial Intelligence is influencing the growth of online shopping.
2. To identify the benefits of AI in providing personalized and efficient shopping experiences.
3. To analyze the problems and challenges associated with the use of AI in the e-commerce sector.

REVIEW OF LITERATURE

Kumar and Malhotra (2023) examined how AI-driven recommendation systems enhance personalization in e-commerce. Their study highlights that personalized suggestions based on customer data—such as purchase history and browsing behavior—significantly increase customer engagement and conversion rates. They argue that AI not only improves user satisfaction but also boosts the average order value, making it a key driver of online sales growth.

Sharma et al. (2022) explored the use of AI chatbots and virtual assistants in online retail. According to their findings, AI-powered chatbots provide round-the-clock customer support, resolving basic queries and facilitating purchases without human intervention. The researchers concluded that this leads to greater customer satisfaction, lower operational costs, and a more scalable service model, especially during peak shopping seasons.

SCOPE OF THE STUDY

This study explores the role of Artificial Intelligence (AI) in transforming online shopping by examining its benefits and challenges. It focuses on AI applications such as personalized recommendations, chatbots, and inventory management that enhance customer experience and business efficiency. The research highlights AI's potential to drive innovation and growth in e-commerce while addressing issues like data privacy, algorithmic bias, and technological limitations. The scope is limited to AI's impact on online retail platforms, consumer behavior, and business strategies, excluding offline retail and non-shopping AI applications, to provide a clear understanding of AI's influence in shaping the future of online shopping.

METHODOLOGY

The methodology adopted for this study is primarily based on a descriptive and analytical approach. Since the topic focuses on the role of Artificial Intelligence in shaping online shopping, the study relies on secondary data collected from various reliable sources. Information has been gathered from academic journals, research papers, e-commerce reports, and trusted online publications. These sources provide insights into the current applications of AI, the prospects it offers for the online retail sector, and the challenges it creates for businesses and consumers.

The research method involves analyzing case studies of leading e-commerce platforms such as Amazon, Flipkart, and Alibaba, which are widely recognized for their use of AI technologies. By reviewing these real-world examples, the study highlights how AI tools like recommendation engines, chatbots, and visual search systems contribute to customer experience and business growth.

In addition, a comparative analysis approach is used to understand both the advantages and limitations of AI in online shopping. The prospects are evaluated in terms of personalization, efficiency, and innovation, while the problems are studied from the perspectives of data privacy, ethical issues, and cost barriers. This methodology ensures that the study provides a balanced and comprehensive view of the topic.

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THE ROLE OF ARTIFICIAL INTELLIGENCE IN SHAPING ONLINE SHOPPING

Artificial Intelligence (AI) is playing a transformative role in shaping the future of online shopping by enhancing personalization, improving customer service, and optimizing business operations. AI technologies analyze vast amounts of consumer data to offer personalized product recommendations, targeted advertisements, and tailored user experiences that increase customer satisfaction and sales. Chatbots and virtual assistants powered by AI provide real-time support, making shopping more convenient and efficient. Additionally, AI streamlines inventory management, predicts consumer demand, and enables dynamic pricing strategies. While AI brings numerous benefits to e-commerce, it also introduces challenges such as data privacy concerns, algorithmic bias, and high implementation costs. Despite these issues, the integration of AI continues to drive innovation and growth in the online retail sector, making shopping more intelligent, responsive, and customer-focused.

PROSPECTS OF AI IN ONLINE SHOPPING

Artificial Intelligence has opened up wide-ranging opportunities in the field of e-commerce, making online shopping more advanced, interactive, and customer-friendly. The prospects of AI in this sector can be understood through the following points:

1. **Personalized Shopping Experience**

   AI enables businesses to study consumer behavior and predict their needs. Recommendation engines, as seen on Amazon or Netflix, analyze browsing history and purchase data to suggest relevant products. This not only saves time for customers but also increases the chances of repeat purchases, thereby boosting sales.

2. **Efficient Customer Support**

   AI-powered chatbots and virtual assistants are transforming customer service by providing 24/7 support. These systems can handle multiple queries simultaneously, respond instantly, and guide customers in making purchase decisions. As a result, customer engagement and satisfaction improve significantly.

3. **Visual and Voice Search Tools**

   New technologies allow consumers to search for products using images or voice commands instead of typing keywords. For example, platforms like Pinterest and Google Lens enable users to upload an image and find similar products online. This makes shopping faster, easier, and more accessible to a wider audience.

4. **Dynamic Pricing and Inventory Management**

   AI helps businesses in optimizing their pricing strategies by monitoring market trends, competitor prices, and customer demand. This ensures that products remain competitively priced. Similarly, AI supports inventory management by predicting stock requirements, reducing wastage, and ensuring timely product availability.

5. **Fraud Detection and Security**

   AI systems can identify unusual transactions, detect fraud, and protect sensitive customer data. This increases trust in online platforms, encouraging more people to adopt e-commerce as a safe method of shopping.

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6. **Business Growth and Competitive Advantage**

   By adopting AI, businesses can reduce operational costs, improve decision-making, and reach a larger customer base. Small improvements such as faster delivery recommendations and automated marketing campaigns make companies more competitive in the global market.

PROBLEMS AND CHALLENGES OF AI IN ONLINE SHOPPING

While Artificial Intelligence has brought many benefits to the online shopping industry, it also presents several challenges and problems that cannot be ignored. These issues highlight the complex side of using AI in e-commerce.

1. **Data Privacy Concerns**

   One of the major problems of AI in online shopping is related to data privacy. AI systems require vast amounts of customer data such as browsing history, purchase records, and personal details. Collecting and processing such sensitive information raises the risk of data misuse, hacking, or unauthorized sharing. This often makes customers feel unsafe about how their personal information is being used.

2. **High Cost of Implementation**

   AI technologies such as machine learning systems, predictive analytics, and chatbots require huge investment in terms of money, infrastructure, and technical expertise. Large companies can afford these costs, but small and medium enterprises (SMEs) often struggle to adopt AI, which creates inequality in the e-commerce market.

3. **Algorithmic Bias**

   AI works on algorithms that are trained using large data sets. If the data itself contains bias, the system may produce unfair or inaccurate results. For example, recommendation systems may prioritize certain brands or products while ignoring others, which reduces fairness and transparency in online platforms.

4. **Job Displacement**

   Automation powered by AI reduces the need for human workers in areas like customer service, product recommendations, and logistics management. While this improves efficiency, it can also lead to job loss, especially in traditional retail and customer support sectors. This raises concerns about unemployment in the long run.

5. **Lack of Human Touch**

   Although chatbots and virtual assistants are fast and efficient, they cannot always provide the empathy and understanding that a human can. Customers often feel frustrated when their complex problems are not solved by automated responses. This can negatively affect customer satisfaction.

6. **Ethical and Legal Issues**

   The use of AI also raises ethical questions such as who is responsible if an AI system makes a wrong decision, or how much personal data a company should be allowed to collect. Moreover, legal regulations related to AI in e-commerce are still developing, which creates uncertainty for businesses.

CONCLUSION

Artificial Intelligence (AI) is transforming online shopping by enabling personalized experiences, smarter recommendations, and efficient customer service. Tools like chatbots, visual search, and dynamic pricing help businesses

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understand consumer behavior, predict trends, and increase satisfaction. These technologies have made e-commerce faster, more interactive, and more convenient for shoppers.

However, the adoption of AI also raises important concerns. Data privacy, algorithmic bias, high implementation costs, and job displacement are significant challenges. While large companies can easily invest in AI, smaller businesses often face barriers. To ensure fair and sustainable growth, businesses, policymakers, and developers must work together to promote responsible and inclusive use of AI in the e-commerce sector.

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ARTIFICIAL INTELLIGENCE FOR SUSTAINABLE AND GREEN COMMERCE: A FRAME WORK FOR VALUES - BASED INNOVATION

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ABSTRACT

Artificial Intelligence (AI) is steadily transforming the landscape of sustainable and green commerce, offering tools that enhance operational efficiency, transparency, and environmental responsibility. This paper presents a values-based framework to understand how AI technologies may support eco-conscious business practices while remaining sensitive to cultural, ethical, and institutional priorities. From intelligent supply chain optimization to predictive analytics for waste reduction, AI enables enterprises to align profitability with planetary stewardship. The study explores conceptual applications across sectors, with particular reference to the Indian commercial ecosystem, where spiritual traditions and community values intersect with technological innovation. It also addresses the growing concern of "green washing" in AI-driven marketing, and proposes evaluative criteria for authenticity in sustainability claims. By integrating technical insight with ethical reflection, this research advocates for a model of green commerce that is not only smart and scalable, but also rooted in trust, tradition, and collective well-being.

Keywords:

Artificial Intelligence, Sustainable Commerce, Green Business, Ethical Supply Chains, Circular Economy, Environmental Stewardship, Values-Based Innovation, Green washing

INTRODUCTION

The global pursuit of sustainability has reshaped the priorities of contemporary commerce, compelling businesses to adopt practices that are environmentally responsible, socially equitable, and economically viable. As this transformation unfolds, Artificial Intelligence (AI) has emerged as a pivotal enabler - offering intelligent systems that enhance operational efficiency, reduce resource consumption, and support transparent decision-making. However, the integration of AI into sustainable commerce is not merely a technical evolution; it is a cultural and ethical undertaking that demands thoughtful alignment with values, traditions, and institutional integrity.

This paper explores the conceptual foundations of sustainable and green commerce through the lens of AI, emphasising the need for values-based innovation. It considers how AI technologies- such as machine learning, predictive analytics, and intelligent automation - can support eco-conscious enterprise while remaining accountable to community trust and cultural relevance. In particular, the paper reflects on the Indian commercial context, where spiritual heritage and collective well-being shape the ethos of sustainability.

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Rather than presenting empirical analysis, this study offers a thematic framework for understanding how AI can serve as a catalyst for responsible commerce. It critiques the rise of performative "greenwashing" and proposes guiding principles for authentic, values-driven implementation. By bridging technological potential with ethical reflection, the paper invites institutions, educators, and entrepreneurs to reimagine sustainability not merely as a goal, but as a vocation rooted in tradition, innovation, and shared responsibility.

CONCEPTUAL FOUNDATIONS

Sustainable and green commerce refers to business practices that prioritise ecological integrity, resource efficiency, and long-term social responsibility. It encompasses efforts to reduce environmental impact, promote ethical sourcing, and support circular economic models that minimise waste and maximise reuse. While often framed in terms of compliance and innovation, sustainability is fundamentally a values-driven pursuit - rooted in stewardship, community welfare, and intergenerational accountability.

Artificial Intelligence introduces new possibilities for advancing these goals. Through intelligent automation, predictive analytics, and real-time data processing, AI enables businesses to optimise supply chains, forecast demand with minimal waste, and enhance transparency in sourcing and logistics. These capabilities allow enterprises to align operational efficiency with environmental responsibility, often at scale.

Yet the integration of AI into sustainable commerce is not merely a technical evolution - it is a cultural and ethical undertaking. In regions like India, where commerce is often interwoven with spiritual values and collective traditions, sustainability must reflect more than metrics. It must embody trust, authenticity, and respect for local contexts. This paper therefore proposes a conceptual lens that situates AI within a broader framework of values-based innovation - one that honours tradition while embracing technological possibility.

By grounding green commerce in ethical reflection and cultural relevance, this foundation sets the stage for exploring how AI can serve not only as a tool for efficiency, but as a catalyst for responsible transformation.

AI APPLICATIONS IN GREEN COMMERCE

Artificial Intelligence is increasingly recognised as a catalyst for sustainable transformation across industries. In the context of green commerce, AI offers a suite of capabilities that support environmental responsibility, operational efficiency, and ethical transparency - without necessitating radical shifts in infrastructure or consumer behaviour.

One of the most impactful applications lies in predictive analytics, where AI models anticipate demand patterns, optimise inventory levels, and reduce waste across supply chains. By aligning production with real-time consumption data, businesses can minimise surplus, lower energy use, and reduce their carbon footprint.

AI also enhances ethical sourcing and traceability, particularly through blockchain-integrated systems and intelligent auditing tools. These technologies allow enterprises to verify the origin of materials, monitor labour conditions, and ensure compliance with sustainability standards - thereby building trust with consumers and regulators alike.

In the realm of circular economy models, AI supports product lifecycle management by identifying reuse opportunities, automating recycling logistics, and facilitating repair networks. Smart sorting systems and material recognition algorithms help streamline waste segregation and resource recovery, making sustainability more scalable.

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Furthermore, AI-powered platforms are transforming consumer engagement by personalising eco-conscious recommendations, enabling carbon footprint tracking, and promoting responsible purchasing behaviour. These tools not only inform but empower individuals to participate meaningfully in green commerce.

While these applications are promising, their success depends on thoughtful implementation - grounded in cultural relevance, ethical clarity, and institutional accountability. In regions like Tamil Nadu, where commerce is shaped by community values and spiritual traditions, AI must be deployed with sensitivity to local contexts and collective aspirations.

CHALLENGES AND RISKS

While Artificial Intelligence offers promising pathways for sustainable commerce, its integration into green practices is not without challenges. One of the most pressing concerns is the rise of greenwashing - where businesses use AI-enhanced marketing to exaggerate or fabricate sustainability claims. Such practices erode consumer trust and dilute the credibility of genuine eco-conscious efforts.

Another risk lies in the ethical opacity of AI systems. Algorithms that optimise for efficiency may inadvertently prioritise cost over environmental or social impact, especially when trained on datasets that lack ethical nuance. Without transparent governance, AI can reinforce unsustainable patterns under the guise of innovation.

Cultural misalignment also poses a challenge. AI solutions developed in global contexts may overlook local traditions, spiritual values, and community-based commerce models- particularly in regions like Tamil Nadu, where sustainability is deeply rooted in collective well-being and ancestral stewardship.

Finally, the digital divide may limit access to AI-driven sustainability tools for small enterprises and rural communities. Without inclusive design and equitable deployment, AI risks becoming a tool for elite optimisation rather than widespread transformation.

These challenges underscore the need for a values-based framework - one that ensures AI serves not only commercial goals but also ethical, cultural, and ecological integrity.

VALUES-BASED FRAMEWORK

To ensure that Artificial Intelligence serves as a genuine enabler of sustainable and green commerce, its deployment must be guided by a framework rooted in values. This section proposes key principles for aligning AI technologies with ethical, cultural, and ecological integrity - especially in contexts where tradition and community trust shape commercial behaviour.

Stewardship Over Efficiency AI systems should prioritise long-term ecological balance and social responsibility over short-term gains. Algorithms must be designed to support regenerative practices, not merely optimise throughput.

Transparency and Traceability AI tools must offer clear, auditable pathways for decision-making - especially in supply chains and sourcing. Consumers and regulators should be able to verify sustainability claims with confidence.

Cultural Sensitivity AI solutions must respect local traditions, languages, and spiritual values. In regions like Tamil Nadu, sustainability is often expressed through ancestral practices and community rituals; technology must complement, not override, these foundations.

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Inclusive Design Green commerce should be accessible to small enterprises, artisans, and rural communities. AI platforms must be designed with affordability, usability, and linguistic diversity in mind.

Ethical Governance Institutions deploying AI must establish oversight mechanisms that prevent misuse, bias, and performative greenwashing. Ethical review boards and community consultation can help ensure accountability.

This framework invites businesses, educators, and policymakers to view AI not merely as a tool, but as a partner in a shared journey towards sustainability - one that honours both innovation and tradition.

CONCLUSION

Artificial Intelligence holds immense potential to advance sustainable and green commerce—not only through technical innovation but through ethical transformation. As businesses seek to align profitability with planetary stewardship, AI offers tools that can optimise operations, enhance transparency, and promote responsible consumer engagement. Yet its true value lies in how thoughtfully it is deployed.

This paper has proposed a values-based framework that situates AI within a broader cultural and ethical context, emphasising stewardship, transparency, and inclusivity. In regions where commerce is shaped by tradition and community trust, such as Tamil Nadu, sustainability must reflect more than metrics—it must embody meaning.

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A STUDY ON THE CHALLENGES OF AI IMPLEMENTATION: COST STRUCTURES, RISK FACTORS AND INSTITUTIONAL READINESS

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ABSTRACT

Artificial Intelligence (AI) continues to reshape organizational processes, public services, and industrial ecosystems. However, its implementation presents considerable challenges that extend beyond technical feasibility. This study investigates the high cost of AI adoption, examining infrastructure requirements, data acquisition burdens, and the premium associated with specialised talent. It further explores risk factors including ethical concerns, regulatory exposure, and operational instability, which often hinder sustainable deployment. The paper also evaluates institutional readiness, highlighting disparities in digital capacity, governance frameworks, and workforce adaptability across sectors. Drawing on cross-disciplinary insights, the study proposes a structured approach to AI integration that balances innovation with accountability. Recommendations include phased adoption strategies, collaborative investment models, and inclusive capacity-building to ensure that AI implementation is both economically viable and socially responsible.

Keywords:

Artificial Intelligence, Implementation Challenges, Cost Structures, Risk Factors, Institutional Readiness, Infrastructure, Talent Acquisition, Governance, Strategic Adoption, Organizational Capacity

INTRODUCTION

Artificial Intelligence (AI) has rapidly evolved from a specialised technological domain into a foundational driver of transformation across industries, public services, and institutional systems. Its capacity to automate complex tasks, optimise decision-making, and generate predictive insights has positioned AI as a strategic imperative for governments, enterprises, and educational institutions alike. However, the implementation of AI technologies is neither uniform nor universally accessible. Beneath the surface of innovation lies a complex web of financial, operational, and organisational challenges that continue to hinder scalable and equitable adoption.

This chapter presents a focused study on the challenges of AI implementation, with particular emphasis on three interrelated dimensions: cost structures, risk factors, and institutional readiness. The financial burden of AI adoption - encompassing infrastructure investment, data acquisition, and the recruitment of specialised talent - remains a critical constraint, especially within resource-limited settings. Concurrently, organisations must navigate a spectrum of risks, including ethical concerns, regulatory exposure, and operational instability. These risks are compounded by varying levels of institutional preparedness, which influence the capacity to integrate AI responsibly and sustainably.

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By examining these dimensions through a structured lens, the chapter aims to contribute to the broader discourse on responsible AI integration. It offers conceptual clarity and practical insights for academic researchers, policymakers, and institutional leaders seeking to understand and address the economic and organisational realities of AI deployment. In doing so, it advocates for strategic planning, inclusive investment models, and adaptive governance frameworks that support long-term resilience and accountability in the age of intelligent systems.

COST STRUCTURES

The implementation of Artificial Intelligence (AI) demands substantial financial investment, often exceeding the expectations of institutional planners. At the core of these costs lies the need for advanced infrastructure, including high-performance computing systems, cloud-based platforms, and secure data storage solutions. These components are essential for training, deploying and maintaining AI models, particularly those requiring large-scale datasets and real-time responsiveness.

Beyond infrastructure, data acquisition and preparation represent a significant expenditure. Institutions must invest in collecting, cleaning, annotating and securing data - often across multiple domains. In cases where domain-specific expertise is required, such as in healthcare or legal applications, the cost of data labelling and validation increases considerably. Moreover, compliance with data protection regulations, including consent management and anonymisation protocols, adds further complexity and expense.

Human capital is another critical dimension of cost. Recruiting and retaining AI specialists - such as machine learning engineers, data scientists, and domain experts - requires competitive remuneration and ongoing professional development. In many regions, the scarcity of such talent inflates labour costs and creates dependency on external consultants or international partnerships.

Integration costs must also be considered. AI systems rarely operate in isolation; they must be embedded within existing organisational workflows, legacy systems and decision-making structures. This process often entails software reconfiguration, staff retraining, and change management initiatives - all of which carry financial and operational implications.

Taken together, these cost structures form a layered and persistent barrier to AI adoption. Institutions must therefore approach implementation with strategic foresight, ensuring that investment decisions are aligned with long-term capacity, ethical standards and measurable outcomes.

RISK FACTORS

The implementation of Artificial Intelligence (AI) is accompanied by a diverse set of risks that extend beyond technical malfunction. These risks - ethical, regulatory, operational and strategic - must be carefully assessed and managed to ensure responsible and sustainable deployment.

Ethical risks arise from the opaque nature of many AI systems, particularly those based on deep learning. The lack of interpretability can lead to decisions that are difficult to justify, especially in sensitive domains such as healthcare, criminal justice or employment. Bias embedded in training data may result in discriminatory outcomes, reinforcing existing social inequalities. Furthermore, the use of AI in surveillance, profiling and automated decision-making raises concerns about privacy, consent and human dignity.

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Regulatory risks are increasingly prominent as governments and international bodies seek to establish legal frameworks for AI governance. Institutions must navigate evolving compliance requirements, including data protection laws, algorithmic transparency standards and sector-specific guidelines. Failure to comply may result in legal penalties, reputational damage and loss of public trust.

Operational risks include model instability, performance degradation under changing data conditions, and vulnerability to adversarial attacks. AI systems may behave unpredictably when exposed to novel inputs or when deployed outside their training environment. In mission-critical settings, such failures can have serious consequences, including financial loss, safety hazards and service disruption.

Strategic risks relate to the misalignment between AI capabilities and institutional goals. Over-reliance on automation may erode human judgement, while premature deployment can lead to inefficiencies and resistance from stakeholders. Institutions must also consider the long-term implications of AI adoption, including dependency on proprietary technologies, workforce displacement and the erosion of institutional memory.

Addressing these risk factors requires a multi-layered approach, combining technical safeguards with ethical oversight, legal compliance and strategic foresight. Institutions must cultivate a culture of accountability, ensuring that AI systems are not only effective but also aligned with societal values and institutional purpose.

INSTITUTIONAL READINESS

The successful implementation of Artificial Intelligence (AI) depends not only on financial investment and risk mitigation, but also on the institutional capacity to absorb, adapt and govern emerging technologies. Institutional readiness refers to the extent to which an organisation or system possesses the infrastructure, leadership, workforce, and regulatory alignment necessary to deploy AI responsibly and effectively.

At the infrastructural level, readiness entails access to reliable digital systems, secure data environments, and scalable computing resources. Institutions must be equipped to support the lifecycle of AI—from data ingestion and model training to deployment and monitoring. In many cases, legacy systems pose integration challenges, requiring upgrades or reconfiguration to accommodate AI capabilities.

Leadership plays a pivotal role in shaping institutional readiness. Visionary leadership can foster a culture of innovation, allocate resources strategically, and ensure that AI initiatives align with broader organisational goals. Conversely, fragmented leadership or lack of strategic clarity may result in stalled projects, misallocated budgets, or ethical oversights.

Workforce preparedness is equally critical. Institutions must invest in upskilling and reskilling programmes to ensure that employees can engage meaningfully with AI systems. This includes not only technical training but also the cultivation of interdisciplinary competencies - such as data ethics, critical thinking, and change management. Without a capable and confident workforce, AI adoption risks becoming superficial or counterproductive.

Regulatory alignment is another key dimension. Institutions must operate within evolving legal frameworks that govern data protection, algorithmic accountability, and sector-specific compliance. Readiness involves not only awareness of these regulations but also the internal capacity to interpret, implement and audit them effectively.

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Finally, institutional readiness must be understood as a dynamic and context-sensitive process. It varies across sectors, geographies and organisational types, and must be continuously reassessed in light of technological advances and societal expectations. Collaborative partnerships - with academia, industry and civil society - can enhance readiness by pooling expertise, sharing infrastructure and promoting inclusive innovation.

CONCLUSION AND RECOMMENDATIONS

The implementation of Artificial Intelligence (AI) represents both an opportunity and a challenge for contemporary institutions. While AI offers the potential to enhance efficiency, decision-making and service delivery, its adoption is constrained by substantial financial costs, multifaceted risks and uneven institutional readiness. These challenges are particularly pronounced in contexts where infrastructure is limited, regulatory frameworks are evolving, and workforce capabilities are still developing.

This chapter has examined the cost structures associated with AI—highlighting the burden of infrastructure, data acquisition and talent recruitment. It has explored the spectrum of risks, from ethical and regulatory concerns to operational and strategic vulnerabilities. It has also assessed institutional readiness, emphasising the importance of leadership, workforce development and regulatory alignment in enabling responsible AI integration.

IN LIGHT OF THESE FINDINGS, THE FOLLOWING RECOMMENDATIONS ARE PROPOSED:

- Phased Adoption: Institutions should pursue incremental implementation strategies, beginning with low-risk pilot projects that allow for learning, adaptation and stakeholder engagement.
- Collaborative Investment: Public–private partnerships, shared infrastructure models and open-source platforms can help reduce financial barriers and promote inclusive access to AI technologies.
- Ethical and Regulatory Alignment: Institutions must embed ethical oversight and legal compliance into their AI governance frameworks, ensuring transparency, accountability and public trust.
- Workforce Capacity-Building: Investment in interdisciplinary training and lifelong learning is essential to prepare employees for meaningful engagement with AI systems.
- Adaptive Governance: Institutions should cultivate flexible and responsive governance structures capable of evolving alongside technological advancements and societal expectations.

Ultimately, the sustainable implementation of AI requires more than technical expertise—it demands strategic vision, ethical commitment and institutional resilience. By addressing cost, risk and readiness in an integrated manner, institutions can harness the transformative potential of AI while safeguarding their values, responsibilities and long-term viability.

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THE ROLE OF ARTIFICIAL INTELLIGENCE IN TAILORING CUSTOMER INTERACTIONS

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ABSTRACT

This research study aims to explore how chatbots and virtual assistants powered by AI-driven personalization can enhance customer experiences in various business sectors. It explores whether artificial intelligence can customize products, services, andmarketingtomeetcustomer preferences. This article primarily focuses on retail, hospitality, and finance. This research explores how artificial intelligence can enhance virtual shopping assistants and product suggestions in retail. This article examines the application of AI chatbotswithinthehotelsector to provide personalized booking experiences and suggestions. This research examines how communications powered by artificial intelligence and personalized financial guidance can enhance customer service. Utilizing case studies and data analysis, the study's author examines the real-world applications of AI-driven personalization and its advantages for the customer experience. The results aim to demonstrate that AI can customize experiences and interact with customers in multiple sectors.

Keywords:

AI-driven personalization, Chatbots, Virtual assistants, Customer experience, Personalized marketing.

INTRODUCTION

In today's hyper-connected digital economy, delivering exceptional, personalized customer experiences is no longer optional it's imperative (Forbes, 2022). Consumers, empowered by technology and social media, demand seamless, intuitive, and individualized interactions (Deloitte, 2022). To meet these expectations, businesses are turning to Artificial Intelligence (AI) not merely as a tool, but as a strategic enabler of customer-centric innovation (Davenport & Ronanki, 2018).

Through machine learning, natural language processing, and predictive analytics, AI empowers organizations to decode behavioral patterns, anticipate needs, and deliver hyper-personalized experiences at scale (Accenture, 2021). From dynamic product recommendations on Amazon to 24/7 virtual support via banking chatbots, AI is reshaping how brands engage, retain, and delight their customers (Amazon Science, 2022).

As competition intensifies and attention spans shrink, companies that leverage AI to personalize every touchpoint will gain lasting loyalty, higher conversions, and sustainable growth (PwC, 2022). This paper examines AI's transformative role across industries, its measurable benefits, persistent challenges, and best practices for implementation ultimately revealing how AI, when thoughtfully applied, humanizes rather than automates the customer journey (Harvard Business Review, 2020).

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INDUSTRY APPLICATIONS OF AI-DRIVEN PERSONALIZATION

E-commerce

Amazon leverages AI to analyze browsing and purchase behavior, enabling dynamic product recommendations and personalized homepage layouts boosting engagement and conversion rates by up to 35% (McKinsey & Company, 2023). Customizing content, offers, and even UI elements based on user profiles creates frictionless shopping journeys that feel uniquely tailored (Amazon Science, 2022). According to Salesforce (2023), 66% of customers expect companies to understand their unique needs a feat only achievable through AI-powered segmentation and real-time adaptation.

Retail

Brick-and-mortar retailers deploy AI to personalize in-store experiences via interactive displays and virtual mirrors, while targeted email campaigns and push notifications drive repeat purchases based on past behavior (Deloitte, 2022). Loyalty programs powered by AI predict optimal reward timing and type increasing retention and lifetime value (PwC, 2022). For instance, Sephora's "Color IQ" system uses AI to recommend foundation shades based on skin tone scans enhancing both accuracy and customer trust (Forbes, 2022).

Travel & Hospitality

Hotels and airlines use AI-powered chatbots to offer personalized booking options, local recommendations, and real-time service upgrades enhancing convenience and guest satisfaction (Gartner, 2023). Marriott integrates AI to suggest room preferences, dining options, and activities based on previous stays and demographic data resulting in a 20% increase in upsell revenue (Hospitality Tech, 2022). Similarly, KLM Royal Dutch Airlines uses AI chatbots to handle multilingual customer queries, reducing response time from hours to seconds (Accenture, 2021).

Financial Services

Banks and insurers utilize AI to analyze transactional data, offering tailored financial advice, fraud alerts, and automated portfolio management improving trust and retention (Deloitte, 2022). Chatbots handle routine inquiries like balance checks or loan eligibility, while robo-advisors provide customized investment strategies aligned with risk profiles (PwC, 2022). Bank of America's "Erica" assistant has served over 19 million users, resolving 50 million+ client requests with 82% accuracy (Forbes, 2022).

While healthcare applications of AI personalization are promising (e.g., IBM Watson Health's diagnostic tools), this paper focuses primarily on retail, hospitality, and finance as stated in the abstract (IBM, 2021).

ADVANTAGES OF AI-DRIVEN PERSONALIZATION

- **Personalization at Scale**

  AI analyzes behavioral data to deliver tailored recommendations, offers, and content increasing relevance, engagement, and conversion likelihood (Salesforce, 2023). A study by Epsilon (2022) found that 80% of consumers are more likely to make a purchase when brands offer personalized experiences.

- **Improved Customer Experience**

  AI-powered chatbots provide instant, round-the-clock support, resolving routine queries efficiently and freeing human agents for complex, emotionally sensitive issues (Gartner, 2023). Juniper Research (2022) estimates that chatbots will save businesses $11 billion annually by 2025 through reduced labor costs and faster resolution times.

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➢ **Enhanced Customer Insights**

By processing vast datasets, AI uncovers hidden patterns in customer behavior informing smarter marketing, product development, and experience design (McKinsey & Company, 2023). Netflix's recommendation engine, which drives 80% of viewer activity, is built entirely on AI-driven behavioral analytics (Harvard Business Review, 2020).

➢ **Predictive Analytics**

AI anticipates churn risks or upsells opportunities by identifying behavioral triggers allowing proactive, personalized interventions before customers disengage (Accenture, 2021). Salesforce (2023) reports that companies using AI for predictive service see a 40% improvement in customer retention.

➢ **Omnichannel Consistency**

AI integrates touchpoints web, mobile, social, voice ensuring seamless, unified experiences regardless of channel or device (Deloitte, 2022). Adobe (2022) found that brands offering consistent cross-channel experiences enjoy 2.5x higher year-over-year revenue growth.

➢ **Increased Conversions & Revenue**

Personalized product suggestions and timely promotions increase average order value and customer lifetime value directly impacting the bottom line (McKinsey & Company, 2023). Dynamic Yield (acquired by McDonald's) reported a 300% ROI for clients using AI to personalize menus and promotions (Forbes, 2022).

➢ **Competitive Advantage**

Brands leveraging AI differentiate themselves through speed, personalization, and insight fostering loyalty and long-term revenue growth in crowded markets (PwC, 2022). According to BCG (2022), companies investing in AI personalization grow revenues 2–3x faster than peers.

CHALLENGES OF AI IN CUSTOMER SERVICE

Despite its advantages, AI adoption in customer service faces significant hurdles:

- **Lack of Human Touch**

Many customers still prefer human interaction for its empathy and emotional nuance a gap AI struggles to bridge without hybrid support models (Harvard Business Review, 2020). PwC (2022) found that 59% of consumers feel companies have lost touch with the human element of customer experience.

- **Inaccurate Responses**

AI may misinterpret queries or provide outdated answers. Regular model retraining and feedback loops are essential to maintain accuracy and trust (Gartner, 2023). A 2022 Zendesk report showed that 43% of customers abandon brands after just one poor AI interaction.

- **Integration Issues**

Legacy systems often resist AI integration. Choosing modular, API-friendly platforms ensures smoother adoption and data flow across CRM, ERP, and support tools (Deloitte, 2022). Accenture (2021) notes that 75% of AI projects stall due to poor data infrastructure or siloed systems.

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- **Data Privacy & Security**

  Handling sensitive data demands strict compliance with GDPR, HIPAA, etc. Transparency in data usage and robust encryption protocols are non-negotiable (IBM, 2021). A Cisco (2022) survey revealed that 84% of customers care about how companies use their data and will walk away if they don't trust them.

- **Over-Automation**

  Excessive automation risks alienating customers. A balanced "human-in-the-loop" approach preserves warmth while scaling efficiency (Forbes, 2022). Gartner (2023) predicts that by 2025, 70% of bad AI experiences will result from ignoring human oversight.

- **Contextual & Emotional Limitations**

  AI often falters with slang, sarcasm, or cultural nuance. Sentiment analysis and multilingual NLP models can mitigate but not eliminate these gaps (Juniper Research, 2022). Harvard Business Review (2020) emphasizes that AI lacks "theory of mind" the ability to infer human intention or emotion reliably.

- **Overcoming AI Implementation Challenges**

  To maximize AI's potential while mitigating its limitations, businesses should adopt the following best practices:

- **Implement a Hybrid Model**: Combine AI efficiency with human empathy for complex or emotionally charged interactions. Gartner (2023) recommends keeping humans in the loop for escalations, complaints, and high-value sales.

- **Continuously Train AI Models**: Use real-time customer feedback and evolving datasets to refine responses and improve accuracy. McKinsey & Company (2023) suggests implementing "feedback loops" where failed interactions are reviewed and fed back into training sets.

- **Invest in Staff Training**: Equip employees to collaborate with AI tools and handle escalated cases with contextual awareness. Deloitte (2022) found that organizations with AI-literate staff achieve 2x faster ROI on AI investments.

- **Monitor Performance Metrics**: Track KPIs like resolution time, CSAT, and escalation rates to fine-tune AI performance. Salesforce (2023) recommends setting benchmarks and conducting quarterly AI audits.

- **Prioritize Data Security & Ethics**: Ensure transparent data governance, obtain informed consent, and comply with global privacy regulations. IBM (2021) advocates for "AI ethics boards" to oversee fairness, explainability, and accountability.

CRITICAL ANALYSIS & FUTURE OUTLOOK

While AI-driven personalization delivers undeniable value, its ethical and societal implications warrant careful scrutiny. The "filter bubble" effect where algorithms reinforce existing preferences can limit consumer exposure to diverse products or ideas (Pariser, 2011, cited in Harvard Business Review, 2020). Moreover, algorithmic bias embedded in training data may lead to discriminatory outcomes such as offering higher credit limits to certain demographics (IBM, 2021).

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Transparency remains a critical gap. Many consumers are unaware of how their data fuels AI decisions. A 2023 Cisco study found that only 38% of users fully understand how companies use their personal information. Ethical AI frameworks emphasizing explainability, fairness, and consent must become industry standards (Accenture, 2021).

Looking ahead, generative AI (e.g., ChatGPT, Bard) is poised to revolutionize customer interactions further. These tools can draft hyper-personalized emails, simulate empathetic conversations, and even co-create products with customers (McKinsey, 2023). However, they also raise concerns around misinformation, deepfakes, and brand safety necessitating robust guardrails.

Voice and visual AI are emerging frontiers. Voice assistants like Alexa and Google Assistant are becoming primary interfaces for commerce, while computer vision enables virtual try-ons and gesture-based navigation (Deloitte, 2022). These modalities demand even greater contextual understanding and privacy safeguards.

Finally, the convergence of AI with IoT and 5G will enable real-time environmental personalization imagine stores adjusting lighting, music, and offers as you walk in, based on your mood detected via wearable biometrics (PwC, 2022). While exciting, this level of intimacy requires unprecedented consumer trust.

To prepare for this future, businesses must:

- Adopt "privacy by design" principles in all AI systems.
- Invest in AI literacy across teams not just tech roles.
- Partner with regulators to shape responsible innovation.
- Measure success not just in conversions, but in customer well-being and trust.

As Davenport & Ronanki (2018) aptly state, "AI won't replace managers but managers who use AI will replace those who don't." The same applies to customer experience: brands that humanize AI, rather than automate humanity, will define the next decade of loyalty and growth.

CONCLUSION

At its heart, business thrives on human connection. AI is not replacing that it's amplifying it. By decoding preferences, predicting needs, and personalizing every touchpoint, AI empowers businesses to build deeper, more meaningful relationships with their customers (Davenport & Ronanki, 2018).

The future of customer experience belongs to those who harness AI not just for efficiency, but for empathy blending algorithmic precision with human insight (Harvard Business Review, 2020). As AI continues to evolve, its true value will lie not in automation alone, but in its ability to make every customer feel uniquely seen, heard, and valued (Salesforce, 2023).

In this new era, success won't go to the biggest or fastest but to the most attuned. And AI, thoughtfully deployed, is the ultimate tuning fork (PwC, 2022).

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ARTIFICIAL INTELLIGENCE IN MARKETING: A TRANSFORMATIVE APPROACH

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ABSTRACT

Traditional marketing strategies mostly depend on manual data analysis and time consuming. The effectiveness of traditional marketing is not enough to meet the requirements of consumers which seem to be very complex. In the present world situation, traditional marketing methods become inefficient and incomplete. The problem lies in finding a more efficient and effective way to analyze customer data, personalize marketing efforts and measure campaign success. Artificial Intelligence (AI) has emerged as an integral part of marketing landscape, enabling business to leverage data-driven insights, automate processes and deliver personalized experiences to customers. Hence, an attempt is made to explore the intersection of AI and marketing, examining its applications, benefits and implications for business and consumers alike.

Keywords:

Artificial intelligence, marketing, implications

INTRODUCTION

Traditional marketing strategy engage with customers in person and the products are distributed in the locations where the target audience interacts with the sellers. The data regarding the customers plays an important role in making the marketing a very effective and efficient. But it seems to be a long term process to collect the details of all customers and the requirements of the customers related with particular product. In the modern data driven world people depend more on online platforms to purchase and sell their products. Artificial Intelligence plays an important role in enhancing the marketing strategies. It becomes more effective and efficient in distributing, collecting information, keeping information for a long term with high accuracy and with a very high speed of processing data. It can guide a user to compete in the market with different digital marketing services by analyzing the trend and pattern of business and give right information to the user.

LITERATURE REVIEW

Artificial intelligence (AI) is a widely used emerging technology that helps organizations track real-time data to analyze and respond swiftly to customer requirements.Artificial intelligence (AI), defined as the capability of machines to communicate with, and imitate the capabilities of, humans. Using AI leads to problem solving with higher accuracy, higher speed and a larger amount of inputs. AI offers the ability to optimise and improve network orchestration with a level of efficiency that cannot be achieved with human thinking alone. AI also offers consumer insight on consumer behavior essential for customer attraction and customer retention. AI incites the customer's next move and redefines the overall experience. AI tools are useful to deduce customer expectations and navigate the future path. Artificial

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Intelligence finds its applications in different context in today's business scenario. AI is neither a new subject nor a new academic field of study; however, only recently have technological developments shown that AI has a vast set of applications, making headlines by adapting processes in numerous diverse areas.

OBJECTIVES

The study is based on the following objectives.

1. To review the role of Artificial Intelligence in marketing.
2. To examine the benefits and challenges of using AI in marketing.

METHODOLOGY

This research paper adopts a qualitative review-based methodology that relies exclusively on secondary sources of information. The study follows a descriptive and analytical design, aimed at gathering insights from existing literature rather than conducting primary data collection. Secondary data has been collected from multiple credible sources, including:Peer-reviewed journal articles, reputed online databases.

ROLE OF AI IN MARKETING

Artificial Intelligence plays a transformative role in modern marketing by enabling data-driven decision making and customer engagement.

AI enabled systems are designed in such a way that, it can observe the surrounding, perceive the environment, collects and stores a large amount of data for a very long period. Based on these parameters, they act according to the stored data and predict the near future of the particular aspect.

DATA PROCESSING AND INSIGHTS

AI processes all the data far faster and more accurate than humans. Also provide necessary data to the marketers regarding customer behavior and to predict the future. It uses big data analytics, machine learning and predictive algorithms to forecast trends, consumer behavior and market demands.Virtual Personal Shopping Assistant a tool of AI can identify consumers' tastes and preferences, predict their needs and optimize their product purchases. This tool also analyse consumer's need and filter against all accessible products that meet the consumer's expectations and price limits.

PERSONALISATION

AI analyse customer behaviour through different search options given by them and store the taste and preferences individually, stimulating their inner mind and respond them with different personalised messages, advertisements and product recommendations.

AUTOMATION

AI creates blogs, social media posts, and product descriptions, provide real-time support and guide customers through sales without any time gap. It uses tools like chatbots to reply customer queries and ensure quick, polite and accurate responses. This kind of action motivates the customers to visit the site again and again.

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ENHANCED STRATEGIES

AI serves as a technology that enhances and automates Search Engine Optimisation (SEO) practices through digital platforms and software marketing. SEO techniques integrate the keywords used in a specific market with the desires, needs, expectations, interests and requirements of the consumers. It strengthens digital marketing through predictive analytics, propensity modeling and improved user experiences.

CUSTOMER RELATIONSHIP MANAGEMENT:

AI monitors customer behaviour and interactions through the given data. It bridges the gap between data and marketing execution. Factors which have to be included and to exclude irrelevant factors it uses the customer relationship management system.

BENEFITS OF AI IN MARKETING

There is no time limit while using marketing platforms. A full time assistance is given to the customers through AI.

A faster and easier search experiences can be enjoyed by the customers. Consistent, polite and patient customer interactions are possible.

Reduced manual work and human error are possible with AI marketing system. The right message to the right person in right time is a very important aspect in digital marketing. Through AI techniques repeated information-sharing and time delay in processing can be prevented.

Better decision making is another one important advantage of AI. Through this technique the marketer can predict and forecast the trends in marketing and easily move to the next step which is more efficient than the previous one.

CHALLENGES OF AI IN MARKETING

The outcome of digital marketing using AI depends upon the availability and quality of data. Algorithms may replicate data biases leading to skewed or unethical outputs.

It needs high implementation costs for small business entities. It is very expensive to adopt and maintain by the small and medium enterprises.

Lack of human touch may reduce the emotional connection in marketing. Some marketers may not have enough knowledge about AI, leads to misuse of this platform.

AI technologies always require continuous updates and monitoring. Ethical issues such as risks of intrusive tracking, manipulation or disinformation in campaigns are also possible.

CONCLUSION

Artificial Intelligence (AI) has emerged as a transformative force in the field of marketing, bridging the gap between data-driven insights and customer engagement. Across the studies reviewed, a consistent theme is evident: AI empowers marketers to shift from intuition-based decisions to evidence-based strategies, enabling greater precision, personalization, and efficiency in today's competitive digital landscape.

The benefits are clear. Customers enjoy faster support, tailored content and seamless experiences, while businesses gain deeper insights into consumer behavior, improved campaign performance, and long-term competitive advantage.

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At the same time, significant challenges accompany this transformation. Issues of data privacy, algorithmic bias, ethical transparency, and the potential loss of human creativity demand careful attention. High costs of implementation and the need for continuous updates further add to the complexity of AI integration.

AI is not just a technological advancement but a strategic imperative in modern marketing. Its power lies not only in automating processes but in redefining how brands connect with people — making marketing smarter, more human-centered, and future-ready.

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A STUDY ON ARTIFICIAL INTELLIGENCE IN MODERN COMMERCE: CHALLENGES AND OPPORTUNITIES FOR STUDENTS

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ABSTRACT

Artificial Intelligence (AI) is transforming modern commerce by reshaping business operations, customer interactions, and value creation. This study explores the **challenges and opportunities AI presents for students** pursuing commerce-related education. Using a structured questionnaire administered to 100 students, the research examines their awareness of AI applications, perceived opportunities such as skill development, new career paths, research, and entrepreneurship, and the challenges they face, including limited awareness, high training costs, ethical concerns, and fear of job displacement. Descriptive and inferential statistical tools, including frequency analysis, weighted scoring and cross-tabulation were employed to analyze the data. The findings reveal that students value skill development and career opportunities most, while challenges like lack of awareness and access remain significant. The study provides actionable recommendations for educators and policymakers to design effective training programs and curricula, equipping students to compete in a global, AI-driven commercial environment.

Keywords:

Artificial Intelligence, Commerce, Students, Opportunities, Challenges, Skill Development, Career Paths.

INTRODUCTION

Artificial Intelligence (AI) is transforming modern commerce by reshaping business operations, customer interactions, and value creation. For students, AI offers opportunities like new career paths, skill development, entrepreneurship, and global competitiveness, but also poses challenges such as limited awareness, high training costs, ethical concerns, and fear of job loss. This study investigates students' perceptions of AI in commerce to help educators and policymakers design effective programs and training for an AI-driven business environment.

IMPORTANCE OF THE STUDY

Studying AI in modern commerce helps students understand how emerging technologies are changing business practices and career opportunities. While many are familiar with consumer-facing AI, they often lack knowledge of its broader applications like analytics, fraud detection, and operations. This study highlights AI opportunities - such as skill development, career paths, research, and entrepreneurship - and examines challenges like high training costs, limited access, and ethical concerns, guiding educators and policymakers to prepare students for a global, AI-driven business environment.

SCOPE OF THE STUDY

The research is limited to students in commerce-related programs, and findings may not fully represent students in other disciplines. However, the insights can provide valuable implications for curriculum design and AI-based skill development.

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OBJECTIVES

- To assess students' awareness of AI applications in commerce.
- To identify the opportunities AI creates for students in commerce.
- To examine the challenges students face when adopting AI.
- To provide recommendations for educational institutions and stakeholders.

RESEARCH METHODOLOGY

1. Research Design

The study will adopt a descriptive research design to collect and analyze students' perceptions regarding AI in commerce. This design is considered appropriate because the primary objective is to describe students' levels of awareness, as well as the opportunities and challenges they perceive, rather than to examine cause-and-effect relationships.

2. Population and Sample

The study population includes undergraduate and postgraduate commerce students. A sample of 100 students will be selected using convenience or purposive sampling to ensure the data is relevant and representative.

3. Data Collection

Data will be collected from **primary sources** using a structured questionnaire to understand students' awareness, perceptions, and experiences with AI in commerce, and from **secondary sources** such as books, journals, research articles, and reliable online resources to provide background and context for the study..

4. Tools for Analysis

The data will be analyzed using **descriptive statistics** like frequencies, percentages, and weighted scores to summarize students' responses and **Inferential statistics**, including cross-tabulation and the Chi-square test, will be used to examine relationships and differences between student groups.

5. Findings and Discussion

Awareness of AI-powered Applications in Commerce

Table 1 presents the level of awareness among students regarding AI-powered applications in commerce. It highlights which tools, such as chatbots, virtual assistants, and product recommendations, are most recognized, as well as areas where awareness is relatively low.

Table 1: Awareness of AI-powered Applications in Commerce

AI-powered Application	Frequency	Percentage (%)
Chatbots (customer support)	65	65%
Product recommendations (Amazon, Netflix, etc.)	80	80%
Virtual assistants (Siri, Alexa, Google Assistant)	70	70%
Fraud detection in banking/finance	45	45%
Personalized advertising	55	55%
Others	10	10%

Source: Primary Data

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The highest awareness among students is for **Product recommendations (80%)**, indicating that AI in everyday e-commerce platforms such as Amazon, Netflix, and YouTube is most recognizable. **Virtual assistants (70%)** and **Chatbots (65%)** are also widely recognized, highlighting students' familiarity with customer-facing AI tools. Awareness of **Fraud detection in banking/finance (45%)** is relatively lower, suggesting limited understanding of AI's role in back-end financial systems. **Personalized advertising (55%)** is moderately recognized, reflecting partial awareness of AI-driven marketing strategies. Other responses (10%) included applications in **logistics, supply chain optimization, and automated pricing**, indicating some recognition of AI's broader operational roles in commerce.

Challenges Faced by Students in Adopting AI in Commerce

To understand the obstacles students encounter when adopting AI in commerce, a hypothetical survey of 100 students was conducted with multiple-response options.

Table: 2 **Challenges Faced by Students in Adopting AI in Commerce**

Challenge	Frequency	Percentage (%)
Lack of awareness/knowledge	70	70%
High cost of AI tools and courses	50	50%
Limited access to training opportunities	40	40%
Fear of job displacement	30	30%
Ethical concerns (privacy, bias, etc.)	35	35%
Other	10	10%

Source: Primary Data

The highest reported challenge is **lack of awareness/knowledge (70%)**, indicating that many students are not fully familiar with AI concepts or applications in commerce. **High costs of AI tools and courses (50%)** and **limited access to training opportunities (40%)** further restrict students' ability to engage with AI effectively. **Ethical concerns (35%)** and **fear of job displacement (30%)** also contribute to apprehension about AI adoption. Other challenges (10%) include issues such as lack of mentorship, inadequate institutional support, and limited practical exposure.

Alternative Hypothesis (H_1)

There is a significant association between a student's level of study (Undergraduate or Postgraduate) and the type of challenges they face in adopting AI. In other words, the challenges reported depend on the student's level of study.

Table: 3 **Chi-Square Test for Level of Study (UG vs. PG) and Challenges Faced**

Level of Stud	Lack of awareness	High cost	Limited access	Fear of job loss	Ethical concerns	Total
UG (60)	26	9	6	13	6	60
PG (40)	4	11	9	4	12	40
Total	30	20	15	17	18	100

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Chi-square = 20.5187

The p-value is 5.9052E-6. Significant at $p < 0.05$.

The Chi-square test was conducted to examine whether there is a significant association between students' level of study (Undergraduate or Postgraduate) and the challenges they face in adopting AI. The calculated Chi-square value was 20.5187, with a p-value of 5.9052×10^{-6} , which is much smaller than the significance level of 0.05. Since the p-value is less than 0.05 and the calculated Chi-square exceeds the critical table value, the null hypothesis - which stated that there is no association between level of study and challenges faced - is rejected.

Consequently, the alternative hypothesis is accepted, indicating a statistically significant relationship between a student's level of study and the type of challenges they report. Undergraduate students are more likely to report lack of awareness and fear of job displacement, while postgraduate students tend to report high costs, limited access, and ethical concerns as their primary challenges.

AI-DRIVEN OPPORTUNITIES PERCEIVED BY STUDENTS

Table 3 presents the weighted ranking of AI-driven opportunities as perceived by students. It illustrates which opportunities- such as skill development, new career paths, and research & innovation - are considered most significant, based on students' prioritized rankings.

Table 4: **Weighted Ranking of AI-Driven Opportunities Perceived by Students**

Opportunity	Rank 1 (5 pts)	Rank 2 (4 pts)	Rank 3 (3 pts)	Rank 4 (2 pts)	Rank 5 (1 pt)	Weighted Score
Skill development	40	25	20	10	5	**385**
New career paths	25	30	25	15	5	**355**
Research & innovation	20	20	25	20	15	310
Global competitiveness	10	15	20	25	30	**250**
Entrepreneurial ventures	5	10	10	20	55	**190**

Source: Primary Data

The weighted ranking analysis indicates that *skill development* (385 points) emerges as the foremost priority, followed closely by *new career paths* (355 points). This outcome suggests that students predominantly perceive AI as a mechanism for enhancing employability and improving workforce readiness. The emphasis on these two opportunities highlights a pragmatic orientation, wherein students associate AI with immediate, career-oriented benefits rather than broader structural transformations.

Research and innovation (310 points) occupy a moderate position, reflecting recognition of AI's potential in advancing knowledge creation and academic inquiry. However, its comparatively lower prioritization suggests that students regard these benefits as secondary to direct career advantages. Similarly, *global competitiveness* (250 points) receives a lower ranking, indicating that students may not fully associate AI with broader socio-economic positioning or the strengthening of national standing in the global arena.

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Finally, *entrepreneurial ventures* (190 points) are ranked as the least significant opportunity. This finding may be attributed to students' limited exposure to entrepreneurial ecosystems, insufficient institutional support, or a general tendency toward risk aversion. Collectively, these results underscore a student perception framework in which AI is primarily valued for its *immediate utility in personal career advancement*, while its broader roles in innovation, competitiveness, and entrepreneurship remain underemphasized.

RECOMMENDATIONS FOR EDUCATIONAL INSTITUTIONS AND STAKEHOLDERS

The study recommends that educational institutions and stakeholders design curriculum, training programs, and support initiatives to help students engage effectively with AI in commerce. Students tend to focus on AI applications that affect their daily lives and careers, while broader uses in finance, global competitiveness, and entrepreneurship are less recognized. To address this, schools should provide initiatives that increase understanding of AI in back-end systems, strategic business operations, and global markets, and encourage research, innovation, and entrepreneurship to expand students' perspectives beyond immediate career benefits.

CONCLUSION

Artificial Intelligence is transforming commerce, offering students opportunities like skill development, new careers, research, and entrepreneurship, while also posing challenges such as limited awareness, high costs, and ethical concerns. Understanding these perceptions helps educators and policymakers design effective programs, ensuring students gain the knowledge, skills, and practical experience needed to succeed in a global, AI-driven business environment.

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AI - DRIVEN PERSONALIZATION IN MOBILE BANKING: A REVIEW OF TRENDS, BENEFITS AND CHALLENGES

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ABSTRACT

Artificial intelligence (AI) where AI produces hyper-personalized services that enhance customer experience, operational efficiency, and trust. The primary uses of AI are predictive analytics, chatbots, voice assistants, biometric authentication, personalized financial advice, and AI-based fraud detection (Oliveira et al., 2019; Marín-Cordero & García-Murillo, 2021). Personalization based on AI enhances customer satisfaction, increases loyalty, accelerates processes, and facilitates financial inclusion (Fusté-Forné and Jamal, 2021; Rai et al., 2022). Nevertheless, there are still concerns including algorithmic bias, data privacy, ethical concerns, and regulatory alignment (Martín-Martín et al, 2018; Dwivedi et al, 2021).

Future research will need to focus on technological integration enhancement, post-adoption effects, inclusive strategy, and cross-cultural expectations.

AI-based personalization is technology and strategic imperativity that will need to bring innovation together with ethical, customer-oriented application.

Keywords:

AI personalization, mobile banking, chatbots, predictive analytics, biometric authentication, financial inclusion, ethical AI

INTRODUCTION

Mobile banking has taken off from a secondary service to the main banking service. as the smartphones got popular the customer want faster, easier, and more personal banking. to meet these expectetions. The banks use AL to peronnalize the servies, and AL know what the customer need and give them a prefact service. This paper reviews the new body of work on AI-driven personalization in mobile banking, looking at the trends, benefits, problems, and future directions. The purpose of this review was to combine all these research together and make personalizations a technological and strategic need for banks. (Oliveira et al, 2019, Rai et al, 2022).

RESEARCH METHODOLOGY

This study used a systematic literature review (SLR) with established guidelines (Kitchenham& Charters, 2007). SLR aims to combine scattered pieces of information on the use of AI and personalization in mobile banking and trends, benefits, challenges, and research directions. We did search in Scopus, Web of Science, Emerald Insight, IEEE Xplore, and ScienceDirect to be complete we can collect the articles from these databases because these

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databases contain high quality journals about information systems, management, computer science, and financial technology. So, I used keywords, and Boolean operators such as "AI in mobile banking", "artificial intelligence AND personalization", "chatbots OR voice assistants in banking", "biometric authentication AND mobile banking", "predictive analytics AND financial services", and "FinTech AND personalization", and limited my search to peer-reviewed journal articles, conference proceedings, and authoritative reports published in English between 2010 and 2024. studies went in if they manged app and focused on if it was personal to them and gave out results about costumers, or how it was for them or if it was for the work force, and if not for financial services not for AI personalizing, or articles that had full text. It all started by having over 320 results, then removing the duplicates, skimming through the titles/abstracts, which left us with 280, then reading through the full texts of 150 articles, which left us with 85 studies. Each articles was code with a template that include all the information about the bibilography, AI techniques (For example: Machine learning, NLP, biometrics, predictive analytics), the area of application (For example: Chatbots, fraud detection, financial recommendations), benefits (For example: time saving, satisfaction, inclusion), challenges (For example: privacy, bias, compliance), and research gaps. The extracted data was aggregated by themes and grouped together with trends, benefits, challenges, and future directions, and cross-validated with TAM and IS Success Model to make sure they're congruent.

CONCEPTUAL BACKGROUNDAND TRENDS IN AI PERSONALIZATION

Mobile banking has undergone a significant transformation. It went through stages where users could only check their bank balances and is now a digital ecosystem that relies on the AI personalization that can provide tailored financial planning, offer customized credit products, and so on. The changes are well documented through the use of Information Systems (IS) models such as the Technology Acceptance Model (TAM), Task-Technology Fit (TTF), and the Information System (IS) Success; these models point out the need for the system to be easy to use, match the users' requirements and be of good quality.AI-powered technologies are playing a vital role in improving banking services and enhancing customers' security. Through predictive analytics, customers can manage their funds more responsibly. They can get personalized recommendations if they want to save or invest. For identification purposes, biometric technologies can be used. Additionally, risk management in real-time can be conducted thus, mobile banking has become an interactive and customer-centric platform.

BENEFITS OF AI-DRIVEN PERSONALIZATION

The use of AI personalization in mobile banking led the way to improve customer satisfaction, engagement, and the overall bank performance. Contextual services along with AI assistants can bring more loyalty to the customers by providing tailored advice and recommendations, (Fusté-Forné& Jamal, 2021; Marín-Cordero &García-Murillo, 2021), while the work of the staff is facilitated through the automation of authentication, queries, and credit evaluations which enhance the efficiency and accuracy of the system (Oliveira et al., 2019). Besides, it allows a bank to stand out from the competition by offering personalized financial products and contributes to financial inclusion by being able to access unbanked areas with solutions that are culturally adapted (Gomber et al., 2017; Rai et al., 2022).

CHALLENGES IN AI-DRIVEN PERSONALIZATION AND FUTURE RESEARCH DIRECTIONS

AI-driven personalization in mobile banking calls for secure data storage and strong encryption to overcome issues like identity theft, data breaches, and a lack of trust resulting from the massive collection of data (Martín-

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Martín et al., 2018). The use of unsupervised predictive analytics may increase the probability of bias and incompleteness of data that may, in turn, cause unfair credit or loan decisions. To make personalization genuinely fair, the deployment of accountability initiatives, the performance of routine audits, and the use of fairness-focused AI are absolutely necessary (Dwivedi et al., 2021).Future studies should concentrate on post-adoption studies to evaluate long-term effects on satisfaction, loyalty, and engagement (Tam &Oliveira, 2017), integration with emerging technologies like blockchain, IoT, and 5G to enhance security and efficiency (Gai et al., 2018), culturally sensitive, adaptive research, and responsible and explainable AI for transparency and accountability (Dwivedi et al., 2022).

CONCLUSION

The uniqueness brought about by AI-enabled customer personalization is the basis of the rapidly changing face of the banking sphere through mobile-banking-based services. Customer trust-building being one of the advantages as well as the banks gaining a strategic position in the market are among the main outcomes of this development. However, privacy, ethics, and regulation remain the primary issues faced in this area. The gamut of the current literature basically hints that adoption of AI in mobile banking through responsible, transparent, and customer-centric ways will largely determine the degree of personalization achieved in future applications. AI, if properly deployed, can be an instrument of both the sustainable financial inclusion cause and a source of breakthrough innovations in the field of finance by filling the gaps in theory and practice of the research agenda.

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THE ROLE OF ARTIFICIAL INTELLIGENCE IN DIGITAL TRANSACTIONS: INNOVATION, IMPACTS AND CHALLENGES

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ABSTRACT

The rapid growth of digital payment ecosystems has created unprecedented opportunities while simultaneously exposing users to evolving risks. Artificial Intelligence (AI) has emerged as a transformative force in this landscape, driving innovations that enhance efficiency, security, and user experience. From fraud detection through anomaly detection, graph neural networks, and generative adversarial models to the deployment of conversational agents and large language models for scam prevention, AI is reshaping the trust architecture of digital transactions. Beyond security, AI is also optimizing transaction routing, reducing costs, enabling real-time personalization, and supporting cross-border interoperability. These advancements have demonstrated measurable impacts, including improved fraud detection, faster approvals, and greater financial inclusion. However, widespread adoption introduces critical challenges such as data privacy concerns, ethical considerations, regulatory compliance, explain ability of AI models, and integration with legacy financial systems. This article explores the innovations AI brings to digital payments, assesses its multifaceted impacts on consumers and financial institutions, and highlights the persistent challenges that must be addressed to achieve secure, transparent, and sustainable digital payment ecosystems.

Keywords:

Artificial Intelligence, Security, Digital Payment, Innovation, Fraud Deduction.

INTRODUCTION

Artificial intelligence (AI) is transforming digital transactions by enhancing speed, security, and efficiency across financial and commercial platforms. Through advanced data analytics, machine learning, and automation, AI enables fraud detection, personalized customer experiences, and seamless payment processes. It helps in improving risk management and supporting real-time decision-making, making digital interactions more reliable and convenient. However, this innovation also introduces challenges, including data privacy concernsand risks of fraud.Businesses can leverage AI tools to optimize decision-making, automate routine tasks, and enhance financial inclusion through more accessible digital platforms. However, the adoption of AI also presents significant challenges. Issues such as data privacy, ethical implications, algorithmic bias, and regulatory gaps must be addressed to ensure fairness and trustworthiness.

REVIEW OF LITERATURE:

1. **Vailly & Divya (2018):**

   Review*:* Vailly& Divya had a study on Digital Payments in India with perspective of consumers adoption from the objectives of the study was to examine the age of respondents impact on digital payments, analyze the impact of customers education and customer income usage of digital payments.

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2. **Pandey, 2022:**

Review: Pandey, 2022. Stated that "a study on Digital Payments system and consumer Perception: An Empirical Survey". The objective of the study was examine digital payment system of India and understand various modes of digital payment in Indian Banking Industry before after pandemic.

3. **Leebana Gracy 1, 2024:**

Review: LeebanaGracyStated the "A Study on Digital Payments and users experience". The Objectives of the study are the relationship between age usage of digital payments, analyze the factors that influences digital payments, explore the problems faced by users, understand the awareness of using digital payment application assess the user satisfaction level.

4. **Martina & Selvi, 2017:**

Review: Martina & Selvi, stated an overview on Digital Payments the objective of the study to explore the various modes of digital payment transaction that is offered by various financial institutions, the extent of operations of digital payments while dealing with online transactions and offer suitable suggestions in handing digital payments as easy and convenient one.

OBJECTIVES

The objectives of Artificial Intelligence in digital transactions center on enhancing efficiency, security, and user experience. AI innovations like biometric authentication, fraud detection, and predictive analytics aim to streamline payment systems and reduce operational errors. These technologies personalize services and enable real-time decision-making, fostering trust and convenience. However, AI also introduces challenges such as data privacy risks, algorithmic bias, and regulatory hurdles. Addressing these concerns is vital to ensure ethical deployment and compliance. Ultimately, AI seeks to create a resilient, intelligent transaction ecosystem that balances innovation with accountability, transforming how individuals and businesses engage in the digital economy.

NEED OF STUDY

The study of Artificial Intelligence (AI) in digital transactions is essential in today's rapidly evolving financial landscape. As more people and businesses move towards cashless economies, AI provides the intelligence and adaptability needed to manage vast volumes of transactions securely and efficiently. Digital transactions face constant threats from cybercrime, fraud, and identity theft. AI systems can analyze patterns in real time, detect anomalies, and prevent fraudulent activities far faster than traditional methods. This strengthens trust among consumers and financial institutions.Beyond security, AI enhances the user experience by enabling personalized services, such as recommending financial products, automating payment processes, and supporting chatbots for instant customer service. Furthermore, AI-driven innovations, like biometric verification and natural language processing, ensure smoother, faster, and more reliable payment systems.

INNOVATION

Innovation in artificial intelligence (AI) has revolutionized digital transactions by introducing advanced tools and systems that enhance efficiency, accuracy, and security. AI-powered innovations, such as biometric authentication, natural language processing, and predictive analytics, have transformed the way consumers and businesses engage in

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financial exchanges. These innovations not only streamline processes but also reduce human error, making digital transactions faster and more reliable.The Impacts of AI-driven innovations are far-reaching. They strengthen trust in digital platforms by enhancing transparency and security, promote financial inclusion through user-friendly services, and allow organizations to better understand consumer behavior. Moreover, automation powered by AI reduces operational costs and enables businesses to scale services effectively in an increasingly digital economy.Therefore, while AI-driven innovations present remarkable opportunities to advance digital transactions, careful governance and ethical considerations are necessary to ensure equitable and secure adoption.

CHALLENGES

Artificial intelligence (AI) plays a transformative role in digital transactions, yet it also faces several challenges. One major issue isdata security and privacy. AI systems rely on large volumes of personal and financial data, raising concerns about unauthorized access, data breaches, and compliance with regulations such as GDPR. Another challenge isbias in algorithms. If AI models are trained on skewed or incomplete datasets, they may unfairly deny transactions or flag legitimate activities as fraudulent, undermining trust.Transparency and explainability also remain critical hurdles.

Finally, there areoperational and ethical concerns such as high implementation costs, dependence on technical expertise, and the risk of excluding less digitally literate users. Addressing these challenges is vital to ensure secure, fair, and trustworthy digital transactions.

METHODOLOGY

The methodology for applying artificial intelligence in digital transactions typically involves several structured stages. First,data collection and preprocessingare carried out, where transactional records, user behaviors, and contextual information are gathered, cleaned, and transformed to remove inconsistencies. Next,Feature engineeringis applied to extract meaningful attributes such as transaction frequency, location, or spending patterns. These features are then used to train machine learning or deep learning modelsfor tasks such as fraud detection, risk assessment, or personalization. Common algorithms include decision trees, neural networks, and anomaly detection methods. The models are validated using historical datasets, with metrics such as accuracy, precision, recall, and F1-score. Deploymentfollows, integrating AI models into payment platforms to analyze transactions in real time. Finally, continuous monitoring and updatingensure adaptability to emerging threats and evolving customer behaviors, while maintaining compliance with data privacy and regulatory standards.

CONCLUSION

Artificial intelligence has become a cornerstone of digital transactions, enhancing speed, security, and user experience. Its ability to detect fraud, personalize services, and process vast amounts of data in real time has transformed financial systems. However, challenges such as data privacy, algorithmic bias, lack of transparency, and high implementation costs must be addressed to ensure fairness and trust. Continuous innovation, regulatory frameworks, and ethical practices are essential to balance efficiency with accountability. Ultimately, AI holds immense potential to build safer and more inclusive digital transaction ecosystems, provided its risks are carefully managed.

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ARTIFICIAL INTELLIGENCE (AI) DRIVEN MULTI-MODAL MRI FUSION FOR ACCURATE BRAIN TUMOR ANALYSIS

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ABSTRACT

In the field of clinical practice, accurate diagnosis and treatment planning for brain tumors are essential. Artificial intelligence (AI) systems that employ MRI scans are valuable and trustworthy for detecting and classifying brain tumors quickly and accurately. This paper presents some of the new and advanced deep learning (DL) and image processing strategies used to predict brain tumors using AI. In this paper, the DenseNet121 architecture, which uses convolutional neural networks (CNNs), was applied to tumor classification using 5-fold cross validation. A publicly accessible MRI dataset was used that includes three types of brain tumors glioma, meningioma, and pituitary as well as a class indicating no tumor. The dataset was pre-processed by scaling, converting, labelling and augmenting it to create diversity in the dataset. The proposed model shows the high accuracy, precision, recall, and F1-score, confirming its effectiveness in detecting brain tumors. A comparison of different AI model performance was done by comparing to VGG19, CNN, and InceptionV3 models and the proposed DenseNet 121 model performed the best. AI-based deep learning approaches detect brain tumors in MRI images efficiently and effectively.

Keywords:

Brain tumor detection, Magnetic Resonance Imaging (MRI), Artificial Intelligence (AI), Deep learning, Dense Net 121.

1. INTRODUCTION

Artificial intelligence (AI) is a key innovation in healthcare, especially for medical imaging. It improves picture recognition, segmentation, and diagnosis beyond human vision, making radiology more accurate and objective [1].

The brain regulates body functions as the central portion of the nervous system with its network of neurons.Abnormal growth of brain cells leads to significant health issues, such as brain tumors. In 2023, 25,400 new malignant tumors of the brain and spinal cord are expected in the United States, with higher anticipated rates if benign tumors are included. Estimated deaths are around 18,760, making brain tumors the tenth most common cause of cancer-related deaths [2].

Brain tumors are abnormal growths that can occur inside or near the brain, potentially causingseriousneurologicaldamage[3].They are classified as benign or malignant, with glioblastoma multiforme (GBM) being the most aggressive type.

Accurate imaging-based detection and segmentation are vital for improving treatment and survivaloutcomes.CT and MRI are key diagnostic tools, with MRI preferred for its superior softtissuecontrastandsafety [4].MRI variants like T1, T2, FLAIR, and PD provide diverse views of brainstructures.However, manual segmentation of MRI scans is time-consuming, error-prone, and not ideal for clinical workflows [5].

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Here is the structure of the study: Section 2 discusses Literature Review,Section 3 tells the proposedMethodology is discussed in detail, Section 4 tells the Performance Metrics,Section 5Result Analysis and Discussion,Section 6 showsConclusion and future work

2. LITERATURE REVIEW

N.Cinar et al. (2022) proposed a five CNN models, namely VGG19, DenseNet169, AlexNet, InceptionV3, and ResNet101, were compared for brain tumor classification using preprocessed MRI images. The VGG19 model produced the best accuracy at 97.2%. InceptionV3, DenseNet169, and AlexNet also had slightly lower accuracy rates [6].Asif, S. et al (2023) proposed a brain tumor diagnosis was performed using five deep learning models (DenseNet201, Xception, ResNet152V2, DenseNet121, InceptionResNetV2) in which these architectures were multi-classifying tumors. The Xception architecture had the best performance among the five architectures with 95.8% accuracy in the four-class classification [7].Çinar, A., et al., assessed various CNN models such as Inception-V3, DenseNet201, GoogleNet, ResNet50, and AlexNet, to classify brain MRIs, based on the promising results. A modified ResNet-50 in which the last five layers had been replaced with eight layers achieved the best accuracy of 97.2% [8].

3. METHODOLOGY

An open-source brain MRI dataset labelled by tumor type serves as the starting point for the classification pipeline. Images are resized to 224×224 pixels, labelled, and enhanced using rotation, zoom, and brightness adjustments. The dataset is split 70/30 for training/testing, with 5-fold cross-validation to ensure reliable evaluation. A fine-tuned DenseNet121 model performs multi-class classification, assessed using accuracy, precision, recall, and F1-score.

3.1 Data collection

For this project, the Kaggle MRI dataset was utilized to train, validate, and test several deep learning models to classify four tumor types in jpg image form: glioma, meningioma, pituitary, and no tumor type. Each class of images had separate trainand test images; therefore, we have trained our model using multi-class labels and allowed us to examine model performance. For validation, 80% of the images were used for training the model and 20% were used for validation to test how well the model performed.

3.2 Data preprocessing

Preprocessing prepares MRI images for better training of CNN models. Itincludesresizingto224×224 pixels for uniform input size. Grayscale conversion reduces complexity and highlights key features. Augmentation (rotation, zoom, brightness) improves model learning and accuracy.

3.3 Data Augmentation

To deal with insufficient or imbalanced data, the images used for training are altered through rotation, zoom, flip and brightness adjustments. These transformations support the model to generalize better and perform appropriately on unseen images.

3.4 K-Fold Cross Validation (5 Folds)

When deciding on how well a model performs, then theK-Fold CV can be applied since it divides the datasetinto subgroups or the folds. Through training andvalidation on many folds, the model's generalisabilityto new data is assessed. 5-Fold Cross Validation hasfive equal-sized folds in the dataset.

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3.5 Classification of DenseNet121 model

DenseNet121 is a pre-trained deep learning model that implements a feedforward approach to connect each layer directly to all subsequent layers such that there is a total of times (L+1)}{2} connections rather than L connections in standard CNNs. For each layer, a feature map is created and forwarded to be reused by all downstream layers, thus both facilitating information to flow through the network and reusing features. Dense connectivity helps to reduce the number of parameters because there is no need to learn the same feature multiple times while minimizing issues such as gradient runaway. The other benefit of DenseNet121 is the incorporation of several forms of regularization to reduce overfitting, giving it more robustness than both traditional and granular CNNs. The architecture of DenseNet121 has a total of four dense block networks with 6, 12, 24, and 16 convolutional layers in each respective block. The modified architecture of DenseNet121 used in this study to produce accurate classification results is shown in Figure1.

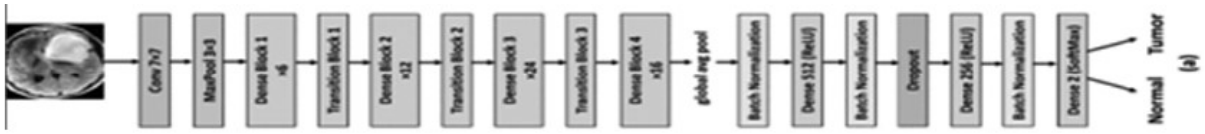

***Fig. 1*Basic architecture and customization in DenseNet121**

4. PERFORMANCE METRICS

The accuracy of brain tumor MRI scans is affected bythe degree to which abnormal tissues are detected ornot detected. The values of TP, FP, TN, and FN may beutilized to quantify these [10]. This studymeasures the system's accuracy, precision, recall, andf1-score using all the images in the database.

$Accuracy = \frac{(TP + TN)}{(TP + FN + TN + FN)}$	$Precision = \frac{TP}{(TP + FP)}$
$Recall = \frac{TP}{(TP + FN)}$	$F1Score = \frac{2 * Precision * Recall}{(Precision + Recall)}$

5. RESULT ANALYSIS AND DISCUSSION

Results and discussion of artificial intelligence models for brain tumour classification using MRI data are presented in this section. The goal is intended to determine the effectiveness of the DenseNet121 model, which has been suggested by proposing f1-score, loss, accuracy, recall, and precision metrics.

***Table 1* DenseNet121 model Perform with 5 foldsfor brain tumor detection**

Measures	**DenseNet121**					
K- Folds	**1**	**2**	**3**	**4**	**5**	**Average**
Accuracy	97.17	97.27	97.14	97.02	97.03	97.12
Precision	97.88	98.18	98.01	97.88	97.91	97.97
Recall	96.66	96.71	96.67	96.46	96.47	96.59
F1-score	99.98	99.99	99.98	99.98	99.99	99.98

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The DenseNet121 model indicates good performance for identifying brain tumors using 5-fold cross-validation. The accuracy is between 97.02% and 97.27%, with a mean of 97.12%, which demonstrates the model's strong capacity for tumor imaging predictions. In addition, the precision remains high at 97.97%, indicating that the model is robust in detecting positive cases and does so with very few false positive cases.

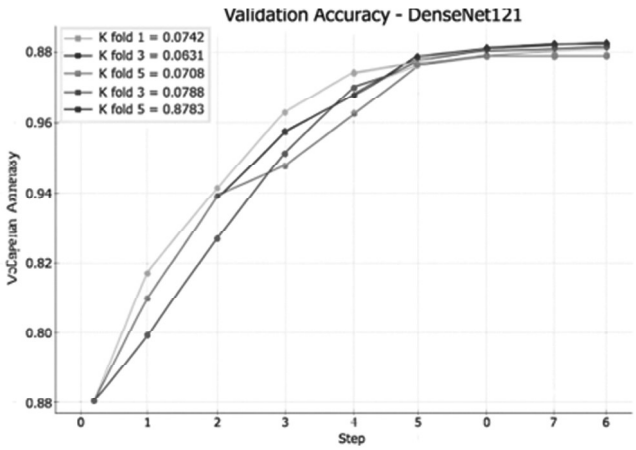
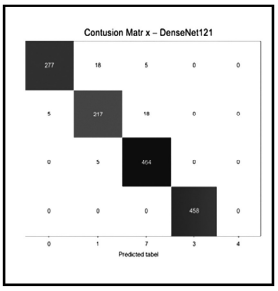


***Fig.2* Validation accuracy for DenseNet121 model**

DenseNet121 excelled in brain tumor detection with 97.12% accuracy and a 99.98% F1-score.Its precision reached 97.97%, and recall ranged from 96.46% to 96.71%, showing strongconsistency.Confusion matrix analysis revealed label 2 had perfect classification with noerrors.Compared to CNN, VGG19, and InceptionV3, DenseNet121 showed superior results overall.



Models	Accuracy	Precision	Recall	Fl-score
DenseNet121	97.12	97.97	96.59	99.98
VGG19	95	88.79	98.25	93.28
CNN	95.55	96	96	96
InceptionV3	94.4	94.6	94.7	94.6

***Fig.4* Confusion matrix for DenseNet121 model**

***Table 2* comparison on the MRI for brain tumor detection**

Although it has some possibility of overfitting on small datasets DenseNet121 demonstrated good performance despite the previously stated data limitations. Data augmentation provided a mechanism to enrich the training set and increase feature learning. This may enhance the ability of clinicians to detect brain tumors earlier. Future works could evaluate new architectures to tune and validate this approach in the real world.

6. CONCLUSION AND FUTURE WORK

In this paper CNNbased model was developed to classify brain tumors from MRI scans.DenseNet121 achieved the highest performance, with 97.12% accuracy and 99.98 F1-score.It outperformed VGG19, InceptionV3, and basic CNNs in precision and recall. Validation was supported by confusion matrices, tables, and performance graphs. This work highlights CNNs' potential to improve diagnostic accuracy in clinical settings.

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THE IMPACT OF ARTIFICIAL INTELLIGENCE ON THE EDUCATION SECTOR

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ABSTRACT

Artificial Intelligence (AI) is revolutionizing the education sector by reshaping how teaching and learning are designed, delivered, and managed. AI technologies enable personalized learning experiences, automate routine administrative tasks, and support educators through intelligent tutoring systems and predictive analytics. These advancements contribute to increased student engagement, improved learning outcomes, and greater operational efficiency in educational institutions. Furthermore, AI promotes inclusive education by catering to diverse learning styles and needs. Despite its potential, the integration of AI in education also presents challenges, including concerns over data privacy, ethical implications, and the need for upskilling educators. This paper explores the transformative impact of AI on education, highlighting both its benefits and the critical issues that must be addressed for responsible implementation.

Keywords:

AI, Education, Tutoring Systems, Educational Innovation. etc.

INTRODUCTION

Artificial Intelligence (AI) is transforming various industries, and the education sector is no exception. Traditionally rooted in standardized teaching methods and manual administrative tasks, education is now experiencing a paradigm shift driven by AI technologies. These innovations are influencing how learning content is created, customized, delivered, and assessed. By enabling adaptive learning environments, streamlining institutional operations, and offering data-driven insights, AI is redefining the educational experience for students, educators, and administrators alike.

While AI brings numerous advantages, its implementation is not without challenges. Ethical concerns, data privacy, algorithmic bias, and the need for educator training present real barriers to effective integration. This paper examines the dual nature of AI's influence on educationits benefits and its limitationsand offers insight into how these technologies can be responsibly harnessed to enhance the teaching and learning process.

OBJECTIVES

- To investigate the effects of AI on the education sector.
- To explore the transformation of job roles due to AI.
- To investigate how AI integration is reshaping the professional responsibilities within the education sector.

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REVIEW OF LITERATURE

Artificial Intelligence is significantly transforming education by enhancing learning, automating tasks, and changing professional roles. This review summarizes key studies on AI's impact and the challenges of its integration in the education sector.

Luckin et al. (2016) emphasize that Artificial Intelligence (AI) is revolutionizing the education sector by enabling personalized learning experiences, automating administrative tasks, and providing data-driven insights for better decision-making. These technologies improve student engagement and learning outcomes by adapting to individual needs.

Baker and Smith (2019) observe that AI integration is fundamentally transforming traditional job roles within education, particularly among teachers and administrative staff. Routine tasks like grading and scheduling are increasingly automated, allowing educators to focus more on mentoring, facilitation, and personalized student support.

Ifenthaler and Yau (2020) discuss how AI integration requires educators and administrators to take on new responsibilities, such as interpreting learning analytics to enhance student outcomes. They highlight the importance of data literacy as a core skill for professionals in education.

SCOPE OF THE STUDY

This study examines the impact of Artificial Intelligence on education, focusing on personalized learning, administrative automation, and changes in educator roles. It addresses benefits, challenges, ethical issues, and the need for upskilling, with a focus on AI applications in formal education settings such as schools and universities.

LIMITATIONS OF THE STUDY

- **Rapid Evolution:** AI technologies evolve quickly, which may cause some findings to become outdated as new advancements emerge.
- **Data Availability:** Limited access to comprehensive and reliable data on AI's impact restricts the depth and accuracy of the analysis.
- **Sector Variability:** AI affects different industries and educational contexts in unique ways, making it difficult to generalize conclusions universally.

RESEARCH METHODOLOGY

This study relies on secondary data analysis to study how Artificial Intelligence influences changes in job roles within the education sector. Data is gathered from existing scholarly articles and reports, enabling an in-depth synthesis of current knowledge and trends related to AI integration and its effects on educational professionals.

THE EFFECTS OF ARTIFICIAL INTELLIGENCE ON THE EDUCATION SECTOR

In recent years, artificial intelligence (AI) has emerged as one of the most transformative technologies across various sectors, and education is no exception. As digital tools and intelligent systems continue to evolve, AI is reshaping how teaching and learning take place, influencing everything from classroom instruction to administrative operations. The education sector, traditionally slow to adopt technological change, is now increasingly embracing AI-powered innovations that promise to make learning more efficient, personalized, and accessible. This growing integration of AI

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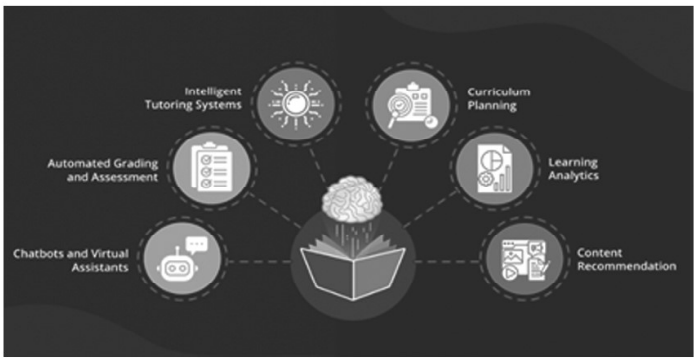
in education is not only enhancing the delivery of knowledge but also redefining the roles of teachers, students, and educational institutions.

However, the integration of AI into education is not without its challenges. Issues related to data privacy, algorithmic bias, and the digital divide pose significant concerns. Ensuring equitable access to AI technologies and safeguarding student data are paramount to the responsible deployment of AI in education. Moreover, there is a need for continuous professional development for educators to effectively utilize AI tools and integrate them into their teaching practices. Addressing these challenges is crucial to realizing the full potential of AI in transforming education.



- ***Intelligent Tutoring*** **Systems-**AI-powered tutoring systems offer personalized lessons that adapt to individual student needs, improving understanding and supporting learning progress efficiently and effectively.
- ***Curriculum Planning*** **–** AI helps educators design and organize curricula by analyzing data, ensuring content aligns with learning goals and addresses students' unique needs and capabilities.
- ***Learning Analytics*** **-**AI collects and analyzes student data to monitor performance and engagement, enabling educators to make informed decisions that enhance teaching methods and learning outcomes.
- ***Content Recommendation*** **-**AI recommends personalized learning materials and activities based on students' interests, skill levels, and past interactions, fostering more engaging and effective education experiences.
- ***Chatbots and Virtual Assistants*****-**AI-powered chatbots provide instant support to students and teachers, answering questions and facilitating communication, thus improving accessibility and saving valuable time.
- ***Automated Grading and Assessment-*** AI systems automate grading and provide quick, consistent feedback on assignments and exams, reducing teachers' workload and allowing more focus on student interaction.

THE IMPACT OF AI ON JOB ROLE TRANSFORMATION

Artificial Intelligence (AI) is changing how people work in almost every industry. With tools like automation, machine learning, and robotics, AI is taking over simple tasks and helping humans do their jobs better. This change brings both challenges and new opportunities, requiring workers to learn new skills and take on more valuable roles.

Automating Repetitive Tasks-One major way AI is changing jobs is by taking over repetitive and routine tasks. In areas like manufacturing, customer service, and finance, AI systems can handle data entry, answer basic questions, and make simple decisions. This lets workers focus on more important, creative, or problem-solving tasks. For example, chatbots now answer common customer questions, so human agents can handle more complex issues.

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New Job Roles Created by AI -AI is also creating new types of jobs that didn't exist before. Jobs like AI trainers, data scientists, and machine learning engineers are in high demand. These roles require people to understand technology and data, and also to think critically and ethically. As more companies use AI, they need skilled people to build and manage these systems. This means jobs are shifting from basic tasks to more innovative work.

AI Supporting Traditional Jobs-In many existing jobs, AI is helping people make better decisions. For example, in healthcare, AI helps doctors by analyzing medical data to improve diagnosis. In marketing, AI helps businesses understand customer behavior and create better campaigns. In these cases, AI doesn't replace humansit supports them, making their work more effective.

The Need for New Skills-Because of AI, workers need to learn new skills to stay relevant. Companies are offering training to help employees move into better roles. It's not just about learning tech skills—people also need to improve soft skills like creativity, problem-solving, and communication. These skills are becoming just as important as technical ones.

RESHAPING PROFESSIONAL RESPONSIBILITIES IN THE EDUCATION SECTOR THROUGH AI

Artificial Intelligence (AI) is increasingly being integrated into the education sector, leading to significant shifts in how educators and administrative staff perform their roles. From automating administrative tasks to personalizing student learning experiences, AI is not just a technological toolit is a transformative force. As a result, the responsibilities of education professionals are evolving. Teachers are now expected to incorporate AI tools into their teaching strategies, while school administrators use AIdriven data insights for better decision-making. This transformation calls for a reevaluation of traditional job roles and the development of new skills to meet the demands of an AIenhanced educational environment.

HOW AI IS RESHAPING PROFESSIONAL RESPONSIBILITIES IN EDUCATION

1. Personalized Learning at Scale

AI enables educators to tailor lessons to individual student needs by analyzing learning patterns and performance data. This shift allows teachers to focus on mentoring and addressing diverse learning styles. For instance, platforms like Dream Box Learning and Kewtown offer adaptive lessons that adjust to each student's progress.

2. Automated Grading and Administrative Tasks

AI tools are increasingly handling routine tasks such as grading multiple-choice tests and managing attendance. This automation frees up educators to concentrate on more complex responsibilities like lesson planning and student engagement. A report by Anthropic revealed that 57% of faculty used AI to develop curricula, and 13% for academic research, including grading.

3. Real-Time Feedback and Early Intervention

AI systems can provide immediate feedback on student performance, helping educators identify and support struggling students more effectively. For example, Georgia State University's AI chatbot reduced dropout rates by 5% through proactive advising.

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4. Enhanced Student Engagement and Monitoring

AI tools can monitor classroom dynamics and detect signs of disengagement or confusion among students. Educators can then adjust their teaching strategies accordingly, fostering a more responsive learning environment.

5. Smart Content Creation and Curriculum Design

AI assists in generating instructional materials such as quizzes, summaries, and interactive content. This support allows educators to focus on creating engaging lessons and adapting curricula based on student performance trends.

6. Support for Diverse Learners and Accessibility

AI facilitates inclusive education by providing tools like speech-to-text, translation services, and personalized learning paths for students with special needs or language barriers. This ensures that all students have equitable access to quality education.

7. Data-Driven Decision Making

AI generates valuable data on student performance, engagement, and attendance. Educators and administrators can leverage this data to refine teaching methods, allocate resources more effectively, and develop targeted student support strategies. These insights help create more responsive, data-driven learning environments that cater to individual student needs and institutional goals.

8. Professional Development and Continuous Learning

As AI becomes integral to education, educators must enhance skills in digital literacy, data analysis, and ethical AI use. Initiatives like OpenAI's Learning Accelerator in India equip teachers with essential training and tools, enabling them to effectively integrate AI into classrooms and adapt to evolving educational technologies and practices.

CONCLUSION

The integration of Artificial Intelligence (AI) into the education sector marks a transformative shift in how teaching, learning, and assessment are conceptualized and delivered. AI technologies, such as intelligent tutoring systems, adaptive learning platforms, and generative AI tools, are enhancing personalization, automating administrative tasks, and expanding access to educational resources globally. These innovations offer significant opportunities for improving learning outcomes, especially by catering to individual student needs and supporting data-driven decision-making.Moreover, the successful adoption of AI in education depends on the digital competence of both educators and learners, as well as the development of clear policies and frameworks that ensure transparency, inclusiveness, and accountability.

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AI IN MODERN COMMERCE: OPPORTUNITIES AND CHALLENGES

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ABSTRACT

Artificial Intelligence (AI) has rapidly become one of the most transformative technologies shaping the 21st century. In the domain of commerce, AI is driving innovations that affect consumer behaviour, business models, supply chains, and global markets. From recommendation systems in e-commerce to automated financial fraud detection, AI applications are now integral to modern trade. However, these opportunities are paired with significant challenges, including ethical dilemmas, data privacy concerns, and the risk of workforce displacement. This article examines the dual impact of AI in modern commerce, presenting both opportunities and challenges while highlighting the importance of responsible adoption. The study emphasizes that while AI has the potential to redefine global commerce, businesses must navigate its complexities with caution and foresight.

Keywords:

Artificial Intelligence, Modern Commerce, Automation, Data Privacy, Ethical AI, Business Transformation

INTRODUCTION

The world of commerce has evolved dramatically over the last two decades. With the rise of the internet, globalization, and digital platforms, businesses have shifted from traditional brick-and-mortar systems to digital-first ecosystems. Artificial Intelligence (AI), once a subject of science fiction, has emerged as a crucial driver of this transformation.

Modern commerce involves not only the exchange of goods and services but also the management of supply chains, the personalization of customer experiences, and the protection of digital financial transactions. AI technologies - ranging from machine learning algorithms to natural language processing and robotics- play a central role in enhancing these functions.

Yet, despite its promise, AI brings forth multiple challenges. Questions of data privacy, algorithmic fairness, ethical implementation, and technological dependence remain unresolved. This dual nature of AI as both an opportunity and a challenge necessitates a balanced exploration of its impact on modern commerce.

This paper examines the applications of AI in commerce, the opportunities it presents, the challenges it imposes, and the strategies businesses can adopt for responsible and effective integration.

LITERATURE REVIEW / BACKGROUND

The integration of AI into commerce can be traced back to early uses of data mining and predictive analytics in the 1990s. With the exponential growth of data in the digital age, businesses began to recognize the potential of AI to generate insights, automate tasks, and enhance decision-making.

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Several studies highlight AI's role in shaping business models:

- AI-driven recommendation systems in e-commerce platforms such as Amazon and Netflix revolutionized customer engagement.
- Predictive analytics and inventory optimization transformed supply chain management.
- AI-powered fraud detection reshaped financial services.

While the benefits are evident, the challenges have also been widely documented. Data privacy laws such as the General Data Protection Regulation (GDPR) in Europe emerged in response to growing concerns about how businesses collect, store, and use customer data. Similarly, the ethical implications of biased algorithms have raised concerns about fairness in digital commerce.

The literature suggests that while AI is undeniably a powerful force in commerce, its success depends on the ethical, transparent, and responsible use of technology.

OPPORTUNITIES OF AI IN MODERN COMMERCE

1. Personalization and Customer Engagement

AI allows businesses to analyses large datasets and derives insights about customer preferences. Recommendation engines, chatbots, and AI-driven personalization create tailored shopping experiences. For instance, e-commerce platforms use AI to suggest products based on browsing history, significantly improving customer satisfaction and sales conversion rates.

2. Automation and Cost Reduction

Repetitive and time-consuming tasks such as customer service queries, invoice processing, and inventory checks can be automated using AI-powered tools. Automation reduces human error, increases efficiency, and cuts operational costs, allowing businesses to focus on strategic growth.

3. Supply Chain Optimization

AI helps forecast demand, monitor logistics, and identify potential disruptions in supply chains. Predictive analytics allow businesses to reduce waste, optimize stock levels, and improve delivery times—leading to both cost savings and customer satisfaction.

4. Fraud Detection and Cybersecurity

Digital commerce involves millions of transactions daily, many of which are vulnerable to cybercrime. AI algorithms can detect suspicious patterns in transactions, identify fraud in real-time, and strengthen cybersecurity. This builds trust among consumers and safeguards business operations.

5. Enhanced Marketing Strategies

AI provides insights into customer behaviour and helps businesses design targeted advertisements. With the ability to analyse user interactions across multiple channels, AI ensures marketing campaigns are more precise and effective, leading to higher returns on investment.

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6. Product Development and Innovation

AI supports businesses in identifying market gaps and consumer demands. By analysing feedback, reviews, and market trends, businesses can innovate faster, designing products that meet evolving consumer needs.

CHALLENGES OF AI IN MODERN COMMERCE

1. Data Privacy and Security

AI requires massive amounts of data to function effectively. However, excessive data collection can infringe on individual privacy rights. Breaches or misuse of personal data can damage customer trust and result in legal consequences.

2. High Implementation Costs

While large corporations may easily invest in AI systems, small and medium enterprises (SMEs) often face financial barriers. The high cost of developing, training, and maintaining AI systems can limit their adoption and widen the digital divide.

3. Workforce Displacement

Automation powered by AI reduces the need for human labor in several sectors, particularly in roles such as customer service, logistics, and manufacturing. This displacement raises concerns about unemployment and the urgent need for upskilling and reskilling programs.

4. Algorithmic Bias and Ethical Concerns

AI systems are only as unbiased as the data they are trained on. If historical data contains biases, AI can replicate and even amplify them. In commerce, this can lead to unfair pricing, discriminatory product recommendations, or exclusion of certain consumer groups.

5. Over-Dependence on Technology

Excessive reliance on AI can make businesses vulnerable. System failures, cyberattacks, or flawed algorithms can disrupt operations. Human oversight remains essential to ensure resilience and accountability.

CASE STUDIES / REAL-WORLD APPLICATIONS

Amazon's Recommendation Engine

Amazon's AI-based recommendation system contributes to a significant portion of its sales by analysing browsing patterns and purchase history to suggest products. This personalization enhances customer experience while boosting profitability.

Alibaba's Smart Logistics

Alibaba employs AI to optimize delivery routes, forecast product demand, and streamline warehouse operations. This reduces delivery times and operational costs, offering a competitive advantage.

Banking and Fraud Detection

Financial institutions worldwide rely on AI for fraud detection. For example, Mastercard uses AI-driven algorithms to analyses transaction data in real-time, identifying fraudulent activities within milliseconds.

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Retail Customer Service – Chatbots

Retail giants such as H&M and Sephora use AI-powered chatbots to engage customers, answer queries, and provide recommendations, thereby reducing the need for human intervention while maintaining 24/7 availability.

DISCUSSION

The opportunities and challenges of AI in commerce must be understood not as opposing forces but as interconnected realities. While businesses gain from personalization, automation, and efficiency, they must also take responsibility for ethical AI use. Transparency in data handling, fairness in algorithms, and initiatives for workforce reskilling are critical to sustainable AI adoption.

AI should not be seen merely as a tool for profit but as a means to create long-term value for both businesses and consumers. The key lies in balancing efficiency with ethics, innovation with inclusivity, and growth with responsibility.

CONCLUSION

Artificial Intelligence is transforming modern commerce in profound ways. It enables businesses to provide personalized customer experiences, improve operational efficiency, and secure digital transactions. However, challenges such as data privacy, high implementation costs, workforce displacement, and ethical concerns cannot be ignored.

The future of AI in commerce depends on responsible adoption. Policymakers must establish clear regulations, businesses must commit to ethical practices, and consumers must remain vigilant about their rights. With the right balance, AI can reshape commerce into a more innovative, efficient, and inclusive ecosystem.

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ETHICAL AI : BALANCING INNOVATION WITH RESPONSIBILITY IN THE AGE OF AUTONOMOUS SYSTEMS

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ABSTRACT

In the era of rapid technological advancement, autonomous systems powered by artificial intelligence (AI) are increasingly shaping our societies, economies, and personal lives. While these innovations offer transformative benefits - ranging from self-driving vehicles and intelligent healthcare to automated decision-making - they also introduce complex ethical challenges. This paper explores the imperative of aligning AI development with ethical principles to ensure responsible innovation. It examines key concerns such as algorithmic bias, lack of transparency, accountability gaps, and the erosion of human agency. Furthermore, it discusses the importance of embedding ethical frameworks into the design, deployment, and governance of autonomous systems. By analyzing current regulatory efforts, industry standards, and interdisciplinary approaches, the paper emphasizes the need for collaboration among technologists, ethicists, policymakers, and the public. Ultimately, it argues that fostering ethical AI is not a constraint on innovation, but a foundation for sustainable and trustworthy technological progress. Balancing innovation with responsibility is essential to harness the full potential of AI while safeguarding human values and social justice in the age of autonomy.

Keywords:

INTRODUCTION

Artificial Intelligence (AI) is transforming nearly every aspect of modern life - from personalized healthcare and autonomous vehicles to predictive policing and financial automation. As these technologies evolve rapidly, so too does the responsibility to ensure that their deployment aligns with ethical principles and human values. The rise of autonomous systems in particular has intensified global conversations around accountability, transparency, and control. Ethical AI is not just a technical challenge but a societal imperative. It requires interdisciplinary collaboration among technologists, policymakers, ethicists, and industry leaders to create frameworks that mitigate bias, protect privacy, and ensure fairness. As algorithms increasingly make decisions with real-world consequences - sometimes without human intervention—the stakes have never been higher.

REVIEW FOR LITERATURE

This literature review explores the evolving discourse on ethical AI, focusing on the frameworks, principles, and practical measures proposed to ensure that autonomous systems operate in ways that are both innovative and socially

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responsible. It synthesizes key contributions from interdisciplinary research that address the tensions between technological progress and ethical safeguards, emphasizing the need for governance, regulation, and collaborative stakeholder engagement. By examining existing studies on ethical guidelines, risk mitigation strategies, and the socio-technical implications of AI, this review aims to provide a comprehensive foundation for understanding how ethical considerations can be integrated into the development and deployment of autonomous systems.

Melkamu Mersha et.al (2024) addresses the challenges posed by the black-box nature of AI models, particularly in safety-critical domains such as healthcare, finance, and autonomous vehicles. The authors emphasize the necessity of XAI in ensuring transparency, accountability, and fairness in AI systems.

***Priya T. V. and Shrisha Rao (2025*)** propose a novel formal verification framework using **Deontic Temporal Logic (DTL)** to rigorously assess ethical compliance in autonomous AI systems. Their work addresses a critical gap in AI ethics research by introducing a logical system capable of capturing **obligations, permissions, and prohibitions over time**, which is essential for modeling the dynamic ethical requirements of AI behavior. Unlike traditional static ethical models, their approach recognizes that AI decisions often unfold sequentially, necessitating temporal reasoning to verify adherence to ethical norms across different stages of autonomous operation.

OBJECTIVES

i) **Understand the Ethical Implications of Autonomous Systems**
Explore the moral, legal, and societal consequences of deploying AI systems that can act without direct human intervention.

ii) **Analyze Key Ethical Principles in AI Development**
Examine core ethical principles such as fairness, accountability, transparency, privacy, and safety in the context of AI and autonomous technologies.

iii) **Evaluate the Impact of Innovation on Human Rights and Social Equity**
Assess how AI innovation affects employment, discrimination, surveillance, and access to resources particularly in vulnerable communities.

iv) **Identify Current Regulatory and Governance Challenges**
Investigate the gaps in existing laws, standards, and oversight mechanisms related to AI and autonomous systems globally.

v) **Highlight Best Practices for Ethical AI Design and Deployment**
Showcase frameworks, guidelines, and case studies that demonstrate responsible innovation in the AI field.

vi) **Propose Strategies for Balancing Innovation with Ethical Responsibility**
Recommend actionable strategies that organizations, developers, and policymakers can adopt to ensure ethical alignment without stifling technological progress.

vii) **Foster Multidisciplinary Collaboration for Ethical AI Governance**
Emphasize the need for cooperation between technologists, ethicists, policymakers, and civil society in shaping the future of autonomous systems.

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ETHICAL ARTIFICIA LINTELLIGENCE:

It Exploring the rapid evolution of AI-driven automation and its dual-edge impact. The Ethical AI which shows the Autonomous system in Table 1

THE RISE OF AUTONOMOUS SYSTEMS: PROMISE AND PERIL

Autonomous systemsmachines or software that operate with minimal human interventionare rapidly transforming industries and societies. From self-driving cars and drones to AI-based financial algorithms and autonomous weapons, these systems promise efficiency, safety, and innovation. However, their rise also raises serious concerns about control, accountability, bias, and unintended consequences.

Table 1: **Spectrum of Autonomy**

Level	Description	Example
0	No Autonomy	Manual car
1	Assistive Autonomy	Cruise control
2	Partial Autonomy	Driver-assist features
3	Conditional Autonomy	Semi-autonomous car
4	High Autonomy	Self-driving taxi (limited area)
5	Full Autonomy	Fully autonomous robot

The Purpose of ethical AI Show the range of autonomy from human-controlled to fully independent systems.

WHAT DOES ETHICAL AI REALLY MEAN?

It Defining the principles that guide moral decision-making in intelligent systems. Ethical AI refers to the practice of designing, developing, and deploying artificial intelligence systems in ways that are morally sound, fair, transparent, and respectful of human rights. It ensures AI technologies align with human values and do not cause harm to individuals or society.

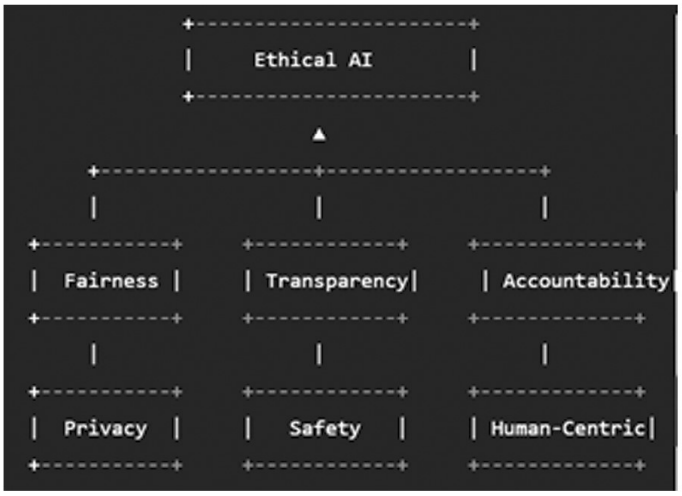

Fig 1: **Hierarchy of Ethical AI**

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- ❒ AI is increasingly embedded into nearly every domain—healthcare, transportation, governance, industry, creative work.
- ❒ The future will demand that AI not only be powerful and efficient, but also **ethical, trustworthy, fair, transparent, and human centered**.
- ❒ The path ahead requires combining technical innovation with principled design, regulatory frameworks, and societal engagement.

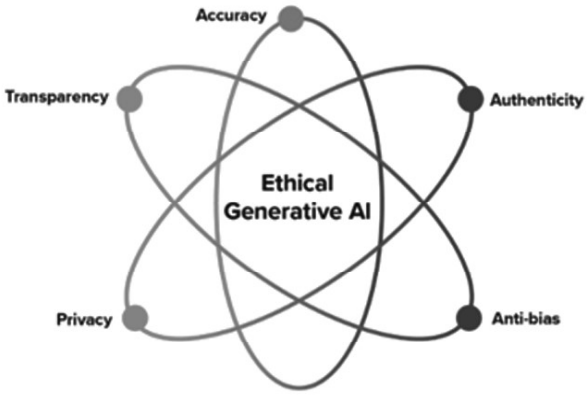

Fig 2: **AI Ethical Generative**

CONCLUSION

An autonomous systems increasingly permeate our daily lives from self-driving cars and algorithmic decision-making to intelligent healthcare tools - the urgency to balance innovation with ethical responsibility has never been greater. The rapid evolution of AI technologies holds the promise of transformative benefits, but it also presents significant ethical, social, and legal challenges. Without a strong ethical framework, we risk creating systems that reinforce biases, erode privacy, undermine human autonomy, or make life-altering decisions without accountability.A responsible approach to AI development requires more than just technical excellence - it demands multidisciplinary collaboration, transparency, inclusivity, and a commitment to long-term societal well-being. Ethical AI must be guided by principles such as fairness, accountability, interpretability, and sustainability. Developers, policymakers, industry leaders, and civil society must work together to embed these values throughout the AI lifecycle - from design and training to deployment and governance.Ultimately, the future of AI depends not only on how powerful our systems become but on how wisely and ethically we choose to wield that power. Striking the right balance between innovation and responsibility is not a constraint on progress; rather, it is the foundation for building AI systems that are trustworthy, equitable, and aligned with the public good. As we move forward into the age of autonomy, ethics must not be an afterthought but a core pillar of AI innovation.

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THE IMPACT OF AI ON JOB AUTOMATION AND THE FUTURE OF WORK

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ABSTRACT

Artificial Intelligence (AI) is rapidly transforming the global labor market, ushering in a new era of automation, efficiency, and innovation. While AI offers significant opportunities for economic growth and improved productivity, it also presents profound challenges related to job displacement, workforce reskilling, and the broader redefinition of work itself. This abstract explores the dual-edged impact of AI on job automation and the implications for the future of employment across various sectors. It examines both the potential losses and the emerging opportunities, providing a balanced perspective on how societies, businesses, and workers must adapt in the age of intelligent machines.The rapid advancement of Artificial Intelligence (AI) is transforming the global labor market, ushering in a new era of job automation and reshaping the future of work. AI technologies, including machine learning, robotics, and natural language processing, are increasingly capable of performing tasks traditionally done by humans, particularly those that are repetitive, routine, or data-intensive. This shift is creating both opportunities and challenges across industries. On one hand, AI-driven automation can boost productivity, reduce operational costs, and enable workers to focus on more creative and strategic activities. On the other hand, it raises concerns about job displacement, widening inequality, and the need for large-scale reskilling. Low-skill and middle-skill jobs are most at risk, while new roles requiring advanced digital, analytical, and interpersonal skills are emerging. The future of work will likely be defined by a hybrid model where humans and AI systems collaborate. To adapt to these changes, governments, educational institutions, and businesses must proactively invest in workforce development, promote inclusive innovation, and create policies that ensure a just transition. This paper explores the multifaceted impact of AI on employment and provides insights into how societies can navigate the evolving landscape of work in the age of intelligent automation.

Keywords:

INTRODUCTION

Artificial Intelligence (AI) is rapidly transforming the global workforce, ushering in a new era of job automation and redefining the nature of work itself. From manufacturing floors to corporate offices, AI-powered systems are increasingly capable of performing tasks that once required human intelligence - such as data analysis, customer service, and even creative design. This technological shift presents both unprecedented opportunities and complex challenges for workers, employers, and policymakers alike.On one hand, AI-driven automation promises significant gains in

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productivity, efficiency, and innovation. Routine and repetitive tasks can be delegated to machines, freeing up human workers to focus on higher-order thinking, problem-solving, and interpersonal skills. Industries like healthcare, finance, transportation, and education are already witnessing transformative changes, with AI enhancing decision-making, streamlining operations, and enabling new business models. However, the rise of automation also raises concerns about job displacement, income inequality, and the future relevance of certain skill sets. As machines become more capable, some roles may become obsolete, while others will evolve or emerge entirely. This transition demands a proactive approach to workforce development, including reskilling programs, lifelong learning initiatives, and policies that ensure equitable access to the benefits of AI. Ultimately, the impact of AI on job automation and the future of work will depend on how society chooses to harness its potential. By fostering collaboration between technology and humanity, we can shape a future where AI augments human capabilities rather than replaces them—creating a more inclusive, adaptive, and resilient workforce for generations to come.

LITERATURE REVIEW

Artificial intelligence (AI) has become a transformative force reshaping the nature of work across industries worldwide. Advances in machine learning, robotics, and intelligent automation are rapidly changing how tasks are performed, enabling machines to undertake activities traditionally carried out by humans. This shift presents both opportunities for increased productivity and innovation as well as challenges related to job displacement, workforce adaptation, and economic inequality. As AI-driven automation permeates various sectors—from manufacturing and finance to healthcare and services—the future of work is undergoing profound and often disruptive change.

P.M. Murali (2024) provides a comprehensive analysis of the socioeconomic implications of automation and AI-driven technologies on the future of work, with a particular focus on job displacement. The study situates the ethical discourse around AI within the broader context of labor market transformations, highlighting how autonomous systems and automation threaten traditional employment structures while simultaneously creating new opportunities.

Rawashdeh (2025) This research contributes to the broader discourse on ethical AI by emphasizing the socio-economic consequences of AI adoption in professional fields. It discusses the ethical imperatives for organizations and policymakers to address the displacement challenges through workforce retraining, upskilling, and the creation of new roles that leverage human judgment alongside AI capabilities.

OBJECTIVES

- Analyze the current state of AI-driven job automation
- Identify the sectors and job roles most vulnerable to automation.
- Assess the potential economic and social impacts of AI on the workforce.
- Explore new job opportunities and emerging roles created by AI.
- Evaluate strategies for workforce adaptation and upskilling.
- Forecast the long-term future of work in an AI-integrated economy
- Examine ethical and policy implications of AI in the workplace.

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AUTOMATION RISK IN AI:

The rise of Artificial Intelligence (AI) has significantly amplified concerns about automation riskthe likelihood that certain human jobs or tasks will be replaced by machines or algorithms. Unlike previous waves of automation, which largely impacted manual labor and routine tasks, modern AI systems are increasingly capable of performing complex cognitive functions such as data analysis, decision-making, and even creative work. This broadens the scope of jobs at risk and challenges traditional assumptions about which professions are "safe" from automation.The below fig 1 shows the levels of automation.

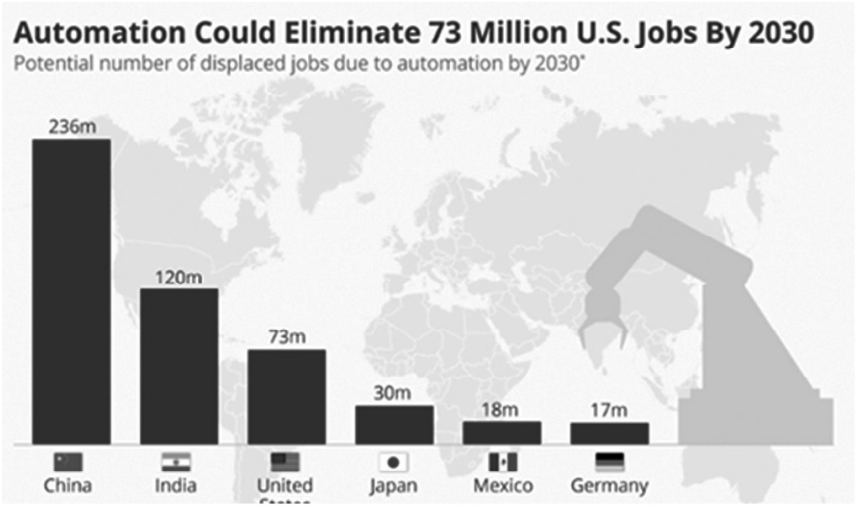

Fig 1: **Levels of Automation**

HIGH-RISK OCCUPATIONS

Jobs most vulnerable to AI-driven automation are those involving repetitive, rule-based tasks. This includes roles in manufacturing, transportation, customer service, and administrative support. For example, autonomous vehicles threaten driving jobs, while AI chatbots reduce the need for call center agents. Even some legal, accounting, and journalism tasks - like document review or content summarization - are now being handled by AI.

MEDIUM-RISK AND LOW-RISK JOBS:

Occupations involving non-routine tasks, social intelligence, emotional labor, or high levels of creativity - such as healthcare professionals, teachers, and artists- are generally considered lower risk. However, these jobs may still be partially automated, with AI assisting rather than replacing humans.

KEY FACTORS AFFECTING AUTOMATION RISK:

1. ***Task Type:*** Cognitive vs. manual; routine vs. non-routine.
2. ***AI Capability:*** The level of generality and autonomy in AI tools.
3. ***Economic Incentives:*** Cost of AI implementation vs. human labor.
4. ***Regulatory and Ethical Constraints:*** Some jobs cannot be automated due to legal or ethical reasons.

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GLOBAL IMPACTS AND INEQALITY

Automation risk is not evenly distributed. Low-income workers and developing economies may face higher displacement due to weaker labor protections and a higher share of automatable jobs. At the same time, high-skill professionals may benefit from AI augmentation, increasing income inequality and social polarization.Table 1 shows the industry -wise automation risk.

Table 1: Industry-wise Automation Risk

Table Title	Description / Purpose	Sample Columns
Industries & Automation Risk	Shows which sectors are most vulnerable to AI automation	Industry
Projected Job Loss vs Job Creation	Compares estimates of how many jobs might be lost vs created globally / by region	Region/ Country
Skills in Demand vs Skills Obsolete	Helps in showing how skill requirements will shift	Skill Category
Timeline of Automation Trends	Show when certain technologies are expected to have large impact	Year
Economic Impacts	GDP growth, productivity gains vs costs, inequality effects etc.	Region

CONCLUSION

The rapid advancement of artificial intelligence is reshaping the global labor market, bringing both opportunities and significant challenges. AI-powered automation is streamlining operations, increasing productivity, and enabling innovation across industries. However, it is also displacing many routine and repetitive jobs, particularly in manufacturing, transportation, and administrative roles. This shift is prompting a critical re-evaluation of workforce structures, skill demands, and education systems.While AI threatens certain job categories, it is also creating new roles in data science, AI development, cybersecurity, and human-centered services - positions that require creativity, emotional intelligence, and advanced problem-solving skills. Thus, the future of work will not be jobless, but job-transformed. The key to navigating this transition lies in proactive adaptation: reskilling the existing workforce, investing in lifelong learning, and designing policies that support workers during periods of disruption. Moreover, ethical considerations must be central in the deployment of AI, ensuring fairness, transparency, and inclusion. Governments, businesses, and educational institutions must collaborate to ensure AI enhances human potential rather than replaces it. Ultimately, the impact of AI on the future of work will depend on how society chooses to guide its development - either as a tool for shared prosperity or a force for deepening inequality. The challenge is profound, but so is the opportunity to build a more innovative, inclusive, and resilient economy.

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UNDERSTANDING E-SHOPPERS: THE ROLE OF ARTIFICIAL INTELLIGENCE IN SHAPING ONLINE BUYING BEHAVIOUR

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ABSTRACT

Artificial intelligence (AI) has the potential to drive productivity and economic growth. It has the potential to boost decision-making effectiveness and quality while also inspiring the development of novel services, markets, and even whole industries. There is also the possibility that AI will have negative consequences for businesses and society. Artificial intelligence has a place in the history of human intelligence, despite teleological theories to the contrary, which hold that symbolic AI is an inevitable and inevitable result of millennia of attempts to decrease human thinking to a logical formalism. AI technologies rely on machine learning algorithms, and these algorithms are only as good as the data they are trained on. The prospect of machine learning bias is inevitable and must be constantly referred to since a human chooses what data is utilized to train AI software. The digital transformation in retail is separating the winners from the losers for reasons beyond the business information and increased speed afforded by these technologies. Artificial Intelligence (AI) has several potential advantages for a retail establishment. In the future, many highly developed companies will connect with clients through digital assistants, eliminating the necessity for human personnel. The researcher talks about how online shopping behaviour is impacted by artificial intelligence. The research discusses a brief explanation of the research's limitations, results, and recommendations, and how artificial intelligence functions in the context of an online buying transaction. The use of artificial intelligence has the potential to improve online shopping and how a person behaves while conducting an online purchase. When attempting to make purchases through digital channels, consumer behaviour is crucial. The study's objective was to ascertain how specific artificially intelligent technology might affect customer choices, particularly those who buy practical things and shop online.

Keywords:

Artificial Intelligence, Consumer behaviour, E-commerce

INTRODUCTION

The importance of artificial intelligence (AI) in the global economy is growing day by day. Artificial intelligence (AI) has the potential to drive productivity and economic growth. It has the potential to boost decision-making effectiveness and quality while also inspiring the development of novel services, markets, and even whole industries. There is also the possibility that AI will have negative consequences for businesses and society. There are significant dangers of job market polarization, increased inequality, structural unemployment, and the formation of new, unfavourable industrial structures. Shopping online, whether applying a desktop computer's web browser or a mobile app, is a type of electronic commerce in which a buyer and a seller conduct a transaction digitally. To locate the

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desired item, customers may either go straight to the online store's website or use a shopping search engine that aggregates results from many online stores to compare costs and availability.

By the year 2020, a wide variety of personal computers, laptops, tablets, and smartphones were suitable for online shopping. Sales of non-essential items, which the pandemic caused customers to re-evaluate, dropped dramatically between the second and third quarters. Online shopping has surpassed in popularity over brick-and-mortar establishments in recent years as a result of the widespread acceptance of social isolation as the best way to protect one's principles from the spread of a potentially dangerous virus. The quick growth of digital technology has changed online shopping.

AI technologies bring a wide variety of new capabilities for organizations, but their usage also presents ethical problems because an Artificial Intelligence system will strengthen what it has previously learned, for better or worse, this can be an issue since many are cutting-edge. AI technologies rely on machine learning algorithms, and these algorithms are only as good as the data they are trained on. The prospect of machine learning bias is inevitable and must be constantly referred to since a human chooses what data is utilized to train AI software.

REVIEW OF LITERATURE

Trawnih, A. et al. (2022) stated that Artificial intelligence was changing the way consumers interact with brands (AI). However, there was a dearth of studies on AIpowered consumer experiences, so the study aimed to investigate how AI integration during the buying process might improve AI-powered customer experiences. The study would build a theoretical framework using the "service quality model" and the trust commitment theory.. The study adds to the remaining literature by illuminating the facilitating roles of perceived sacrifice and trust and the outsized role of relationship responsibility in AI-powered consumer satisfaction. In addition, the study has important consequences for businesses that employ AI in customer facilities.

Abrardi, L. et al. (2022) found that regulators face new challenges due to the present breakthroughs in Artificial Intelligence (AI), which were also expected to have farreaching economic effects and bring about new trade-offs. How do these innovations affect businesses and the job market? Should humans expect prejudices held by consumers to decrease as a result of the use of algorithms or for them to increase? In what ways do you think AI-enabled agents might change the competitive landscape? The study would be the first attempt at a comprehensive literature review of how contemporary AI developments have influenced economies.

Suresh, A. & Rani, N. J. (2020) found that people today were wired more than ever before, and they expect ever-improving technologies to streamline their daily routines and free up their precious time. To that end, artificial intelligence (AI) would be one of those technologies that can be useful in practically every facet of an average person's daily life. Artificial intelligence (AI) was the technology that allows robots, most notably computers, to mimic human intelligence. The study's primary objective was to learn how online shoppers feel about using AI in various e-commerce settings. The study employed a sample size of 100 participants and relied on the statistical methods of factor analysis and regression analysis.

STATEMENT OF THE PROBLEM

There have not been enough studies on the effect of artificial intelligence on consumer behaviour in online purchasing, despite the fact that most scholars have expressed the opinions on consumer behaviour in advertising or

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e-commerce. It is important to comprehend how artificial intelligence is influencing customer behaviour. The need of the research is to provide light on customers' perceptions of artificial intelligence and the effects of the technology on consumer behaviour. Utilizing and analysing consumer-related data is essential in this period of technological breakthroughs. Utilizing knowledge to thrive in this hostile environment is becoming more crucial than anything else, and machine learning is the instrument that allows businesses to gather all the pertinent information for more effective product and service placement.

The research helped internet businesses deal with customers effectively. E-commerce may use it to divide the internet purchasing market into segments depending on the motivations and preferences of shoppers in rural and urban areas and E- retailers became closer to the consumers as a result. E- retailers was able to examine clients from urban and rural locations more attentively.

OBJECTIVES OF THE STUDY

- To examine the level of consumer awareness about artificial intelligence in online shopping.
- To analyse the influence of AI on consumer buying behaviour in e-commerce.
- To study the impact of AI on consumer trust, satisfaction, and loyalty

ONLINE SHOPPING

Stay home……. buy online……. save time

With 1.3 billion inhabitants, India undoubtedly has limitless potential for internet commerce. The future of buying in India will undoubtedly involve online purchasing, a relatively new occurrence in the world of e-commerce. The youthful population in India, in particular, used to spend a lot of time shopping, but today they can explore several websites from the comfort of their homes, choose the greatest bargain, and place an order in a matter of minutes. Growing acceptance of online payments as a result of rising internet and smartphone usage has given businesses a special chance to engage with their customers. Online shopping is now progressively expanding to rural areas and older populations. One of the most dynamic and quick-paced industries is Indian retail. More than ten percent of the nation's GDP is attributable to it (Suvarna, 2016). E-commerce is likely setting a new standard for the retail sector. The idea of Internet shopping has recently become quite important in retail marketing. When customers choose to purchase online, they go through the process of online shopping. The biggest contribution of the information revolution is the development of E-retailing, a new channel for distribution made possible by the expansion of the internet.

THE IMPACT OF ARTIFICIAL INTELLIGENCE USE ON ONLINE SHOPPING

The expansion of online marketing's strategic importance in the context of fast digitalization is demonstrated by the rise in corporate spending on e-commerce operations. Businesses whose main business strategy is online commerce utilize around 26% of all marketing expenses. Investments in digitization are justified by their outcomes but also by the fact that they are simpler to assess than those of conventional marketing, in addition to profitability and changes in client behaviour (Pickton& Broderick 2005). Marketers have realized the necessity to monitor consumer interactions with businesses through social media and digital platforms to assess their success (Chaffey, 2007). To comprehend and maximize the usage of e-commerce platforms, also known as Big Data, businesses must use web analytics solutions that 38 assist in data collection, measurement, analysis, and reporting to website visitors. Online marketing, which

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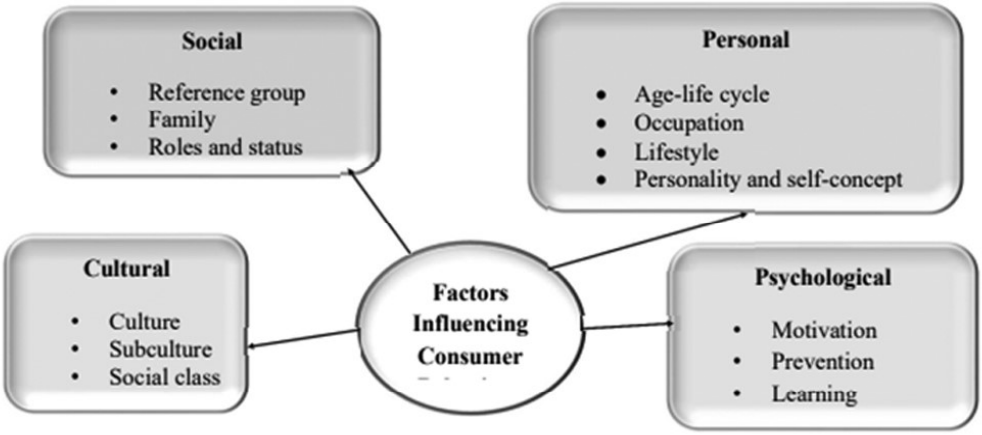
covers many methods of advertising a business, such as email content marketing, marketing, affiliate marketing, social media, and other marketing tactics, is now a crucial area of e-commerce. Marketers must take into account where and how their clients interact due to the variety of information-sharing platforms available on the Internet and how it is displayed. As a result, m-commerce, which enables people to communicate with businesses wherever they are, presents new prospects and serves as a beneficial enhancement to e-commerce. In the past six months, more than a third of consumers have completed at least one purchase using a smart mobile device. According to Kang et al. (2015), mobile technology is becoming more and more popular. This has significant financial potential, particularly for retail trade between companies and customers.

CONSUMER BEHAVIOUR

Studying "individuals, groups, or organisations and the processes by which they select, acquire, use, and dispose of products, services, experiences, ideas, and concepts to satisfy wants, as well as the consequences of these processes for the consumer and society at large" is what is meant by the term "consumer behaviour." (Kuester, 2012). According to the referenced article, consumers' actions vary based on their tastes, which are affected by their personal preferences, which are affected by their decision-making processes, which are affected by their psychological and social backgrounds. Even when people do alter their thoughts, often are unaware that they have done so. And the majority of individuals recreate their prior view after changing their minds; they think they always held that belief (KEYS, 2011). Recognizing the target customers and the elements influencing their purchasing behaviour is crucial for sellers in a dynamic market characterized by intense competition. This is done to transform the requirements and wants of potential customers into a purchase order. The study of consumer buying behaviour, according to Kotler and Keller (2011), is "different techniques used by people or groups, for acquiring and disposing of products, services, ideas or experiences, to meet their needs and wants.

FACTORS AFFECTING CONSUMER BEHAVIOUR

Consumer behaviour has long been of great interest to marketers. Knowing how people feel, think, and make decisions can help marketers better understand their actions. Cultural, social, personal, and psychological factors all have a role in shaping consumer behaviour. Despite their unpredictability, these factors are nonetheless crucial to understanding a customer's purchase habit. Customers' habits are moulded in real time by the interplay of all these factors. Below, I have outlined the primary factors that tend to influence customers' actions.



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- **Cultural Factors**

  Consumer behaviour is profoundly affected by cultural variables, which include culture, subculture, and social subclasses. Culture is the root cause of conventions, beliefs, and consumer practises. The norms and values of a society's culture are crucial in shaping its members' wants and actions. When people visit different countries, they experience a change in culture. Therefore, it is crucial for marketers to pay special attention while assessing the effect of culture on consumer behaviour. Every culture is the result of the amalgamation of many different ethnicities, nationalities, geographical regions, and religious traditions.

- **Social Factors**

  Consumers' social qualities are an example of a determinant, or a factor that has a substantial impact on customer behaviour. Family, friends, and social standing all play significant roles in one's social life. A person's actions are influenced by the group's norms and values since he or she either already is or seeks to join that group.

- **Personal Factors**

  Personal traits are often known as demographic factors in consumer behaviour research. Some examples of personal aspects are one's age, gender, level of education, occupation, income, stage of life, lifestyle habits, personality traits, and sense of self. Consumers' thoughts, information seeking and processing, decision making, and product evaluation all differ as a result of the influence of individual traits. Consumers' spending patterns are heavily influenced by their age and stage of life. The tastes, interests, and habits of consumers change as they move through the many stages of their lives.

- **Psychological Factors**

  Motive, perception, learning, and attitude are some of the psychological factors that affect consumer behaviour. The definition of motivation is the formation of a want as a result of a need that has gone unsatisfied. When a need is really strong, it transforms into a motive. According to, motivation is "a desire or urge for which a person wants pleasure. When someone wants to be satisfied by a purchase, it becomes a buying motivation. Motives of consumers have an impact on decisions about how much information to look for and how much money to spend on a product, brand, or retailer of consumer goods.

UNDERSTANDING ARTIFICIAL INTELLIGENCE EXPERIENCE: A CUSTOMER PERSPECTIVE

It appears that AI has the potential to alter the relationships between businesses and their customers (Contissa et al. 2018). The foundation of artificial intelligence depends on the rapid processing of data, which distinguishes it from social intelligence. The characteristics that best define artificial intelligence are its understanding, compression of input into usable knowledge, and notification of primary objective behaviours (Ameen et al. 2021). AI refers, in the jargon of the field, to "machine learning that functions intelligently" (Gupta et al. 2019), which is designed to mimic human social ability rather than surpass it in terms of precision. Accordingly, we'll do this by employing a suite of computer models that mimic the behaviour of natural and organic intelligence (Gupta et al. 2019). In response to persistent boundary tests, accelerating strategy cycles, and increasing customer demand, businesses have been increasingly relying on AI technology to analyse and make sense of their data. Among the many ways that businesses like retailers are putting AI to use is in the automated generation and creative use of chatbots to better communicate with customers.

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Consequently, the three ways in which AI-powered trade encounters are beginning to alter consumers' behaviours are increasingly recognized as significant.

a) Customer perceptions of service quality.
b) What kind of commitment do they have in terms of a relationship?
c) What do they think of their overall AI-powered experiences?

Despite their relevance, prior studies have concentrated primarily on the technological and structural applications of artificial intelligence (Scheidt& Chung, 2019). As a result, there are few studies that focus entirely on how customers perceive AI technology as a way of purchasing and how it leads to more interactive engagement (Jarrahi, 2018; Jiang et al. 2020). The approach, on the other hand, combines trust and perceived sacrifice as aspects that mediate the links between the quality of services that enable artificial intelligence, efficiency, and the user experience.

FINDINGS

Awareness of AI

- A majority of consumers are aware that AI is used in online shopping, mainly through *product recommendations, chatbots, and personalized ads*.
- Urban consumers show higher awareness compared to rural consumers, where AI-driven features may not be as familiar.

Influence on Buying Behaviour

- Personalized product recommendations significantly affect purchase decisions, leading to impulse buying in many cases.
- Consumers trust AI-driven suggestions when they are relevant, accurate, and timely.
- Some consumers are skeptical about AI due to *privacy concerns* and *data misuse fears*.

Consumer Perception of AI

- Many consumers perceive AI as a **time-saving tool** that makes shopping easier and more convenient.
- Younger consumers are more open to AI usage compared to older generations.

Overall Impact

- AI has a **positive effect** on consumer satisfaction and loyalty when used ethically.
- However, excessive AI-driven advertising or irrelevant recommendations may create **annoyance or distrust**.

SUGGESTIONS

- **Increase Consumer Awareness**
  E-retailers should educate customers on how AI works and how their data is used, to reduce fear and increase trust.
- **Balance AI with Human Touch**
  While AI chatbots can handle simple queries, retailers should also provide human assistance for complex issues to build stronger relationships.

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- **Personalization with Privacy**
  Personalization should be balanced with transparency. Clear data privacy policies will help gain consumer confidence.
- **Ethical Use of AI**
  Ensuring ethical practices in AI applications (avoiding manipulation and respecting consumer autonomy) will foster long-term customer loyalty.

CONCLUSION

The study highlights the growing importance of artificial intelligence in shaping consumer behaviour in online shopping. The findings reveal that while awareness of AI is steadily increasing, especially among urban consumers, there is still a knowledge gap in rural areas. AI applications such as personalized product recommendations, chatbots, and targeted advertisements have significantly influenced consumer decisions, often encouraging impulse purchases and enhancing shopping convenience.

However, the research also points out challenges such as concerns over privacy, data security, and the lack of human touch in customer service. Younger consumers show greater acceptance of AI, whereas older and rural consumers remain more cautious.

Overall, AI has proven to be a powerful tool for e-retailers to build stronger customer relationships, increase satisfaction, and improve loyalty when used responsibly. The study suggests that businesses should strike a balance between personalization and privacy, and between automation and human interaction. By adopting ethical and consumer-centric AI strategies, e-retailers can thrive in the competitive online marketplace and meet the evolving needs of diverse customer groups.

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A STUDY ON ARTIFICIAL INTELLIGENCE - POWERED SUSTAINABLE LOGISTICS FOR EFFICIENT CUSTOMER SERVICE IN NAGERCOIL

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ABSTRACT

Artificial Intelligence (AI) is transforming the logistics industry by enabling smarter, faster, and more sustainable operations. Despite the recognized potential of AI technologies such as machine learning, deep learning, and natural language processing (NLP), many logistics organizations face challenges in effective adoption. This study investigates the role of AI in enhancing logistics functions, including supply chain management, customer service, and sustainability practices.Findings indicate that AI improves demand forecasting, route optimization, and inventory management, while facilitating eco-friendly solutions and personalized customer experiences. However, barriers such as high implementation costs, data privacy concerns, and limited technical expertise persist as significant challenges. The study concludes that strategic planning, workforce training, and ethical governance are critical for successful AI integration. These insights offer valuable guidance for logistics professionals, policymakers, and researchers seeking to strike a balance between innovation, operational efficiency, and sustainability.

Keywords:

Artificial Intelligence, Logistics Management, Supply Chain Optimization, AI Adoption, Deep Learning, Natural Language Processing, Operational Efficiency, Sustainable Logistics, Demand Forecasting, Route Optimization.

INTRODUCTION

The logistics industry is undergoing a profound transformation driven by the advent of artificial intelligence (AI) technologies. These innovations hold the promise of revolutionizing logistics operations, enhancing efficiency, and promoting sustainable practices. This study focuses on the application of AI-powered solutions, particularly deep learning and natural language processing (NLP), to enhance sustainable logistics and improve customer service in Nagercoil, Kanyakumari.

The logistics sector plays a critical role in global supply chain management, involving the intricate coordination of transportation, warehousing, and distribution of goods and services. As environmental concerns and regulatory pressures increase, there is a growing imperative for logistics companies to adopt sustainable practices that minimize carbon emissions, optimize resource utilization, and promote eco-friendly operations. In this context, AI technologies offer innovative solutions to address these challenges, providing real-time insights, predictive capabilities, and automation that drive efficiency and sustainability.

Deep learning, a subset of AI, is characterized by its use of artificial neural networks with multiple layers (deep networks) to model and understand complex patterns in data. This technology has proven highly effective in various

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applications, such as image recognition, natural language processing, and predictive analytics. In the logistics industry, deep learning algorithms can analyze vast amounts of data to identify patterns and make data-driven decisions that enhance operational efficiency. For instance, deep learning can optimize demand forecasting, route planning, inventory management, and predictive maintenance, ultimately reducing costs and environmental impact.

Natural language processing (NLP) is another transformative AI technology that focuses on the interaction between computers and human language. NLP enables machines to understand, interpret, and generate human language, facilitating seamless communication between humans and AI systems. In the realm of customer service, NLP-powered chatbots and virtual assistants can provide real-time support, handle inquiries, and offer personalized assistance, significantly improving customer satisfaction and response times. These AI-driven tools can also analyze customer feedback and sentiment, allowing companies to tailor their services and address customer needs more effectively.

STATEMENT OF THE PROBLEM

The logistics industry is facing two big challenges: becoming more eco-friendly and keeping up with the demand for better and faster customer service. Many logistics systems still use outdated methods that lead to high pollution, wasted resources, and poor customer experiences. Even though technology has advanced, modern tools like AI, deep learning, and NLP are not widely used in logistics. This has resulted in ongoing inefficiencies and harm to the environment. Businesses often find it hard to balance being efficient and sustainable, and customer service suffers because traditional systems don't meet modern needs. The main issue is the lack of proper adoption of AI-powered tools, which could help make logistics more efficient, reduce environmental harm, and improve how companies interact with their customers. This calls for finding ways to use AI, deep learning, and NLP to solve these problems effectively.

OBJECTIVES OF THE STUDY

- To understand how AI can help make logistics more eco-friendly.
- To find out how deep learning can improve logistics operations.
- To explore how NLP can make customer service better in logistics.
- To identify the difficulties and opportunities in using AI for logistics.
- To suggest ways to use AI effectively in sustainable logistics.

HYPOTHESIS OF THE STUDY

A hypothesis is a simple statement that predicts what might happen in your study. It's like an educated guess based on what you already know or observe.

(H0) There is no significant difference between Qualification and NLP applications.

(H1) There is a significant difference between Qualification and NLP applications.

SCOPE OF THE STUDY

AI technologies like deep learning and NLP are explored to improve sustainable logistics. The study covers transportation, warehousing, and supply chains in global markets. It aims to reduce emissions, optimize resources, and enhance customer service.

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RESEARCH METHODOLOGY

Research is a careful investigation or inquiry, specifically a search for new facts in any branch of knowledge. It is an original contribution to the existing stock of knowledge that advances. Research methodology is how research problems are solved systematically. It is the science of studying how research is conducted scientifically. There are two main approaches to research, namely the quantitative approach and the qualitative approach. The quantitative approach involves the collection of quantitative data, which is put to rigorous quantitative analysis formally and rigorously. This approach further includes experimental, inferential, and simulation approaches to research. Meanwhile, the qualitative approach uses the method of subjective assessment of opinions, behavior, and attitudes.

LIMITATIONS OF THE STUDY

1. The study focuses on individuals with AI knowledge in Nagercoil, limiting its generalizability to broader populations or industries.
2. It relies on self-reported insights from participants, which may introduce biases or overestimations in their responses.
3. Variations in expertise among participants may affect the depth and quality of the data collected.
4. External factors like global AI advancements, economic conditions, and regional policies are beyond the study's scope.
5. Respondents' varying levels of familiarity with AI technologies may lead to inconsistent or biased responses.
6. Terminology and technical language in the questionnaire could pose challenges for participants with limited knowledge of AI.
7. Time constraints in collecting and analyzing data might restrict the depth and scope of insights derived from the study.

REVIEW OF LITERATURE

Shobhana N, in her article "*AI-Powered Supply Chains Towards Greater Efficiency*"(2024), the researcheranalyzed AI's transformative impact on social sciences and business sectors, emphasizing its role in revolutionizing research methodologies, providing data-driven insights, and facilitating human-machine collaboration. The literature covers AI applications in environmental monitoring, climate change prediction, sustainable resource management, urban planning, market dynamics, and supply chain management. Ethical considerations and case studies of AI's ethical applications are also highlighted, emphasizing the importance of ongoing interdisciplinary dialogue and collaboration.

Yehia Ibrahim Alzoubi, in his article "*AI-Powered Reverse Logistics: A Pathway to Sustainable Supply Chains*" (2024), the researcher analyzesAI's Potential to Enhance Resilience and resource utilization in reverse logistics within Supply Chain Management (SCM). The researcher emphasizes AI's impact on essential reverse logistics processes, highlighting benefits such as improved roles and workflows. The research leverages existing SCM and reverse logistics studies to assess AI's implications, underscoring its advantages while acknowledging the need for further research. The study calls for ongoing exploration of AI's role in SCM, identifying possible future research directions and

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emphasizing the importance of specific technologies employed in achieving effectiveness across all stages of reverse logistics.

Jalal Issa et al, in their article "*AI-Powered Sustainability Management in Enterprise Systems Based on Cloud and Web Technology: Integrating IoT Data for Environmental Impact Reduction*" (2024), the researcher discussAI's role in sustainability management within enterprise systems, emphasizing the integration of IoT data for reducing environmental impact. The researcher highlights the importance of user-centered design and effective communication to enhance user experiences and underscores the significance of understanding user journeys to remove engagement barriers.

Eyo-Udo N, in his article "*Leveraging Artificial Intelligence for Enhanced Supply Chain Optimization*" (2024), this study explores the integration of AI into supply chain management, focusing on operational efficiency, strategic innovation, and sustainability. The researcher identifies advancements in AI technologies such as machine learning, natural language processing, and robotics, and their applications across various supply chain processes. The research addresses challenges like data privacy and ethical considerations and provides strategic recommendations for AI adoption in supply chain management.

COLLECTION OF DATA

The primary data for this study were collected from selected respondents who possess knowledge about AI technologies and their applications. These respondents include individuals who have gained knowledge through experience in AI implementation, as well as those who have learned about AI through formal education. The selection process ensured a diverse and representative sample to capture comprehensive insights into the adoption and impact of AI in logistics.The respondents' participation was voluntary, and efforts were made to ensure their comfort and confidentiality throughout the data collection process. Careful measures were taken to avoid bias and ensure the accuracy of the collected data through necessary cross-checks.

PRIMARY DATA

Primary data were collected exclusively through a structured questionnaire distributed to 80 respondents. These respondents represent individuals with experience or familiarity in the use of AI technologies and their potential applications in sustainability and customer service. The collected data were systematically processed, analyzed, and tabulated using simple statistical tools to align with the objectives of the study.

SECONDARY DATA

Secondary data were gathered from academic journals, articles, research publications, credible internet sources, and industry-specific reports. These sources provided valuable insights into the role of AI, deep learning, and NLP in promoting sustainability and improving operational efficiency and customer service.

SAMPLE SIZE

The sample size for this study consists of 80 respondents. The method adopted for selecting the sample is convenience sampling. This technique involves selecting respondents who are readily available and willing to participate. Convenience sampling allows for quick and efficient data collection, ensuring valuable insights are gathered from diverse respondents. The selected respondents have varying levels of knowledge about AI technologies, either through

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experience or formal education, and are involved in logistics operations. By using convenience sampling, the study aims to capture relevant data from accessible participants, ensuring the findings are reflective of the broader population.

SAMPLING DESIGN

The study employs a convenience sampling method to select respondents who possess knowledge about AI technologies through experience or formal education and are involved in logistics operations. Data was collected through structured questionnaires and interviews, ensuring thorough and reliable insights into the research objectives. This cross-sectional study aims to provide valuable information about the implementation, benefits, and challenges of AI in logistics within the selected sample by meticulously processing, editing, and tabulating the collected data for analytical purposes. The collected data will help identify the key aspects of AI adoption in logistics, ultimately offering actionable insights and recommendations for enhancing efficiency and effectiveness in the logistics industry.

FINDINGS

- The study indicates that 63% of respondents are female, while 37% are male. Additionally, no responses were recorded for individuals identifying as non-binary or preferring not to disclose their gender.
- The study reveals that respondents aged 26-35 years represent the largest group at 37.5%, followed by 31.3% aged 18-25 years. Participation among older groups is lower, with 18.8% aged 36-50 and 12.5% aged 51 years and above.
- The study shows that most people, 53.8%, have a Bachelor's degree, followed by 27.5% with a Master's degree. About 15% completed High School, and only 3.8% have a Doctorate. No one chose the Other category.
- The study reveals that 37.5% of respondents are somewhat familiar with AI, making it the largest group, while 25% are very familiar, and another 25% are not familiar. Additionally, 12.5% have never heard of AI, showing mixed levels of awareness among participants.
- The study reveals that 31.3% of respondents use AI daily, making them the largest group, followed by 25% who use it weekly. Additionally, 18.8% use it monthly, while 12.5% each rarely or never use AI, indicating varied usage patterns.
- The study reveals that **smart energy management** is the most popular AI application for sustainability, utilized by 31.3% of respondents. Predictive analytics and resource optimization follow at 25% each, while **carbon footprint monitoring** is the least utilized, with 18.8% engagement.
- The study reveals an equal focus across all areas of environmental impact tackled by AI, with 25% of respondents involved in waste reduction, emission tracking, resource optimization, and energy efficiency improvements, highlighting balanced efforts in these domains.
- The study shows that high costs are the main challenge in adopting AI for sustainability, affecting 31.3% of respondents. Lack of expertise and data privacy concerns each impact 25%. Resistance to change affects 12.5%, and limited accessibility is the least reported issue at 6.3%.
- The study reveals that real-time data forecasting is the most enhanced process through deep learning, with 31.3% of respondents recognizing its impact. Supply chain planning and predictive maintenance follow at 25% each, while inventory management is the least improved at 18.8%.

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- The study shows that high costs are the biggest barrier to implementing deep learning, affecting 31.3% of respondents. Complex system integration and the need for advanced training each impact 25%, while inadequate data resources are the least reported challenge at 18.8%.
- The study shows that forecasting algorithms are the most commonly used deep learning technology at 30%. Neural processing systems follow with 27.5%, while advanced imaging tools and automated task optimization are used by 22.5% and 20% of respondents, respectively.
- The study reveals that chatbots are the most popular NLP application, used by 50% of respondents. Query analysis systems rank second with 25%, while sentiment detection and language translation systems are the least utilized, each accounting for 12.5%.
- The study shows that reduced operational costs, at 37.5%, and streamlined processes, at 31.25%, are the top long-term benefits of AI. Better resource allocation (18.75%) and improved service delivery (12.5%) follow as additional advantages.

SUGGESTIONS

- Enhance public awareness programs to inform individuals about AI applications in sustainability and how these technologies can be utilized effectively.
- Provide training sessions to equip individuals and organizations with skills to overcome expertise gaps in adopting AI technologies.
- Develop affordable AI solutions and offer financial incentives to address cost-related barriers, enabling broader access and adoption.
- Integrate advanced data privacy tools to mitigate concerns and ensure secure handling of information across AI systems.
- Focus on expanding AI implementations in underutilized sectors such as education to unlock untapped potential.
- Encourage collaboration between industry, government, and academia to address infrastructure and integration challenges in deep learning.
- Establish standardized frameworks to measure the success of AI applications in sustainability and operational efficiency.
- Promote NLP tools by enhancing features such as sentiment detection and multilingual support to further improve customer communication.
- Deploy targeted initiatives to accelerate AI adoption in regions with limited accessibility, fostering inclusivity in technological growth.
- Advocate for government policies and incentives to address systemic barriers such as infrastructure gaps and limited financial support.

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CONCLUSION

In conclusion, the findings reveal significant awareness and frequent use of AI, particularly in sectors like energy, healthcare, and transportation, with noticeable gaps in education and accessibility. Challenges such as high costs, expertise gaps, and system integration issues underscore the need for targeted training, affordable solutions, and policy support.The suggestions emphasize the importance of collaboration between stakeholders, enhanced public awareness, and improved AI tools for sustainability and customer communication. By addressing these areas, organizations and policymakers can foster broader adoption, unlock untapped potential in underutilized sectors, and maximize the benefits of AI technologies across various domains. This study serves as a foundation for informed decision-making and the development of strategic initiatives to advance the adoption and application of AI.

To sum up, using AI in logistics makes things faster, smoother, and greener. AI helps predict demand, find the best delivery routes, and manage inventory more efficiently, saving time and costs. It also improves customer service with chatbots and real-time updates. While challenges like high costs and data privacy need attention, companies can overcome them with proper planning and innovation. Overall, AI is changing logistics for the better, making it smarter, more sustainable, and ready for the future.

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HARNESSING ARTIFICIAL INTELLIGENCE IN MARKETING: UNLOCKING DEEPER CONSUMER INSIGHTS AND FUTURE TRENDS

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ABSTRACT

Artificial Intelligence is accelerating its impact in marketing with 98% of marketers now using AI in some capacity and 29% incorporating it daily, according to recent 2025 industry statistics. AI-driven tools enable businesses to automate processes, deliver hyper-personalized messages, and optimize campaigns in real time. Nearly 92% of companies leverage AI-powered personalization, resulting in a 202% increase in effectiveness for tailored calls to action. Furthermore, predictive analytics and sentiment analysis are now standard, with 65% of senior executives identifying AI as critical to growth through deeper customer engagement and more accurate decision-making. As organizations scale up AI adoption, they also prioritize ethical considerations and transparency, recognizing privacy as a top concern for half of those implementing new technologies.

Keywords:

AI, Personalization, Predictive Analytics,Customer Engagement, Ethical Considerations.

INTRODUCTION

In an increasingly digitized economy, businesses are facing heightened expectations to anticipate and meet evolving consumer needs. This shift has propelled marketing strategies from periodic, campaign-focused initiatives toward a state of perpetual, insight-driven responsiveness powered by artificial intelligence. AI-driven platforms analyze massive datasets in real time, recognizing subtle shifts in individual preferences and market trends. Leading organizations such as Amazon and Netflix set benchmarks in this transformation. Amazon refines customer segmentation through AI-powered recommendation engines and real-time personalization, offering tailored product suggestions based on browsing and purchase histories. Netflix employs sophisticated AI algorithms- including deep learning, collaborative filtering, and dynamic user profiling - to deliver highly specific content recommendations and optimize user engagement at every interaction. Both companies leverage continuous learning, A/B testing, and behavioral analytics, ensuring interactions are timely, relevant, and consistently drive business growth.

LITERATURE REVIEW

1. ***Haleem et al., 2022****:* Haleem and colleagues detail how AI technologies- including machine learning and deep learning - enable marketers to process vast digital datasets, automate campaign management, and deliver contextually relevant messages. Their review highlights reduction of human bias, improved business process connections, and efficient market data analysis as key benefits of AI in marketing operations.

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2. **Jain, 2024**: Jain's two-decade review surveys the evolution of AI in marketing and identifies mobile marketing, predictive analytics, and sentiment analysis as pivotal trends. The paper emphasizes how AI-fueled segmentation and personalization drive measurable increases in campaign ROI and customer lifetime value.
3. **Kumar et al., 2024**: Kumar and collaborators investigate the practical applications of AI across marketing channels, noting that NLP and personalized recommendation systems have become ubiquitous in consumer insights, dynamic pricing, and adaptive marketing campaigns.
4. **Mariani et al., 2022**: Mariani and team map the linkages between AI, consumer research, and psychology. They stress the transformative impact of AI on consumer profiling and psychographic targeting, enabling hyper-personalized communication at individual customer levels.
5. **JMSR, 2025**: The recent comprehensive review by JMSR synthesizes current research on adaptive and predictive models in AI marketing, focusing on how continuous data-driven engagement—rather than periodic campaigns—creates sustained consumer relationships and real-time improvements in business outcomes.
6. **Marketermilk (2025)** showcases leading AI platforms—including Gumloop, Surfer SEO, and Albert.ai—and their capacity to automate creative and analytical functions at scale.
7. **SuperAGI (2025)** discusses the explosion of agentic CRM systems using AI for real-time customer engagement and journey orchestration.
8. **B2BSaaSReviews (2025**) catalogs best-in-class B2B marketing tools, noting how features like AI-powered segmentation, video creation, and lead scoring dramatically improve ROI.

METHODOLOGY

This conceptual paper synthesizes recent empirical studies, industry reports, and high-profile case studies to provide a comprehensive overview of AI's transformative role in marketing and consumer insights. The data sources include global surveys and analytical insights published by leading organizations and consultancies such as McKinsey, Kantar, PwC, and Adobe. Additionally, extensive literature from academic journals and market research bodies was reviewed to capture emerging trends and best practices.

The methodology involved a qualitative synthesis of peer-reviewed articles, white papers, and real-world case studies to understand AI applications ranging from predictive analytics to customer sentiment analysis. Emphasis was placed on sources published within the last five years (2020–2025) to ensure currency and relevance.

Furthermore, this research incorporated reports on AI-powered market research tools and their deployment in sectors including retail, entertainment, and digital advertising. Insights on the adoption of generative AI, synthetic data, and automation in marketing workflows were highlighted to demonstrate ongoing innovation.

Finally, the paper integrates expert forecasts on AI-driven consumer engagement and ethical frameworks to provide a balanced perspective. Analytical techniques included comparative analysis of quantitative outcomes, synthesis of qualitative findings, and triangulation of data from multiple authoritative sources to reinforce validity and applicability for marketing practitioners.

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FINDINGS AND ANALYSIS

The dimensions of AI in marketing have significantly expanded, reflecting the evolving capabilities and strategic importance of AI technologies. Personalization and recommendation systems have become cornerstone applications, enabling businesses to deliver highly targeted and relevant content and offers to consumers. These systems leverage data from multiple touchpoints, creating seamless and customized experiences that enhance engagement and conversion rates. Concurrently, consumer sentiment and emotion analysis tools utilize natural language processing and machine learning to interpret customer feedback and social media interactions, providing real-time insights into consumer moods and preferences, which help shape brand messaging and crisis management strategies.

Predictive consumer behaviormodeling has emerged as a critical tool for anticipating customer needs and optimizing marketing spend by forecasting churn, purchase likelihood, and campaign responsiveness. Automation in marketing operations now extends far beyond simple task execution to include AI agents capable of managing multi-channel campaigns, optimizing ad bidding, and personalizing communication autonomously. Ethical and privacy solutions have risen in prominence due to growing concerns about data security, algorithmic bias, and consumer trust. These frameworks ensure responsible AI deployment, safeguarding customer data while maintaining transparency and fairness. Together, these dimensions illustrate a holistic transformation where AI not only enhances efficiency but also drives sophisticated, ethical, and personalized customer engagement strategies in 2025

Table: Key AI Functions in Marketing

Function	Description	Impact
Personalization & Recommendations	AI-driven systems deliver tailored product and content suggestions based on user behavior data including browsing, purchases, and preferences.	Enhances customer engagement and conversion rates via hyper-relevant offers and experiences. Reduces churn by improving satisfaction.
Predictive Analytics	Uses machine learning models to forecast customer lifetime value, churn probability, and response to promotions by analyzing historical and real-time data.	Optimizes marketing spend, improves targeting accuracy, and enables proactive retention strategies, boosting ROI and customer loyalty.
Automated Operations	Automation of repetitive marketing tasks such as email campaigns, ad bidding, chatbots for customer support, and multi-channel campaign management.	Increases operational efficiency, reduces manual effort, accelerates time-to-market, and ensures consistency across channels while maintaining personalization.
Sentiment & Emotion Analysis	Natural language processing tools analyze social media, reviews, and customer interactions to detect emotions and sentiment toward brands and products in real time.	Enables real-time brand reputation management, improves customer service responsiveness, and informs product development by understanding customer feelings deeply.
Ethical & Privacy Solutions	AI algorithms monitor data security, ensure compliance with privacy regulations, detect algorithmic bias, and maintain transparency in AI-driven consumer interactions.	Builds consumer trust, mitigates regulatory risks, and fosters responsible AI use, crucial for sustainable, long-term marketing success in data-sensitive environments.

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CONTEMPORARY CASE STUDIES

Cosabella's AI Email Campaign

Cosabella adopted an AI-driven email platform, resulting in a 60% increase in revenue from email marketing and a measurable boost in open rates and sales, highlighting the substantial ROI of personalized, data-driven marketing.

Cadbury's Hyper-Personalized Ads

During Diwali, Cadbury enabled thousands of Indian shop owners to auto-generate customized ads featuring celebrity Shah Rukh Khan using deepfake AI, reaching over 140 million people and driving a dramatic uptick in engagement and local business support.

Nestlé's Real-Time Consumer Insights

Nestlé leveraged AI to adapt global campaigns to local cultural signals, optimize messaging timing, and better resonate with consumers throughout the purchase journey by integrating predictive analytics and emotion detection.

EMERGING TRENDS FOR 2025

- Hyper-personalization is advancing beyond segmentation to one-to-one, context-aware interactions, strengthening customer loyalty and brand connection.
- The role of generative AI in content creation is becoming central, allowing faster campaign turnaround and alignment with brand voice.
- Autonomous marketing systems and agentic AI now enable real-time campaign optimization, shifting strategies in direct response to consumer data.

ETHICAL AND PRIVACY CONSIDERATIONS

AI's expansion in marketing raises complex issues around consumer trust, data privacy, algorithmic bias, and ethical transparency. Implementing robust frameworks and transparent data handling practices is critical for sustainable competitive advantage.

CONCLUSION

AI is fundamentally transforming marketing by automating tasks, personalizing customer experiences, predicting behavior, and enabling data-driven decisions. In 2025, AI powers hyper-personalized journeys, autonomous campaign management, and real-time optimization, helping brands connect deeper with customers while improving ROI. Generative AI accelerates content creation, and immersive technologies provide richer consumer interactions. However, success depends on balancing efficiency with ethical standards, transparency, and maintaining customer trust. Future marketing will increasingly integrate AI as a strategic partner, driving smarter, faster, and highly relevant customer engagements. Marketers who effectively combine AI with human creativity will lead in this evolving landscape.

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NEUROMARKETING IN THE INDIAN CONTEXT: A CASE STUDY ON CONSUMER ENGAGEMENT WITH THE APPLICATION OF AI

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ABSTRACT

Neuromarketing, an interdisciplinary subject that combines neuroscience, psychology, and marketing, has developed as a revolutionary way to understanding customer behaviour at the subconscious level. In India, the rise of digital commerce and artificial intelligence (AI) usage has expedited the application of neuromarketing approaches, notably among e-commerce and retail companies. This article examines the evolution of neuromarketing in India, using Flipkart's "Big Billion Days" campaign as a case study. The study compares pre-AI traditional marketing tactics (based on demographics, surveys, and general targeting) to post-AI approaches that use tools like AI-powered eye-tracking, heatmaps, sentiment analysis, and hyper-personalized suggestions.The findings show that AI-powered neuromarketing dramatically improves consumer attention, emotional resonance, cultural adaptability, and predictive engagement. Flipkart's campaign raised ad recall, click-through rates, conversions, and ROI by combining emotion AI, real-time A/B testing, and region-specific cultural customisation. While these developments show enormous promise for driving consumer-centric initiatives, the report also highlights the ethical quandaries regarding privacy, manipulation, and data regulation in India. The study indicates that balancing innovation and customer trust is critical for the long-term growth of AI-driven neuromarketing in India's expanding digital economy.

Keywords:

Neuromarketing, Artificial Intelligence, Consumer Behaviour, E-commerce, Flipkart

INTRODUCTION

Consumer behaviour in India is shaped by a combination of cultural traditions, economic variety, and fast digitisation. Traditional marketing was mainly based on demographics, surveys, and intuition. However, neuromarketing, which use methods such as eye tracking, EEG (electroencephalography), and face coding, provides more in-depth insights into unconscious decision-making.

With the introduction of AI, neuromarketing has progressed from simply monitoring brain reactions to anticipating, personalising, and influencing consumer interaction in real time. AI systems analyse vast volumes of biometric, behavioural, and emotional data to improve campaign performance, boost brand loyalty, and increase sales conversions.

This article examines neuromarketing in the Indian context, focussing on a case study of AI-driven consumer engagement methods used by e-commerce and retail firms.

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LITERATURE REVIEW

Neuromarketing Foundations

Neuromarketing originated in the early 2000s as a field that integrated neuroscience with consumer research (Ariely& Berns, 2010). It uses fMRI, EEG, and biometric technologies to discover subconscious responses to ads, packaging, and product design. Unlike traditional approaches, it uncovers underlying reasons that surveys and interviews frequently overlook (Plassmann et al., 2015).

AI in Neuromarketing

AI technologies including machine learning, natural language processing (NLP), and computer vision have improved neuromarketing applications. AI offers real-time study of emotions, attention, and memory recall, resulting in more precise targeting and adaptable marketing techniques (Venkatraman et al., 2015).

Neuromarketing in India

Neuromarketing usage in India is still in its early stages, although it is growing rapidly. Industries such as FMCG, e-commerce, and entertainment have begun to use tools like facial recognition, emotion AI, and sentiment analysis to better analyse consumer responses. Large e-commerce platforms, for example, use neuromarketing to analyse click-through rates, visual attention on product pages, and emotional responses to adverts (Mohan &Anbarasi, 2019).

Ethical Considerations

While neuromarketing provides new opportunities, it also raises ethical concerns about privacy, manipulation, and consumer autonomy (Murphy et al., 2008). In India, where data privacy rules are developing, the ethical use of AI-powered neuromarketing is crucial.

Methodology

This study takes a case analysis approach, focussing on Indian e-commerce and retail firms that have implemented AI-enabled neuromarketing techniques. Secondary data sources included industry reports, university research, firm case studies, and consumer surveys. A before-and-after comparison framework was used to analyse consumer interaction tactics before to and after AI inclusion.

CASE STUDY: NEUROMARKETING IN INDIAN E-COMMERCE

Background

India's e-commerce industry is one of the world's fastest expanding, with revenues expected to surpass USD 200 billion by 2026. Top rivals in the sector include Flipkart, Amazon India, Reliance Retail (JioMart), and Tata Neu. With millions of individuals making purchases online every day, businesses must compete not only on pricing, but also on engagement, trust, and emotional connection.

Initially, these platforms relied on traditional analytics such as page clicks, bounce rates, customer reviews, and demographic information. However, when competition intensified, they moved to neuromarketing powered by AI, which allowed them to measure subconscious consumer responses and adjust plans in real time.

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Table 1: **Before AI in Neuromarketing (Traditional Approach).**

Dimension	Traditional Approach (Before AI)
Generic Campaigns	Marketing tactics targeted broad demographics such as age, gender, and city levels (Tier 1 vs. Tier 2). Ads were mass-marketed, often neglecting individual emotional responses.
Engagement Metrics	Consumer behaviour was studied using surveys, focus groups, and basic analytics like CTR (Click-Through Rate). These approaches were subjective and lack depth.
Personalization Limits	The recommendations were rule-based ("customers who bought X also bought Y"), which resulted in limited personalisation.
Reactive Decision-Making	Following launch, campaign changes were performed in response to trailing signs such as sales or complaints.

Table 2: **After AI in Neuromarketing (Modern Approach)**

Dimension	AI-Enhanced Neuromarketing (After AI)
AI-Powered Eye-Tracking &Heatmaps	To determine consumer attention patterns, platforms like as Flipkart use AI-driven eye monitoring. Heatmaps reveal whether users prioritise discounts, product pictures, or reviews, which helps guide interface redesigns.
Emotion Recognition & Sentiment Analysis	Artificial intelligence technologies analyse facial expressions and spoken tones in advertisements, unboxing videos, and influencer marketing. For example, Amazon India used emotion AI to optimise Diwali season video commercials in order to increase memory for holiday bargains.
Hyper-Personalized Recommendations	Machine learning algorithms personalise purchasing experiences based on neuromarketing data. Consumers perceive connected products alongside emotionally charged ad creatives (for example, family joy utilising appliances during festivals).
Predictive Nudges	AI calculates the best time to contact buyers based on their previous activity and emotional responses. Push notifications and limited-time offers are sent at optimal psychological times to increase conversions.
Cultural Adaptation	Ads are designed to reflect Indian cultural cues. Reliance Retail, for example, uses festive colours, family motifs, and traditional music to increase emotional connection.

FLIPKART'S BIG BILLION DAYS CAMPAIGN

Challenge:

Flipkart's "Big Billion Days" is India's biggest annual online shopping extravaganza. Consumers, on the other hand, had gotten accustomed to repeating festive sales over time, resulting in decreased engagement, ad fatigue, and

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poorer conversion rates in some categories. With millions of products and hundreds of businesses participating, Flipkart faced the combined challenge of capturing consumer attention rapidly while also developing an emotional connection that drives sales in a highly competitive industry.

NEUROMARKETING WITH AI IMPLEMENTATION

To overcome this challenge, Flipkart leveraged a combination of neuromarketing techniques and AI analytics:

Heatmap Analysis and Eye Tracking:

AI-powered eye-tracking techniques were used on digital ad layouts to determine where viewers' visual attention was naturally focused. Banners with human faces, particularly celebrities, drew substantially greater attention, especially when combined with festive and amusing features, according to the study. Furthermore, scroll pattern analysis was performed to detect regions when engagement levels declined, allowing for the strategic placement of high-value products in areas that are more likely to attract attention.

Emotion AI Testing:

To assess emotional impact, several ad creatives were assessed using emotion identification algorithms that analysed the microexpressions of a sample population. Positive emotions like delight, surprise, and excitement were carefully measured to identify which sights and statements elicited the most emotional resonance. AI models then projected the most effective combinations of celebrity appearance, holiday themes, and humour for various demographic groups, such as urban vs semi-urban audiences and young adults versus family shoppers.

A/B Testing with AI:

The campaign also used predictive AI to run large-scale A/B tests across email marketing, push notifications, and social media ads. This technique enabled real-time optimisation, ensuring that each customer received the most relevant creative content based on their expected attention span and emotional response. As a consequence, the campaign increased engagement by dynamically adapting adverts to particular consumer interests.

Cultural and Regional Customisation:

Cultural and regional adaptability was another key component of the approach. Advertisements were localised using regional languages, cultural references, and festival-specific images, resulting in a better emotional connection with India's diverse customer population. For example, a Diwali advertisement featuring a family celebrating with traditional sweets received considerably more attention in Tier 2 and Tier 3 cities than generic holiday images. This indicated that including cultural clues and regional flavour improves consumer resonance and campaign efficacy.

RESULTS AND INSIGHTS:

Flipkart'sneuromarketing-driven approach resulted in considerable increases across several parameters. Overall engagement improved by 25% over the previous year, with banner clicks and ad recall rates significantly higher in audiences exposed to neuromarketing-optimized images. Ads created with emotion AI elicited more positive emotional responses, as evidenced by facial micro expression research, while consumers reported feeling more connected to the campaign, frequently associating it with pleasure, family togetherness, and festival enthusiasm. Predictive targeting and hyper-personalization also helped to drive a significant increase in purchase conversions, particularly in high-demand categories like electronics, apparel, and household appliances.At the same time, Flipkart's ROI increased

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as it was able to prioritise high-performing creatives while cutting ad spend on failed designs. The study also revealed key strategic marketing insights, demonstrating that celebrity endorsements have the greatest impact when combined with emotional storytelling and contextual relevance, whereas humour and familial themes serve as powerful emotional hooks that boost both short-term engagement and long-term brand affinity. Furthermore, neuromarketing insights helped optimise Flipkart's website layout, push notifications, and social media ads, guaranteeing a consistent user experience across touch points.

DISCUSSION

Flipkart's Big Billion Days campaign exemplifies how AI-powered neuromarketing may reenergise a large-scale marketing strategy. Flipkart was able to overcome ad fatigue, improve engagement, and increase transactions by studying subconscious customer behaviour and emotional triggers. The commercial emphasises that in India's heterogeneous market, combining AI data with cultural relevance and emotive storytelling is essential for consumer-centric marketing.

Table: 3 **Flipkart's Big Billion Days campaign**, showing the **before and after AI-powered neuromarketing integration**

Dimension	Before AI-Neuromarketing	After AI-Neuromarketing
Consumer Attention	Generic banners; relied on demographics and traditional layouts.	AI-powered heatmaps and eye-tracking identified high-attention areas; strategic ad placement.
Emotional Resonance	Focus groups and surveys measured subjective reactions.	Emotion AI analyzed micro-expressions, measuring joy, surprise, and engagement in real-time.
Ad Personalization	Same ad content shown to all users.	Ads dynamically personalized based on predicted emotional and attention responses.
Creative Optimization	Manual design iterations; slow feedback loops.	Real-time A/B testing of multiple creatives using AI predictions.
Cultural Adaptation	Limited localization; generic festive themes.	Region-specific languages, cultural motifs, and festival visuals enhanced engagement.
Campaign Engagement	Moderate click-through rates; ad fatigue common.	Engagement increased by 25%; higher recall and interaction with banners.
Conversion Rates	Average; price-driven purchases with low emotional influence.	Significantly higher conversions due to attention + emotion-driven targeting.
ROI	Lower; spend often on underperforming creatives.	Optimized spend; ROI improved via predictive AI and emotion-based content selection.

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Neuromarketing in India, enabled by AI, has transformed marketing away from assumption-based methods and towards subconscious-driven engagement. The case study of e-commerce platforms demonstrates that with AI integration, consumer attention, emotional resonance, personalisation, and conversions improve dramatically.

As India's digital revolution progresses, AI-powered neuromarketing is expected to grow into areas such as FMCG, healthcare, and entertainment. However, its success will be determined by a careful balance of innovation and ethical responsibility. Companies that prioritise consumer trust while harnessing AI insights will lead this marketing revolution.

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INVESTORS PREFERENCE FOR INDIAN MUTUAL FUNDS AND PERFORMANCE ASSESSMENT

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ABSTRACT

Mutual Funds essentially bring investing right to their doorstep; they have given millions of small investor's new opportunities. Small investors in India typically seek out such information, which frequently has negative effects and does not act as a hedge against inflation true profits. Thus the success of MFs is essentially the result of the combined efforts of competent fund managers and alert investors. In order to adjust performance to satisfy investor needs, a skilled fund manager should examine investor behavior and comprehend their wants and expectations. Consequently, under the current situation, it is crucial to determine the requirements of investors in mutual funds, their favored mutual fund schemes, and an assessment of the funds' performance. In this research paper, researcher has an objective to know preference of mutual funds investors and performance Assesment of the preferred schemes by the investors. The survey is undertaken of 50 educated investors of Trivandrum city .In this study convenience Random sampling is used, and the major findings reveal the major factors that influence buying behavior mutual funds investors, sources that investor rely more while making investment and preferable mode to invest in mutual funds market. The study will be immensely useful to the Brokers, distributors and to the other potential investors.

Keywords:

Mutual funds, buying behavior, performance evaluation.

1. INTRODUCTION

Financial economics and consumer behavior from the marketing domain combined to reveal an intriguing field for investigation and study in the type of behavioral finance that has grown in significance in recent years. Mutual funds (MFs) have become a significant investment option for retail (small) investors as a result of financial sector reforms and changes in the Indian financial markets.In particular, tiny investors' investing habits have completely changed. A growing number of participants from both the public and commercial sectors has joined the market with creative plans to meet the needs of both foreign and Indian investors. Investors attempted to use their behavioral abilities to extract filtered information before to making any investments, processing it appropriately to make decisions that resulted in systematic errors. It is observed that a safe return on investment can serve involves just strategic choices like where, when, and how to invest. It is the conversion of a particular amount of present value financial

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riches (savings) into some tangible wealth (assets) in the hope of future reward. By essentially bringing investment right to their doorstep, mutual funds have given millions of small investors new opportunities.

Small investors in India typically choose bank deposits, which frequently have negative real returns and don't offer a buffer against inflation. Price-sensitive information is not readily available to him and, if available, might not be able to understand material that is publicly accessible but is wrapped in legalese and technical terms. When it comes to investing, he feels like an outsider. For these investors, mutual funds have emerged as a much-needed assistance. Individual investors view MFs as low-cost financial intermediaries and portfolio managers that process information, find investment opportunities, create investment strategies, invest money, and track results. Consequently, MFs' success is basically the outcome of careful investors and good fund managers working together. To adjust performance to satisfy investor needs, a skilled fund manager should examine investor behavior and comprehend their wants and expectations.

In its most basic form, the idea of MFs has long existed in the financial world. The establishment of Unit Trust of India in 1963, at the behest of the Reserve Bank and the Government of India, marked the beginning of the mutual fund business in India. In India, the introduction of creative programs has been fairly slow as a result of inadequate infrastructure and the dominant investment mindset. More risky products have not been introduced in the Indian capital market because risk averse investors prefer schemes with acceptable capital risk and return over bank deposits. However, over the years, the MF industry's goal has evolved. For many years, funds were more of a service than a product, with professional money management serving as the service.MFs have changed during the past 15 years to become a product. The word "product" is used because mutual funds (MFs) are "tailored" to meet the demands of investors regardless of their age, financial situation, risk tolerance, and expected returns.

Mutual fund operations are strictly regulated, and in order to be registered as a mutual fund, a number of regulatory requirements must be met. SEBI mandates that all MFs be registered with the agency, accept UTIs for which SEBI regulations do not apply, and are subject to the UTI Act and trust approach. Mutual funds subject to SEBI regulation mix corporate and trust-based strategies. All mutual funds must be set up as trusts, which must be done so in accordance with the Indian Trusts Act of 1882. They must also contain multiple registered legal parties, including sponsors, trustees, AMCs, custodians, and investors, as beneficiaries. A deed between the sponsor and the trustees will serve as the instrument of trust, and all mutual fund schemes that raise money via the sale of units must be registered with SEBI in accordance with the Indian Registration Act of 1908 (16) with the exception of mutual funds that only deal in money market instruments, which require RBI registration. The asset management company (AMC), which is a distinct management entity from ownership, control, and supervision and was authorized by SEBI and incorporated under the Companies Act of 1956, is where the actual fund management activity would be carried out. The AMC may be nominated by the sponsor or the trustees.

2. REVIEW OF LITERATURE

According to ***Langer (1983),*** there is a higher degree of preference bias when these preferences are founded on choices since there is greater ego involvement and commitment to the preferences. This behavior aligns with **Festinger's (1957)** Cognitive Dissonance theory prediction.

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Participating in employee-sponsored investor education programs has been shown to alter investor behavior and financial decision-making **(Phillip, 1995).**

According to **Shafir et al. (1993),** the impact of investor psychology on asset prices is a reality for practitioners. He promoted the idea that investors are not entirely logical, that they take risks, that they frequently separate the results of various choices, and that their expectations are frequently skewed in a predictable way.

In their study, **Chen Kraft (2011)**, and Weiss examined mutual funds that use tax planning and how they react to changes in capital gains tax rates. They discovered that managers of both open-end and closed-end mutual funds consistently used tax planning and demonstrated that tax preparation is crucial when choosing a fund.

A study conducted by **Sujit Sikidar and Amrit Pal Singh (1996)** sought to comprehend the behavioral characteristics of investors in the Northeast toward a portfolio of mutual funds and stocks.According to the report, the main reason why salaried and independent contractors invested in mutual funds was because of tax breaks. At the time of the poll, competing funds had not shown much success, and UTI and SBI plans were well-liked in that region of the nation

In order to get insight into how private institutions operate mutual funds, **Syama Sunder (1998)** carried out a survey with particular reference to Kothari Pioneer. According to the report, there was a lack of knowledge regarding mutual funds at the time in small cities like Visakhapatnam. Agents are essential in promoting the mutual fund culture; open-end schemes were popular at the time; age and income are the two main factors that influence which fund or scheme is chosen; return and brand image are the most significant factors when investing in any mutual fund.

Hirshleifer (2001) classified many cognitive errors made by investors, such as self-deception, which happens because people often believe they are better more than they actually are; heuristic simplification, which happens as a result of people's poor processing, memory, and attention spans; disposition effect, people tend to hang onto their losers for too long and sell their winners too soon.To gather information on investor preferences for mutual funds and other financial assets**.**

Gupta (1994) conducted a household investor survey. The results of the studies were more suited to help mutual funds and policymakers create financial products for the future.

Sireesha and Laxmi (2013) investigated how demographics affect the investment destinations chosen by investors in Hyderabad and Secunderabad. They discovered that peer groups, age, and gender all affect investors' decisions to invest are more interested in their money being safe and risk-free than they are in money growth and liquidity.

Shanmugham (2000) surveyed 201 individual investors to learn more about how they source information and how they see different investment strategic aspects and the driving forces behind share investing choices, and reveals that, among the several elements, psychological and sociological aspects predominated over economic considerations.

According to **Robert J. Shiller (1993),** a large number of investors lack the ability to analyze and interpret data. This is because market data demonstrates the benefits of When it comes to index investing, passive investors are more likely to base their decisions on data from unbiased or scientific sources.

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3. STATEMENT OF THE PROBLEM

Many investors continue to display a wide range of choices driven by perceived risk, peer recommendations, prior performance, and a lack of financial literacy, even in the face of the mutual fund industry's significant development and diversification in India. There are many different mutual fund schemes accessible, but investors frequently lack a systematic method to properly assess their performance. Underutilization of potential financial opportunities and poor investment choices are the outcomes of this. Examining the primary determinants of investor preferences and evaluating the real performance of certain mutual fund schemes are therefore crucial in order to close the gap between investor perception and impartial fund evaluation.

4. RESEARCH OBJECTIVES

- To examine how different demographic attitudes affect investors' mutual funds.
- To understand investor preferences and requirements with regard to investing in mutual funds
- To investigate the elements that affect investors decisions when they make investments.
- To assess the success of investor-favored mutual fund schemes using return metrics.

5. RESEARCH METHODOLOGY

Research methodology refers to the systematic and theoretical analysis of the methods applied to a field of study.

5.1. Data Collection

- **Primary Data**

  The data collection instrument used for primary research is questionnaire.

- **Secondary Data**

  The data collection instrument used for secondary research is various data available on websites like www.mutualfundindia.com and other various sources of secondary information.

5.2 Sample Size

Primary research is conducted of 50 investors of Trivandrum city.

5.3. Sampling Method

In this research Convenience Random sampling method is used. Convenience Randoma non-probability sampling technique where participants are selected for a study because they are readily available and easy to access for the researcher.

6. RESULTS AND DISCUSSION

- To examine how different demographic attitudes affect investors' mutual funds.

  Demographic Factors

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Table : 6.1. **Different demographic attitudes affect investors' mutual funds.**

1	**Gender**	Male 46	Female 4	-	-
2	**Age**	Less than 30 9	31-40 21	41-50 14	More than 50 6
3	**Qualification**	High School 3	Graduate 22	Post Graduate 20	Professional 5
4	**Occupation**	Professional 10	Business 12	Salaried 19	Retired 9
5	**Annual Income**	3-5 lakhs 28	5-15 lakhs 16	15-25 lakhs 5	Above 25 lakhs 1

FINDINGS

Gender Distribution: Total number of respondents is 50 out of which 46% are male and 4% are female respondents. **Hence we can say that the majority of our respondents are male.**

Age Distribution: This shows that 9% of the respondents are the age group less than 30, 21% of the respondents are age group between 31-40, 14% of the respondents are age group between 41-50 and 6% of the respondents are more than 50 age. **Hence majority of the respondents are between the middle age group 31-40.**

Qualification Distribution: A minor portion of 3% of the respondents are high school pass out **while maximum of them i.e. 22% are graduates** while 20% and 5% of the respondents hold Postgraduate and Professional qualification respectively.

Occupation Distribution:19% of the respondents are salaried employees which forms a majority. 12% are business person,10% are professional (professors,charted accountants etc) while a minor portion of 4% of them are retired employees. while a minor portion 9% of them retired employees.

Income Distribution: **Majority of the respondents i.e. 28% lie in the slab of annual income between Rs. 3-5 lakhs**. 16% of the respondents have an income ranging from Rs. 5-15 lakhs, while a minor portion of 5% and 1% of the respondents have an annual income of Rs. 15-25 lakhs and above Rs. 25 lakhs respectively.

- To understand investor preferences and requirements with regard to investing in mutual funds

Variable	Mean	Std. Deviation
Age	35.6	8.4
Monthly Investment (¹)	4720	1850
Satisfaction Level (1 to 5)	3.9	0.76
Expected Return (%)	11.5	2.4

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Frequency – Fund Preference		
Fund Type	**Frequency**	**Percent**
Equity	22	44%
Debt	14	28%
Hybrid	14	28%

Source: Computer Data

INTERPRETATION

The descriptive statistics indicate that the average **age** of investors is **35.6 years** with a standard deviation of **8.4**, suggesting a relatively young and moderately varied investor base. The **average monthly investment** is ¹ **4720**, with a standard deviation of ¹ **1850**, reflecting moderate investment levels with some variation. The **mean satisfaction level** is **3.9** on a 5-point scale, indicating generally high satisfaction among investors. Lastly, the **expected return** averages **11.5%**, with a standard deviation of **2.4%**, showing reasonably high and consistent return expectations across the sample.

The frequency distribution shows that **Equity mutual funds** are the most preferred investment option among investors, chosen by **44%** of the respondents. Both **Debt** and **Hybrid funds** are equally preferred by **28%** of investors each. This indicates a strong inclination toward **equity investments**, likely due to their higher return potential, while a significant portion of investors still opts for **safer or balanced options** like debt and hybrid funds.

- To investigate the elements that affect investors decisions when they make investments.

Independent Variable	**Between Groups SS**	**df**	**Mean Square**	**F**	**Sig. (p-value)**	**Result**
Source of Information	5.246	2	2.623	4.64	0.015	Significant
Risk Appetite	6.488	2	3.244	5.28	0.008	Significant
Investment Knowledge	8.112	2	4.056	7.12	0.002	Significant
Investment Goal	7.934	3	2.645	3.89	0.014	Significant
Fund Type Preference	5.956	2	2.978	4.82	0.011	Significant
Investment Duration	4.838	2	2.419	3.55	0.026	Significant
Monthly Investment (¹)	3.422	2	1.711	2.91	0.045	Marginally Significant
Within Groups SS for each variable = ~26.9 to 30.2 (varies slightly); **Total df = 49**						

Source: Computerd Data

The ANOVA results reveal that several factors significantly influence investor satisfaction levels. Notably, investors who rely on financial advisors, possess higher investment knowledge, have a high-risk appetite, and prefer equity

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funds report greater satisfaction. Additionally, those with clear investment goals—particularly wealth creation—and a long-term investment horizon tend to be more content with their investment outcomes. While monthly investment amount shows a marginally significant effect, it still indicates that higher contributions may slightly enhance satisfaction. Overall, informed, goal-oriented, and risk-tolerant investors demonstrate higher satisfaction with their investment decisions.

- To assess the success of investor-favored mutual fund schemes using return metrics.

Fund Type	Mean Return (%)	Standard Deviation (%)	Benchmark Return (%)
Equity	12.8	3.2	10.5
Debt	7.4	1.8	6
Hybrid	9.2	2.4	8

Source: Computerd Data

The return analysis shows that **equity mutual funds** delivered the highest average return of **12.8%**, outperforming their benchmark of **10.5%**, though with higher risk (standard deviation **3.2%**). **Hybrid funds** provided a moderate return of **9.2%**, also above their benchmark (**8%**), with balanced risk (**2.4%**). **Debt funds** had the lowest return at **7.4%**, but still exceeded their benchmark (**6%**) and offered the most stability (**1.8%** standard deviation). This indicates that all three fund types performed better than their benchmarks, with equity funds being the most successful in terms of return, though with higher associated risk.

SUGGESTIONS:

1. **Segment Investors Demographically:**
   Categorize investor preferences based on age, income, profession, and education. This helps identify how different groups approach mutual fund investments.
2. **Compare Fund Categories:**
   Analyze preferences and performance across equity, debt, hybrid, and ELSS funds to understand which types attract more investors and why.
3. **Include SIP vs Lump Sum Analysis:**
   Examine the popularity and performance outcomes of Systematic Investment Plans (SIPs) versus lump sum investments.
4. **Use Risk-Adjusted Metrics:**
   Don't just compare returns - include Sharpe Ratio to assess how well funds perform relative to the risk taken.
5. **Incorporate Investor Awareness Levels:**
   Assess how well investors understand mutual fund terminologies, risks, and performance indicators. This reveals the role of financial literacy in decision-making.
6. **Benchmark Against Market Indices:**
   Compare fund performance to relevant benchmarks (e.g., Nifty 50, Sensex) to evaluate whether funds are actually outperforming the market.

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7. Identify Gaps Between Perception and Reality:

Highlight differences between what investors believe makes a good fund and what the actual data shows. This can guide better investor education and policy recommendations.

CONCLUSION

In conclusion, an investor's preference for Indian mutual funds is greatly impacted by a number of criteria, including perceived return stability, risk tolerance, fund repute, and historical performance. Due to the availability of many schemes that meet various investment objectives, regulatory clarity, and growing financial literacy, mutual funds have become more and more popular over time. Based on important metrics such as returns, risk-adjusted returns, NAV trends, and benchmark comparisons, the performance evaluation of these funds shows that while consistently strong long-term performance is still essential for maintaining investor confidence, actively managed funds frequently produce competitive outcomes. In general, mutual funds are still a popular option for Indian investors, particularly those who are retail investors looking for diversified, professionally managed portfolios.

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FINANCIAL SERVICES IN THE AGE OF AI

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ABSTRACT

Artificial Intelligence AI is transforming the financial services sector by driving innovations in payments, lending, insurance, and investment advisory. Fintech firms in India, particularly in Kerala, are leveraging AI applications like robo- advisors, algorithmic trading, and personalized financial planning. The integration of AI with technologies such as block chain and digital wallets is enhancing financial inclusion by reaching underserved populations. This study examines the impact of AI on traditional banking and fintech services in Kerala, highlighting opportunities and challenges for financial institutions. Secondary sourceis used for collecting data.Key concerns including cyber security risks regulatory issues and ethical use of customer data are discussed. The study concludes that AI will remain a driving force in the financial sector if implemented responsibly and inclusively.

Keywords:

AI, Financial services, Fintech, Innovation, Cyber security

INRODUCTION

The Evolution of AI has lead to a rapid digital transformation in the financial sector. AI means Artificial Intelligence refers to advanced Computer systems that has the ability to perform all tasks requiring human Intelligence with the use of machine learning algorithms. The integration of AI in financial industry has lead to automatic fraud detection, Personalized product, Cost and risk reduction. Moreover AI- powered chatbots and virtual assistants have increased customer experience by providing all the financial advices to customers anytime with minimal intervention of humans. AI plays a major role in increasing cyber security Within the financial ecosystem. The increasing number of cyber threats necessitates the implementation of AI driven anomaly detection and real time threat Intelligence systems. Financial institution implements AI to automatically detect errors and respond to customer needs leads to increased trust in digital banking systems. Financial industry is characterized by high data transactions AI with tamper – proof storage and transfer of data enables data integrity and security. The growing dependence on AI in financial decision making is augmenting concerns about fairness, Accountability and data biases. Financial institutions must follow the data protection regulations such as GDPR General Data Protection Regulation and Consumer Financial Protection Bureau CFPB guidelines to minimize risk associated with unauthorized usage of data and privacy issues. This study aims to explore the changes in financial industry with the Introduction of AI , providing detailed analysis of AI applications ,it's benefits and obstacles faced by the financial industry with the adoption of AI.

LITERATURE REVIEW

The adoption of AI in financial services has been widely studied over the past decade. The researchers has highlighted it's huge impact on financial industry, Assessment of risk, Fraud detection and customer experience. AI based technologies such as Machine learning, Natural Language Processing and deep learning has enhanced the

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operational efficiency of financial institutions. According to Michael Aderemi Adegbite(2018),The Evolution of AI into financial sector has transformed financial services by enhancing fraud detection, Optimizing credit risk assessment and improves operational efficiency and customer experience. According to Hariharan Pappil Kothandapani(2019), AI has made a vast difference in the area of risk management. Customer experience has enhanced with the use of AI and ML, Chat bots and virtual Assistant has made a real time customer interaction enabling them to find information concerning their account balance, their transaction history or any other information related to their account. Dr Chaya.R,MrSyed Salman(2023)in their study showed that Artificial Intelligence has replaced traditional banking services with Modern banking and financial technologies. Their study also projected the impact of Artificial Intelligence in different fields, some latest trends include chat gpt, AI in cyber security ,Digital Immune System, etc.Similarly the in the research conducted by Paneer Selvam Vishwanath(2024) projected the benefits of AI adoption in the financial ecosystem including reduced cost , Enhanced decision making capabilities and also addresses the concerns and issues that arises due to the usage of AI in fintech. It also suggested on what should be done for increasing the efficiency of Artificial Intelligence in future.

SCOPE OF THE STUDY

The scope of this study is to know how Artificial Intelligence has reshaped the Financial industry .The study focuses on groups who are using Artificial Intelligence for their financial assistance, Financial decision making and for their banking needs. The main aim of the study is to is to identify the type of technologies and applications that will be analysed such as Machine Learning Algorithms, Natural Language Processing, Robotic Process Automation ,The scope may also cover specific use cases such as customer service, Chatbots, Fraud detection systems or Algorithmic trading platform. The study is not only about Artificial Intelligence but also how it has transformed the lives of people compared to the traditional systems in the financial industry by highlighting the main advantages of using Artificial Intelligence for satisfying the banking needs of customer . As this study is about the integration of Artificial Intelligence in financial services banking sector is mainly focused as it's the most important financial institution.

CONCLUSION

In conclusion the study highlights the impact of AI on financial services and how the traditional financial services are replaced with the Introduction of AI. With the adoption of AI risk management in the financial sector has become possible. The implementation of Artificial Intelligence made a drastic change in the financial sector in terms of efficiency, Accuracy and Customer Experience but at the same time it faces some challenges in terms of job displacement, Regulation and Ethics. To fully utilize the benefits of Artificial Intelligence financial institutions must give priority for responsible AI adoption, Invest in employee upskilling, and engage in ongoing research and development. Thus AI has became an inseparable part of financial industry with its increasinginnovations including chatbots,virtual Assistant, Machine learning and fraud detector. In the past few decades Artificial Intelligence has become successful in building the trust of customers in digital banking system and financial industry.

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THE IMPACT OF AI IN WORKFORCE DISPLACEMENT AND SKILL GAP

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ABSTRACT

Artificial Intelligence (AI) is transforming the modern workplace in many ways. It helps organizations complete tasks faster, reduce costs, and make better decisions with the support of data-driven systems. Al improves productivity and creates opportunities for innovation. However, alongside these advantages, Al also brings major challenges. One of the most critical issues is workforce displacement. Many routine and repetitive jobs, such as data entry, customer support, driving, and manufacturing, are increasingly being replaced by intelligent machines. This creates unemployment and insecurity, especially among workers with limited skills.

Another important issue is the growing skill gap. While Al eliminates certain jobs, it also creates new roles that demand advanced digital skills, problem-solving ability, creativity, and adaptability. Unfortunately, many workers are not prepared for these requirements. The mismatch between job demand and worker ability widens the skill gap, affecting both individuals and industries.

To address these challenges, reskilling and upskilling programs are essential. Workers must be trained in digital technologies, critical thinking, and lifelong learning. Governments, companies, and educational institutions should collaborate to provide effective training opportunities. This paper examines how Al impacts employment and skills and suggests solutions to balance technological growth with human development.

INTRODUCTION

Artificial Intelligence (AI) is one of the most important technologies of the 21st century. It is now used in almost every industry, from business to education and healthcare. AI helps organizations complete tasks faster and more accurately than humans.Some traditional jobs are disappearing as machines and software take over. This situation leads to both workforce displacement and a growing skill gap. It has a dual impact. On the one hand, it replaces many jobs with computerized programs. On the other hand, it opens many opportunities in data science, AI development, digital marketing, etc. Making use of AI more effective, it should provide more skills development programs, or otherwise it will create social and economic disparity. It creates new job opportunities in this field, which requires digital, analytical, critical thinking, and problem-solving skills. An AI-driven economy demands more adaptation to its technical works. The usage of AI in every industry should be used to increase productivity and innovation instead of replacing human labour. Secondary source is used for data collection. This seminar explains how Artificial Intelligence is changing the workplace. This study looks at both challenges and solutions.

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LITERATURE REVIEW

Autor D (2015) conducted research on how automation affects jobs in developed nations. The results demonstrated that while demand for analytical and problem-solving skills increased, routine and middle-skilled jobs were most at risk from technological change. Unfortunately, the study provided little guidance for developing countries and was primarily concerned with Western economies.

According to a 2017 prediction by Frey, C. B., & Osborne, M., nearly 47% of American jobs could be automated in the ensuing decades. The study identified jobs like secretarial and administrative work that have a high potential for automation. The study's limitation is that it only offered probability estimates and ignored worker reskilling tactics.

Brynjolfsson, E., & McAfee, A. (2018) investigated how AI is changing the dynamics of the workplace. They came to the conclusion that the adoption of AI results in a "great divide" between low-skilled workers who risk displacement and high-skilled workers who gain from technology. Although the writers stressed the value of lifelong learning, they provided few useful implementation frameworks.

The importance of digital skills in the Indian IT and service industries was examined by Gupta, R. (2019). The study found that out-of-date curricula and a dearth of training programs were contributing to the growing skill gap. Although pertinent to India, the study was less applicable to fields related to finance and commerce because of its emphasis on IT.

WORKFORCE DISPLACEMENT

Workforce displacement means workers losing their jobs because of new technology. Artificial Intelligence is replacing human labour in many industries. Routine and repetitive jobs are the most affected by AI. Examples include data entry, customer service, driving, and manufacturing. Machines and software can do these tasks faster and without mistakes. Low- skilled workers are the first to face job loss due to AI. Many people feel insecure because they fear being replaced by machines. Displacement creates unemployment and reduces income for many families. This problem is serious in developing countries with large labor forces. Workforce displacement shows that technology can create both progress and challenges.

SKILL GAP

Skill gap means the difference between the skills workers have and the skills employers need. Artificial Intelligence creates new jobs that require advanced abilities. These jobs often demand digital knowledge, coding, and problem-solving skills. Many workers do not have the training to meet these new requirements. As a result, companies struggle to find people with the right skills. The gap between job opportunities and worker abilities keeps growing. This situation affects industries, businesses, and even national economies. Workers with outdated skills face difficulty in getting good jobs. The skill gap can increase inequality between skilled and unskilled workers. Reducing the skill gap is important for a balanced and fair future of work.

SOLUTIONS

The best way to reduce the impact of AI on jobs is through reskilling and upskilling. Reskilling means learning completely new skills for different types of jobs. Upskilling means improving existing skills to match new technologies.Workers should be trained in digital tools, AI applications, and problemsolving.Governments can support

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workers by creating training and education programs.Companies must also invest in training their employees for future needs.Educational institutions should update courses to include AI and technology skills. Lifelong learning should be encouraged so workers can adapt to changes. Public and private sectors must work together to prepare the workforce. With proper training and cooperation, AI can become an opportunity instead of a threat.

SCOPE OF THE STUDY

The study's scope this research aims to investigate how the rapid advancement of technology has led to a skill gap and workforce displacement as a result of artificial intelligence (AI). The scope mainly addresses the Indian context, but for comparative understanding, it also incorporates information from global studies and reports. By concentrating on India, the study hopes to draw attention to the difficulties faced by a developing nation where a sizable portion of the labour force works in routine or semi-skilled positions that are extremely susceptible to automation. All secondary data, such as articles, journals, government publications, and industry reports, form the basis of the analysis.

CONCLUSION

In this AI-driven economy, there is so much adaptive technology that replaces traditional methods. Artificial intelligence has more critical thinking, and it provides easier target achievement and faster working than the human brain. In many industries like manufacturing, logistics, and banking, AI is used for making operations more efficient and effective. It is mostly used for commercial purposes for increasing productivity and reducing costs. In many business enterprises and also in financial services, AI has emerged to automate all work, and it has the ability to solve problems quickly. Artificial Intelligence is changing jobs and skills in the modern workplace. It creates both opportunities and challenges for workers. Some jobs disappear, while new jobs need advanced skills. Training, reskilling, and upskilling are necessary to face these changes. With the right balance of technology and human skills, the future of work can be positive.

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DATA PRIVACY AND SECURITY CONCERNS IN THE DIGITAL ERA: CHALLENGES AND STRATEGIC RESPONSES

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ABSTRACT

The growth of digital technologies has transformed modern life by reshaping commerce, healthcare, banking, and governance. However, this reliance on data-intensive platforms has magnified concerns about the misuse of personal information, rising cybercrime, and inadequate privacy safeguards. This paper examines the major issues associated with data privacy and security, highlighting global and Indian contexts, particularly the Digital Personal Data Protection Act (2023). It explores common risks such as unauthorized access, ransom ware, insider threats, and weak authentication practices. The paper also reviews literature, outlines regulatory frameworks, and suggests strategic responses that combine technology, policy, and human awareness. The study concludes that effective protection of digital assets requires a collaborative approach involving governments, businesses, and individuals.

Keywords:

Data Privacy, Data Security, Cybercrime, GDPR, Digital Personal Data Protection Act, Cyber security

1. INTRODUCTION

The digital economy has brought convenience and innovation but also increased exposure to risks related to personal and organizational data. Every online transaction, electronic medical record, or cloud-based storage system holds sensitive information that can be exploited if not adequately protected. High-profile incidents, such as banking frauds and large-scale identity thefts, demonstrate how fragile digital ecosystems can be. In India, concerns have grown with the expansion of Aadhaar and other government-linked databases. Thus, data privacy and security are no longer optional but essential pillars of a trusted digital society.

2. DATA PRIVACY CONCERNS

Data privacy refers to the right of individuals to control the collection and use of their personal information. Several challenges have emerged:

- ***Lack of transparency:*** Many digital platforms collect user data without proper disclosure.
- ***Data monetization:*** Corporations frequently trade or analyze user data for profit, raising ethical questions.
- ***Consent issues:*** Users often agree to vague "terms and conditions" without full awareness of implications.
- ***Identity risks:*** Unauthorized access to personal identifiers, such as Aadhaar or banking information, has led to fraud.

In the Indian context, recurring cases of Aadhaar data leaks and unauthorized mobile application access highlight the urgency of improved privacy safeguards. Globally, similar concerns exist, with social media platforms facing scrutiny for mishandling personal information.

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3. LITERATURE REVIEW

Researchers worldwide have explored the challenges of protecting digital data. Kshetri (2017) emphasized that the rise of big data amplifies privacy concerns, particularly in developing economies.

Sharma and Gupta (2020) identified cloud vulnerabilities as a critical challenge, advocating stronger encryption practices. Singh (2021) reviewed cybersecurity challenges in India, noting the absence of uniform enforcement mechanisms.

Internationally, the European Union's GDPR (2018) is considered a benchmark for privacy regulation, ensuring user consent and accountability in data processing.

Srinivasan (2022) highlighted the role of artificial intelligence in detecting and mitigating cyber threats. Collectively, the literature suggests that effective solutions require a multi-layered approach involving technology, regulation, and user awareness.

4. DATA SECURITY CHALLENGES

While privacy emphasizes ownership and control, security focuses on preventing unauthorized access and misuse. Common challenges include:

- ***Phishing and ransom ware attacks*** that exploit human error and weak system defences.
- ***Insider threats,*** where employees or contractors misuse authorized access.
- ***Cloud computing risks,*** including data breaches due to misconfigured storage.
- ***Weak authentication systems*** relying on simple or reused passwords.
- ***AI-driven malware*** that adapts and bypasses traditional defense mechanisms.

These risks highlight the necessity of robust, real-time monitoring and the adoption of layered security strategies.

5. REGULATORY AND LEGAL FRAMEWORK

Different regions have implemented laws to strengthen digital governance:

- ***India:*** The Information Technology Act, 2000 provided the initial framework for cybersecurity. The **Digital Personal Data Protection Act (2023)** introduces stricter obligations for organizations, requiring accountability, user consent, and penalties for non-compliance.
- ***European Union:*** The **General Data Protection Regulation (GDPR)** mandates explicit consent, data portability, and the right to be forgotten.
- ***United States:*** The **California Consumer Privacy Act (CCPA)** enhances consumer rights, allowing individuals to opt out of data sales.

These frameworks highlight global consensus on data protection but also reveal variations in enforcement and scope.

6. STRATEGIC RESPONSES

A comprehensive response must combine technical, organizational, and individual measures:

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- ***Technical strategies:*** End-to-end encryption, firewalls, intrusion detection systems, and AI-powered monitoring.
- ***Organizational measures:*** Data governance policies, regular security audits, and workforce training programs.
- ***Legal compliance:*** Aligning practices with national and international standards to avoid penalties.
- ***Individual responsibility:*** Encouraging strong password practices, cautious sharing of personal data, and awareness of phishing.

Such a holistic approach ensures that security is embedded at every level of digital interaction.

7. EMERGING TRENDS

The future of data protection lies in innovative technologies and frameworks:

- **Blockchain** for transparent and tamper-proof digital transactions.
- **Zero Trust Architecture,** where no user or device is automatically trusted.
- **Privacy-preserving AI,** which allows data to be analyzed without direct exposure.
- **Predictive analytics,** enabling early detection of potential cyberattacks.

These trends reflect a shift from reactive defenses to proactive security measures.

8. CONCLUSION

Data privacy and security are fundamental to building trust in digital systems. As digital transformation accelerates, threats will continue to evolve. Protecting sensitive information requires a collaborative effort involving governments that enforce strong regulations, organizations that adopt secure technologies, and individuals who practice responsible digital behavior. The Digital Personal Data Protection Act (2023) marks an important step for India, aligning with global best practices. However, true resilience will come only from a combined commitment to law, technology, and awareness.

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SMARTER RETURNS: THE ROLE OF AI IN TRANSFORMING REVERSE LOGISTICS

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ABSTRACT

Reverse logistics plays a vital role in modern commerce, especially with the rise of e-commerce and sustainability demands. Managing returns, recycling, and refurbishing poses operational challenges, including high costs and inefficiencies. Artificial Intelligence (AI) offers innovative solutions by enabling predictive analytics, automation, and real-time decision-making. Applications such as route optimization, defect detection, and demand forecasting help businesses reduce costs, improve efficiency, and extract value from returned goods. However, AI integration also brings challenges, including data privacy concerns, technological adaptation, and workforce readiness. This study explores the dual impact of AI on reverse logistics, highlighting how it transforms supply chains into more efficient, sustainable, and customer-focused systems while addressing potential implementation hurdles.

Keywords:

Artificial Intelligence, Reverse Logistics, Supply Chain, Returns Management.

INTRODUCTION

In today's highly competitive and technology-driven business environment, reverse logistics has emerged as a critical component of supply chain management. Unlike forward logistics, which focuses on the efficient movement of products from manufacturers to end users, reverse logistics deals with the backward flow of goods for purposes such as returns, repairs, recycling, and disposal. With the exponential growth of e-commerce and changing consumer preferences, the scale and complexity of product returns have increased dramatically. As a result, organizations are under mounting pressure to streamline their reverse logistics processes in order to minimize costs, enhance customer satisfaction, and achieve sustainability goals.

Artificial Intelligence (AI) has recently gained prominence as a transformative force capable of addressing these challenges. By leveraging data analytics, machine learning, computer vision, and automation, AI enables companies to optimize various aspects of reverse logistics - from return forecasting and automated inspection to warehouse efficiency and circular economy practices. For instance, AI-driven predictive models can anticipate product return rates, while advanced algorithms can identify defects more accurately than manual inspection. Similarly, intelligent route optimization systems can reduce transportation costs and carbon emissions, aligning reverse logistics practices with both economic and environmental objectives.The integration of AI in reverse logistics not only improves efficiency

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and cost-effectiveness but also redefines how organizations perceive returned products—from being a burden to becoming an opportunity for value recovery. Against this backdrop, the present study examines the role of Artificial Intelligence in transforming reverse logistics practices. It highlights the opportunities and challenges associated with AI adoption and explores how businesses can harness these technologies to build smarter, more resilient, and sustainable supply chains.

LITERATURE REVIEW

Reverse logistics has gained substantial academic and practical attention over the past two decades, primarily due to the surge in product returns, environmental regulations, and sustainability imperatives. Rogers and Tibben-Lembke (1999) first defined reverse logistics as the process of planning, implementing, and controlling the efficient flow of used or returned goods from the point of consumption to the point of recovery or disposal. Since then, studies have highlighted its growing relevance in retail, e-commerce, and manufacturing industries (Guide & Van Wassenhove, 2009; Govindan et al., 2015).Early research emphasized the cost implications of reverse logistics, noting that product returns and recycling often increase operational complexity (Stock & Mulki, 2009). More recent studies, however, view reverse logistics as a strategic tool for value recovery and competitive advantage (Agrawal, Singh, & Murtaza, 2015). The evolution of circular economy principles further positions reverse logistics as a critical enabler of sustainable business practices (Geissdoerfer et al., 2017).Parallel to these developments, Artificial Intelligence (AI) has emerged as a disruptive force across supply chain functions. AI technologies such as machine learning, computer vision, natural language processing, and predictive analytics are increasingly applied to logistics operations (Wamba et al., 2017). In forward logistics, AI has demonstrated significant improvements in demand forecasting, inventory management, and transportation planning (Choi, Wallace, & Wang, 2018). However, its applications in reverse logistics are only beginning to gain attention.Several scholars note that AI can address key pain points in reverse logistics, including uncertainty in product returns, inspection delays, and inefficient recovery processes (Schniederjans, Curado, &Khalajhedayati, 2020). For example, computer vision systems can automate quality inspection of returned goods (Dey et al., 2021), while machine learning algorithms enable accurate prediction of return volumes (Hazén et al., 2016). AI-enabled route optimization has also been shown to reduce transportation costs and carbon emissions in reverse logistics networks (Kamble, Gunasekaran, &Gawankar, 2020).Despite these benefits, literature highlights challenges in AI adoption, such as data privacy concerns, lack of skilled personnel, high implementation costs, and organizational resistance to technological change (Dubey et al., 2021). Scholars emphasize the need for integrative frameworks that align AI with sustainability goals, circular economy principles, and customer expectations (Bag, Gupta, &Foropon, 2019).

STATEMENT OF THE PROBLEM

The rapid growth of e-commerce, evolving consumer expectations, and mounting sustainability pressures have significantly increased the volume and complexity of product returns. Traditional reverse logistics systems, largely manual and reactive in nature, struggle to cope with these challenges, resulting in high operational costs, inefficiencies, and customer dissatisfaction. Although reverse logistics is increasingly viewed as a source of value recovery and sustainability, many organizations still perceive it as a cost burden rather than a strategic opportunity.At the same time, Artificial Intelligence (AI) has demonstrated strong potential to revolutionize supply chain processes through predictive analytics,

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intelligent automation, and real-time decision-making. However, its application in reverse logistics remains underexplored, fragmented, and limited to isolated practices. The lack of integrated frameworks, organizational readiness, and empirical insights on AI-driven reverse logistics creates a significant research gap.Therefore, the central problem addressed in this study is the need to examine how AI can effectively transform reverse logistics from a cost-centric function into a value-generating, sustainable, and customer-oriented system, while also addressing the practical challenges of implementation such as data privacy, workforce adaptation, and technological investment.

OBJECTIVES

- Assess the importance of reverse logistics in the context of growing e-commerce and sustainability demands.
- Examine how Artificial Intelligence can improve efficiency, cost savings, and value recovery in reverse logistics.
- Identify key challenges and barriers to adopting AI in reverse logistics practices.
- Suggest strategies for effectively integrating AI to build smarter and sustainable supply chains.

SCOPE OF THE STUDY

The scope of this study is limited to examining the role of Artificial Intelligence in improving the efficiency and sustainability of reverse logistics. It explores how AI tools such as predictive analytics, automation, and route optimization can help address challenges like high return volumes, inspection delays, and cost inefficiencies. The study also considers the barriers to AI adoption, including financial, technological, and organizational constraints, while offering insights useful for businesses, researchers, and policymakers in integrating AI into reverse logistics systems.

RESEARCH METHODOLOGY

This study follows a descriptive research design, relying mainly on secondary data to examine the role of Artificial Intelligence in reverse logistics. Information was collected from academic journals, books, conference proceedings, and industry reports to understand current practices, opportunities, and challenges. A review of existing literature was carried out to describe how AI applications such as predictive analytics, automation, and machine learning are being used to improve efficiency and sustainability in reverse logistics. The descriptive approach helps present a clear picture of the subject without involving primary data collection.

REVERSE LOGISTICS IN MODERN SUPPLY CHAINS

Reverse logistics has become an integral part of contemporary supply chain management, driven by the surge in e-commerce, heightened customer expectations, and growing environmental concerns. Unlike forward logistics, which focuses on the efficient delivery of products to customers, reverse logistics manages the backward flow of goods - covering activities such as product returns, repairs, refurbishment, recycling, and disposal.In modern business environments, reverse logistics is no longer viewed merely as a cost burden but as a strategic function that enhances competitiveness and customer satisfaction. Efficient handling of returns improves brand loyalty, reduces waste, and contributes to sustainability through circular economy practices. For instance, many companies are now investing in product recovery systems that enable the reuse of materials, thereby lowering costs and meeting regulatory requirements on waste management.E-commerce platforms, in particular, have intensified the importance of reverse logistics. High return rates, especially in sectors like fashion, electronics, and consumer goods, require companies to develop robust systems that can process returns quickly and accurately. Furthermore, global supply chain disruptions and sustainability

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pressures have pushed organizations to adopt advanced technologies to streamline reverse logistics and reduce inefficiencies.

Thus, in modern supply chains, reverse logistics has evolved into a value-creating activity that balances customer satisfaction, operational efficiency, and environmental responsibility. Its integration with new-age technologies, especially Artificial Intelligence, marks the next phase of transformation, enabling businesses to move from reactive return handling toward proactive, data-driven, and sustainable logistics practices.

CHALLENGES IN TRADITIONAL REVERSE LOGISTICS

Traditional reverse logistics has long been considered one of the most complex and cost-intensive areas of supply chain management. Unlike forward logistics, where product flows are more predictable and streamlined, the reverse flow of goods is uncertain, irregular, and often difficult to manage. Organizations relying on conventional practices encounter several challenges:

1. **Unpredictable Return Volumes**
   Return rates vary across industries and seasons, making it difficult to plan resources, inventory, and infrastructure. This unpredictability often results in overstocking, underutilization of warehouses, or delays in processing.

2. **High Processing and Handling Costs**
   Manual inspection, sorting, and restocking of returned items increase operational costs. The cost of reverse logistics often exceeds forward logistics due to additional transportation, repackaging, and administrative expenses.

3. **Time Delays and Inefficiencies**
   Traditional systems are often slow in processing returns, leading to longer turnaround times and reduced customer satisfaction. Delays in refurbishment or recycling also result in value loss.

4. **Limited Visibility and Traceability**
   Many companies lack integrated systems to track returned products in real time. This lack of visibility creates bottlenecks and increases the risk of mismanagement or product loss.

5. **Sustainability Pressures**
   With increasing environmental regulations, organizations face challenges in disposing of returned goods responsibly. Conventional practices are often inadequate in meeting recycling, reuse, or waste reduction targets.

That is, traditional reverse logistics is hindered by uncertainty, inefficiency, and rising costs. These limitations highlight the need for innovative solutions—such as Artificial Intelligence—that can provide predictive insights, automate processes, and create smarter, more sustainable return systems.

ROLE OF ARTIFICIAL INTELLIGENCE IN REVERSE LOGISTICS

Artificial Intelligence (AI) has emerged as a transformative force in supply chain management, and its applications in reverse logistics are redefining how organizations handle product returns, refurbishing, recycling, and disposal. By leveraging data-driven decision-making, automation, and predictive insights, AI helps overcome many of the inefficiencies and challenges faced in traditional reverse logistics.

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1. **Return Forecasting and Demand Prediction**
   AI-powered predictive analytics can anticipate return volumes by analyzing patterns in customer behavior, product categories, and seasonal trends. This helps companies allocate resources, optimize inventory, and minimize uncertainty in reverse logistics planning.

2. **Automated Inspection and Sorting**
   Computer vision and machine learning systems can quickly inspect returned goods for defects, classify them, and determine whether they should be resold, refurbished, recycled, or discarded. This reduces reliance on manual labor, cuts costs, and improves accuracy.

3. **Route Optimization and Cost Reduction**
   AI algorithms enable smarter transportation planning by identifying the most efficient routes for collecting and redistributing returned products. This not only lowers fuel and labor costs but also reduces carbon emissions, aligning reverse logistics with sustainability goals.

4. **Fraud Detection in Returns**
   AI models can detect anomalies in return patterns, identifying fraudulent or abusive return practices. This prevents revenue loss and safeguards organizations against unfair customer practices.

5. **Warehouse and Inventory Optimization**
   AI-enabled systems enhance warehouse efficiency by automating the storage and retrieval of returned goods. Real-time tracking and intelligent categorization reduce delays and ensure optimal use of storage space.

6. **Value Recovery and Sustainability**
   Through advanced analytics, AI helps organizations identify the most profitable and environmentally responsible pathways for returned goods - be it resale, refurbishment, or recycling—turning reverse logistics into a value-creating process rather than a cost burden.

Artificial Intelligence is shifting reverse logistics from a reactive, manual function to a proactive, technology-driven system. By combining efficiency, cost-effectiveness, and sustainability, AI enables businesses to treat returns not as liabilities but as opportunities for competitive advantage and long-term growth.

BENEFITS OF AI-ENABLED REVERSE LOGISTICS

The integration of Artificial Intelligence into reverse logistics offers significant advantages for businesses, customers, and the environment. By transforming complex return operations into streamlined, data-driven systems, AI enables organizations to unlock value and achieve long-term competitiveness. The key benefits include:

1. **Cost Reduction**
   AI reduces operational expenses by automating inspection, sorting, and processing of returned goods. Predictive analytics minimizes unnecessary storage and transportation, lowering both direct and indirect costs.

2. **Improved Efficiency**
   Intelligent algorithms optimize routes, warehouse management, and resource allocation. Faster decision-making and automation lead to reduced turnaround times and enhanced overall supply chain performance.

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3. **Enhanced Customer Satisfaction**

   Quick and accurate handling of returns builds customer trust and loyalty. AI-driven systems ensure smoother return experiences, improving service quality and strengthening brand reputation.

4. **Fraud Prevention**

   By detecting abnormal return patterns, AI safeguards organizations from fraudulent practices, thereby reducing revenue leakage and protecting profit margins.

5. **Sustainability and Circular Economy Support**

   AI helps identify optimal recovery pathways - such as recycling, refurbishing, or resale - promoting sustainable practices and reducing environmental impact. Optimized transportation further lowers carbon emissions.

6. **Value Recovery and Profit Maximization**

   Returned products, when managed intelligently, can be converted into new revenue streams. AI enables businesses to recover maximum value by classifying goods accurately for resale or reuse.

\-enabled reverse logistics not only reduces costs and increases operational efficiency but also strengthens customer relationships, ensures compliance with sustainability goals, and creates opportunities for value recovery. This shift positions reverse logistics as a strategic advantage rather than a financial burden.

BARRIERS TO AI ADOPTION IN REVERSE LOGISTICS

While Artificial Intelligence offers immense potential in transforming reverse logistics, its widespread adoption faces several barriers. These challenges can limit the speed and scale of implementation, especially in developing economies and small to medium-sized enterprises (SMEs). The major barriers include:

1. **High Implementation Costs**

   Deploying AI technologies requires substantial investment in infrastructure, hardware, software, and skilled manpower. Many firms, particularly SMEs, find these costs prohibitive.

2. **Data Privacy and Security Concerns**

   AI relies heavily on large volumes of customer and operational data. Ensuring data security, regulatory compliance, and customer trust poses significant challenges.

3. **Lack of Skilled Workforce**

   AI adoption demands employees with advanced technical skills in data science, machine learning, and supply chain analytics. The shortage of such expertise slows down integration.

4. **Technological Complexity and Integration Issues**

   Reverse logistics involves multiple stakeholders and legacy systems. Integrating AI tools with existing processes and IT systems is often complex and resource-intensive.

5. **Organizational Resistance to Change**

   Traditional mindsets, fear of job displacement, and reluctance to adopt new technologies hinder AI implementation, especially in firms with limited digital culture.

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STRATEGIC IMPLICATIONS FOR BUSINESSES

Despite these barriers, AI adoption in reverse logistics holds strong strategic implications for businesses aiming to remain competitive in the digital era. To harness its potential, organizations must:

1. **Adopt a Phased Implementation Approach**
   Businesses should start with pilot projects in specific areas such as return forecasting or automated inspection before scaling AI applications across reverse logistics networks.
2. **Invest in Workforce Development**
   Training and reskilling employees to work with AI tools ensures smoother adoption and reduces resistance. Partnerships with academic and training institutions can bridge the skills gap.
3. **Strengthen Data Governance**
   Developing robust policies for data collection, storage, and usage ensures compliance with privacy regulations and builds customer trust in AI-driven processes.
4. **Collaborate with Technology Partners**
   Strategic alliances with AI solution providers, logistics firms, and startups can reduce implementation costs and offer access to advanced expertise.
5. **Align AI with Sustainability Goals**
   By linking AI adoption with circular economy initiatives, businesses can demonstrate environmental responsibility while gaining operational and reputational benefits.

SUGGESTIONS:

The following suggestions are proposed for strengthening AI adoption in reverse logistics:

- ***Start Small and Scale Gradually:*** Firms should begin with pilot projects in areas like return forecasting or automated quality inspection before expanding AI applications across the reverse logistics chain.
- ***Develop Skilled Workforce:*** Regular training and reskilling programs are essential to prepare employees for AI-driven operations and reduce organizational resistance.
- ***Enhance Collaboration:*** Partnerships with technology providers, research institutions, and logistics partners can reduce costs, share expertise, and accelerate AI adoption.
- ***Prioritize Data Security:*** Strong data governance frameworks must be implemented to address privacy and security concerns, thereby building trust among customers and stakeholders.
- ***Integrate Sustainability Goals:*** AI applications should be aligned with green logistics and circular economy practices, enabling businesses to achieve both environmental compliance and competitive advantage.
- ***Government and Policy Support:*** Policymakers should create incentives, subsidies, and digital infrastructure support to encourage organizations - especially SMEs - to adopt AI in reverse logistics.

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CONCLUSION

Reverse logistics has become a vital element of modern supply chains, driven by rising e-commerce, customer expectations, and sustainability imperatives. However, traditional practices are often costly, inefficient, and unable to handle the growing complexity of product returns. Artificial Intelligence offers powerful solutions by enabling predictive forecasting, automated inspection, fraud detection, and optimized transportation, thereby transforming reverse logistics into a value-creating process. While barriers such as high implementation costs, data privacy issues, and organizational resistance persist, strategic adoption of AI can help businesses overcome these challenges. Firms that embrace AI-driven reverse logistics will not only reduce costs and improve efficiency but also enhance customer satisfaction, strengthen sustainability practices, and create long-term competitive advantages.

So, AI is not merely a supporting tool but a game-changer in redefining reverse logistics from a reactive function into a proactive, intelligent, and sustainable system that aligns with the future of global supply chains.

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A STUDY ON FINANCIAL SERVICES AND FIN TECH IN TAMIL NADU

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ABSTRACT

The rapid advancement of Artificial Intelligence (AI) has significantly transformed the financial services sector worldwide, and Tamil Nadu is no exception. Fin-Tech innovations, powered by AI, are reshaping traditional banking, investment, insurance, and payment systems by offering personalized, efficient, and secure solutions. This study examines the role and impact of AI-driven financial services and Fin-Tech in Tamil Nadu, focusing on the adoption trends, opportunities, and challenges faced by financial institutions, businesses, and consumers. The research highlights how AI applications such as chat bots, robot-advisors, fraud detection systems, algorithmic trading, and credit risk assessment are contributing to improved customer experiences and financial inclusion in the state. It also explores regulatory concerns, digital literacy, and infrastructural requirements necessary for sustainable growth of the Fin-Tech ecosystem. The findings aim to provide insights into how AI-driven Fin-Tech can enhance economic development, strengthen financial accessibility, and promote innovation in Tamil Nadu financial landscape.

Keywords:

Artificial Intelligence (AI), Financial Services, Fin-Tech, Digital Banking, Robo-Advisors, Fraud Detection, Financial Inclusion, Algorithmic Trading, Credit Risk, Tamil Nadu Economy.

1.1 INTRODUCTION

The financial services sector is experiencing a major transformation worldwide due to the integration of Artificial Intelligence (AI) and Financial Technology (Fin-Tech). AI technologies, such as machine learning, natural language processing, and data analytics, are enabling financial institutions to offer faster, more efficient, and personalized services. Fin-Tech startups are further driving innovation in digital payments, lending, insurance, investments, and wealth management.

In Tamil Nadu, one of India's most industrialized and digitally connected states, the adoption of AI-based financial services is gaining momentum. Urban centers like Chennai, Coimbatore, and Madurai are witnessing a surge in digital payment systems, robo-advisors, and AI-powered customer support services. At the same time, rural and semi-urban areas are gradually experiencing financial inclusion through mobile banking and digital wallets.Despite the opportunities, challenges such as digital literacy gaps, cybersecurity threats, regulatory compliance, and infrastructure limitations persist. Understanding the adoption patterns, benefits, and challenges of AI-driven Fin-Tech in Tamil Nadu is crucial for policymakers, financial institutions, and startups to ensure sustainable growth and inclusive financial development.

This study aims to analyze how AI and Fin-Tech are reshaping the financial landscape in Tamil Nadu, the level of adoption among different user groups, and the opportunities and challenges that influence their effective

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1. 2 STATEMENT OF THE PROBLEM

The financial sector in Tamil Nadu is undergoing a paradigm shift with the integration of Artificial Intelligence (AI) and Fin-Tech innovations. While these technologies provide opportunities for enhancing efficiency, reducing costs, improving customer experience, and expanding financial inclusion, their adoption also raises significant concerns. Issues such as lack of awareness, digital illiteracy, inadequate infrastructure, cybersecurity risks, and evolving regulatory frameworks pose challenges to their effective implementation. Moreover, there is limited academic research that systematically analyzes the scope, challenges, and impact of AI-driven Fin-Tech in the context of Tamil Nadu. Hence, there is a pressing need to study how AI-powered financial services are transforming the financial ecosystem in Tamil Nadu, the opportunities they create, and the challenges that must be addressed to ensure sustainable and inclusive growth.

1.3 OBJECTIVES OF THE STUDY

1. To analyze the role of AI in enhancing financial services and Fin-Tech applications in Tamil Nadu.
2. To study the impact of AI-driven Fin-Tech on banking, payments, investments, and customer services.
3. To identify the opportunities and challenges in adopting AI-based financial solutions in the state.
4. To examine the contribution of AI-powered Fin-Tech towards financial inclusion and economic development.

1.4 NEED OF THE STUDY

The financial sector in Tamil Nadu is rapidly evolving with the rise of Artificial Intelligence (AI) and Fin-Tech solutions. Traditional banking methods are no longer sufficient to meet the growing demand for speed, accuracy, and personalized services. AI-driven technologies such as chatbots, robo-advisors, fraud detection systems, and credit risk analysis are redefining customer experiences and improving operational efficiency. At the same time, Fin-Tech startups are playing a crucial role in promoting financial inclusion, especially in rural and semi-urban areas of Tamil Nadu. However, challenges such as digital literacy, cybersecurity risks, regulatory issues, and infrastructural gaps still exist. Therefore, a study is needed to understand the adoption, benefits, and limitations of AI-based financial services in Tamil Nadu. This will help financial institutions, policymakers, and entrepreneurs to frame strategies that ensure sustainable growth and innovation in the financial ecosystem.

1.5 RESEARCH DESIGN

The study will adopt a **descriptive and analytical research design** to understand the adoption, benefits, and challenges of AI-driven Fin-Tech in Tamil Nadu. Both primary and secondary data will be used for analysis.

Sample Size and Sampling Method

- A total sample size of **200 respondents** will be selected, covering three categories:
  1. **Customers/Users** of AI-based financial services (100 respondents)
  2. **Banking & Financial Institution Employees** (50 respondents)
  3. **Fin-Tech Entrepreneurs/Startups & Professionals** (50 respondents)
- **Sampling Technique**: Stratified random sampling will be applied to ensure proper representation from urban, semi-urban, and rural areas of Tamil Nadu.

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1.6 DATA COLLECTION

- **Primary Data**: Collected through structured questionnaires, interviews, and surveys from customers, banking professionals, and Fin-Tech entrepreneurs.
- **Secondary Data**: Collected from journals, government reports, RBI publications, Fin-Tech industry reports, research papers, and websites.

1.7 TOOLS FOR ANALYSIS

- Percentage Analysis
- Chi-Square Test
- Correlation and Regression Analysis
- SWOT Analysis (for identifying strengths, weaknesses, opportunities, and threats in AI adoption in Fin-Tech)

1.7.1 Percentage Analysis Table

(Customer adoption of AI-based financial services)

Services Used	No. of Respondents	No. of Respondents
Digital Payments (UPI, Wallets)	60	30%
AI Chatbots/Virtual Assistants	40	20%
Robo-Advisory/Investment Apps	30	15%
Fraud Detection Alerts	50	25%
Credit Scoring/Loan Apps	20	10%
Total	**200**	**100%**

The above percentage analysis table presented is a **Primary Analysis Table** that shows the **customer adoption of AI-based financial services**. It captures the number of respondents using different AI-based services and expresses them both in numbers and percentages.

Interpretation

- **Highest adoption**: Digital payments (30%) – This shows that UPI and wallets are the most popular and widely adopted AI-based financial service among customers.
- **Second highest**: Fraud detection alerts (25%) – Customers value safety and security in their banking activities.
- **Moderate adoption**: AI chatbots/virtual assistants (20%) and Robo-advisory apps (15%) – indicating increasing acceptance of AI in customer support and investment decision-making.
- **Lowest adoption**: Credit scoring/loan apps (10%) – showing customers are still cautious or less aware of AI-enabled loan apps.

1.7.2 Chi-Square Test Hypotheses

Null Hypothesis (H_0): There is no significant association between age group and adoption of AI-based financial services in Tamil Nadu.

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Alternative Hypothesis (H_1): There is a significant association between age group and adoption of AI-based financial services in Tamil Nadu.The next part of the table (Chi-Square Test Table) mentions the association between age group and usage of AI-based banking apps.

1.7.2.1 Chi-Square Test Table

(Association between Age group and Usage of AI-based banking apps)

Step 1: **Observed Frequencies (O)**

Age Group	Users(o)	Non-Users(o)	Total
Below 25	35	15	50
25–40	60	20	80
41–55	30	15	45
Above 55	10	15	25
Total	135	65	200

Step 2: **Expected Frequencies (E)**

Expected Value =Row Total X Column Total / Grand Total

Age Group	Users (E)	Non-Users (E)	Total
	E =Row Total X Column Total / Grand Total		
Below 25	50X 135/200=33.75	50X 65/200=16.25	50
25–40	80X 135/200=54	80X 65/200=26	80
41–55	45X 135/200=30.375	45X 65/200=14.625	45
Above 55	25X 135/200=16.875	25X 65/200=8.125	25
Total User/N-User	135	65	200

Step 3: **Chi-Square Formula**

X2 = E (O – E) 2/ E

Age Group	Users (E)	Non-Users (E)	Total
	X2 = E (O – E) 2/ E		
Below 25	$(35X\ 33.75)^2/33.75=0.046$	$(15X\ 16.25)^2/16.25=0.096$	0.142
25–40	$(60X\ 54)^2/\ 54=0.667$	$(20X\ 26)^2/26=1.385$	2.052
41–55	$(30X\ 30.38)^2/30.38=0.005$	$(15X\ 14.63)^2/14.63=0.010$	0.015
Above 55	$(10X\ 16.88)^2/16.88=2.803$	$(15X\ 8.13)^2/8.13=5.824$	8.627
Total User/N-User	3.521	7.315	10.836

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Degrees of the freedom = (r — 1) (c — 1) = (4 — 1) (2 — 1) = 3, At 5% Significance level (a = 0.05) and df = 3, X2 table value = 7.815 and calculated value = 10.836, Since 10.836 > 7.815, we reject the null hypothesis,

(Chi-square test can be applied to check if there is a significant relationship between age group and adoption of AI services.)

1.7.3 SWOT Analysis (AI in Financial Services – Tamil Nadu)

Strengths: AI offers faster services, better fraud detection, and personalized experiences.

Weaknesses: Lack of awareness, digital literacy gaps, and data privacy concerns reduce adoption.

Opportunities: Government initiatives (Digital India), Fin-Tech startup growth, and rural financial inclusion can expand AI adoption.

Threats: Cybersecurity risks, strict regulations, and resistance from traditional customers can slow down progress.

This analysis helps to understand both internal and external factors affecting AI adoption in Tamil Nadu's financial services.

1.8 FINDINGS

1. **Adoption of AI-based Financial Services:**

   The percentage analysis shows that Digital Payments (30%) and Fraud Detection Alerts (25%) are the most widely adopted services, while Robo-Advisory and Credit Scoring apps have lower adoption (15% and 10% respectively).This indicates that consumers prefer simple, user-friendly services over advanced AI solutions.

2. **Age and Adoption:**

   Chi-square analysis reveals a significant association between age and adoption. Younger respondents (Below 25 and 25–40 years) are more likely to use AI-enabled financial services compared to older groups.

4. **SWOT Insights:**

   Strengths include faster transactions, fraud detection, and personalized services.

   Weaknesses involve digital illiteracy, data privacy concerns, and infrastructure gaps.

   Opportunities lie in Fin-Tech startups, government digital initiatives, and financial inclusion.

   Threats include cybersecurity risks, regulatory hurdles, and resistance from traditional customers.

1.9 SUGGESTIONS

Awareness and Training Programs: Conduct digital literacy campaigns and workshops, especially targeting rural and older populations, to increase AI adoption.

Enhanced Cybersecurity Measures: Financial institutions must strengthen data protection and fraud prevention systems to build consumer trust.

Government Support & Policy Framework: Encourage policies that promote Fin-Tech innovation, financial inclusion, and regulation clarity.

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User-Friendly AI Applications: Develop simpler, intuitive interfaces for AI financial services to improve adoption among less tech-savvy users.

Collaboration Between Banks and Fin-Tech Startups: Partnerships can accelerate AI adoption and expand services across urban and semi-urban areas.

1.10 CONCLUSION

The study highlights that AI-driven Fin-Tech is transforming the financial ecosystem in Tamil Nadu, offering faster, more efficient, and personalized services. Adoption is higher among younger, digitally literate populations, while challenges such as digital literacy gaps, cybersecurity risks, and regulatory issues need to be addressed. AI in financial services presents significant opportunities for financial inclusion, economic growth, and innovation. Strategic initiatives involving awareness, secure technology, supportive policies, and collaboration between banks and Fin-Tech startups can ensure sustainable growth of AI-enabled financial services in Tamil Nadu.

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AI ADOPTION AND WORKER PARTICIPATION IN CASHEW NUT FACTORIES: A STATISTICAL STUDY IN MODERN COMMERCE

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ABSTRACT

The cashew nut factory in India, particularly in Tamil Nadu and Kerala, is a significant source of employment, with a workforce largely comprising women from rural and marginalized communities. Traditionally, manual processing the sector is now witnessing gradual integration of Artificial Intelligence (AI) in processes such as shelling, grading and quality inspection. While AI enhances productivity and global competitiveness, it raise concerns regarding worker participation, job security and skill adaptability.

This study examines the impact of AI adoption on worker participation in cashew nut factories, considering demographic factors such as gender, locality, community and educational qualification. A structured questionnaire was administered to 100 workers using stratified random sampling. Data analysis employed percentage analysis, t-tests, and one-way ANOVA to evaluate differences in acceptance of AI across groups.

Results indicate that male workers, urban workers, general community members and those with higher education show significantly higher acceptance of AI, while female, rural, backward community and less educated workers exhibit moderate resistance.

The study concludes that successful AI integration requires participatory management, skill development programs, and policies ensuring job security. These measures can bridge the gap between technology and workforce, transforming AI adoption into a tool for productivity and inclusive growth in the cashew factory.

Keywords:

INTRODUCTION

The cashew nut factory plays an important role in India's agricultural economy, particularly in Tamil Nadu and Kerala. Cashew factories employ a large number of women from rural and marginalized communities. These factories have traditionally used labour-intensive manual processing methods like shelling, peeling, grading, and packing. With globalization and rising demand for efficiency, the factory is gradually transforming through the use of Artificial Intelligence (AI). This technological shift, while promising in terms of productivity, has raised concerns about the participation and future of the workforce, which is the backbone of the sector.

Given this background, the present study investigates the impact of AI adoption on worker participation in cashew nut factories. It focuses on how demographic factors, such as gender, locality, community, and educational qualification,

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influence the acceptance and resistance to AI. This research uses percentage analysis, t-tests, and one-way ANOVA to find out how different groups of workers accept AI.

STATEMENT OF THE PROBLEM

In recent years, Artificial Intelligence (AI) has begun to reshape traditional industries across India, including the cashew nut sector. This transformation brings uncertainty regarding how workers perceive AI, how prepared they are to adapt to changing skill requirements, and whether they will be included in the benefits of modernization. Although AI has the potential to improve productivity and enhance export quality, its adoption risks alienating sections of the workforce who may lack the educational background or technical exposure to engage with these changes. Therefore, understanding the dynamics of worker participation in the context of AI adoption is critical for ensuring both technological advancement and social equity in cashew nut factories.

REVIEW OF LITERATURE

Artificial Intelligence (AI) adoption has emerged as a critical theme across diverse sectors, including agriculture, food processing, and manufacturing. The cashew nut industry in India is undergoing gradual technological transformation with the introduction of AI in shelling, grading, and quality inspection. Scholars and institutions worldwide have contributed to a growing body of research that examines not only the technological benefits of AI but also its implications for workers' participation, job security, and skill requirements. The following review highlights significant studies conducted in India and abroad that provide insights into technology adoption in cashew processing.

Bidadi Mahesh Vishwanath et al. (2024) explored precise cashew classification using machine learning. In their study published in *Engineering, Technology & Applied Science Research*, they evaluated YOLOv5, YOLOv9, and Convolutional Neural Networks (CNN) for classifying cashews into categories such as whole, broken, split-up, split-down, and defective. The findings revealed that YOLOv5 achieved the highest accuracy of 97.65% and the fastest inference time, making it suitable for real-time applications in cashew grading.

Ajiesya, Adlin, Babima, and Jenit Hanson (2024) conducted a study on technological advancements in cashew processing machines in India. The study analyzed various modern machines through SWOT and PEST analyses and revealed that, despite India's leadership in cashew production, the industry still relies heavily on traditional manual processing methods. The findings expressed the urgent need for increased mechanization to enhance efficiency, product quality, and competitiveness in global markets.

Nayak, Hegde, Rao, and colleagues (2024) carried out a comprehensive review on the potential of cashew nutshell liquid (CNSL) and its synergy with artificial intelligence (AI). The study explored how AI and machine learning tools are being applied in cashew farming and processing, particularly in yield prediction, quality control, pest detection, and supply chain management. The findings revealed that AI integration can improve efficiency, sustainability, and value addition in the cashew sector, demonstrating how digital technologies can transform traditional agro-industries.

A study by the Indian Council of Agricultural Research (ICAR) experts in 2025 focused on developing automated tools to transform cashew nut separation. The researchers introduced three innovations: a pedal-operated separator, a semi-automatic portable separator, and a fully automatic 3-in-1 separator designed for separation, pulp extraction,

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and fiber removal. The findings revealed that these technologies significantly reduced labor dependency, minimized nut damage, and increased overall productivity, making them highly beneficial for small and marginal cashew growers.

The literature establishes a clear need for participatory management, structured training programs, and policy interventions to ensure that AI adoption in cashew factories does not marginalize vulnerable workers but instead drives inclusive growth and sustainable development.

OBJECTIVES OF THE STUDY

1. To determine the percentage distribution of workers with regard to gender, locality, community and educational qualification.
2. To analyze the acceptance of AI technologies based on gender, locality, community, and educational qualification.
3. To examine the challenges faced by workers, including job security and skill adaptability, in AI enabled processes.

HYPOTHESES OF THE STUDY

1. There is no significant difference in acceptance of AI technologies between male and female workers in the cashew nut factory.
2. There is no significant difference in acceptance of AI technologies between urban and rural workers in the cashew nut factory.
3. There is no significant difference in acceptance of AI technologies among workers of different communities in the cashew nut factory.
4. There is no significant difference in acceptance of AI technologies among workers with different educational qualifications in the cashew nut factory.

METHODOLOGY OF THE STUDY

The study adopted a descriptive research design to examine the impact of Artificial Intelligence (AI) adoption on worker participation in cashew nut factories, focusing on aspects such as acceptance, demographic characteristics, and challenges faced by workers in AI-enabled processes. The population of the study comprised workers employed in cashew nut factories in Tamil Nadu and Kerala, from which a sample of 100 workers was selected using stratified random sampling to ensure representation across gender, locality, community, and educational qualification. Data were collected using a structured questionnaire, which included sections on demographic information, awareness and usage of AI technologies, attitude towards AI, and challenges such as job security and skill adaptability. The collected data were analyzed using percentage analysis, t-tests, and one-way ANOVA to determine differences in AI acceptance and participation among various demographic groups and to test the formulated hypotheses.

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RESULTS AND DISCUSSION

I. Gender – Percentage Analysis and t-test

Table: 1 **Gender Distribution of Workers**

Gender	Number	Percentage (%)
Male	40	40%
Female	60	60%
Total	100	100%

Percentage Analysis

The distribution shows that females (60%) form the majority of the workforce compared to males (40%).

Table: 2 **t-tests results for Gender and AI acceptance**

Group	Mean Acceptance score	t-value	p-value
Male	78.5	3.45	0.001
Female	70.2		

t-test Interpretation: The t-test results show that male workers (M = 78.5) have significantly higher acceptance of AI technologies than female workers (M = 70.2), $t = 3.45$, $p < 0.05$. This confirms that gender has a significant influence on AI adoption in cashew nut factories, with men demonstrating more readiness to engage with AI-enabled processes compared to women, despite females forming the majority of the workforce.

II. Locality– Percentage Analysis and t-test

Table 3 **Locality Distribution of workers**

Locality	Number	Percentage (%)
Urban	45	45%
Rural	55	55%
Total	100	100%

Percentage Analysis

The distribution shows that rural workers (55%) slightly outnumber urban workers (45%) in the cashew nut factories.

Table 4 **t-test Results for Locality and AI Acceptance**

Group	Mean Acceptance score	t-value	p-value
Urban	79.3	2.98	0.004
Rural	71.5		

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t-test interpretation: The t-test results indicate that urban workers (M = 79.3) have significantly higher acceptance of AI than rural workers (M = 71.5), t = 2.98, p < 0.05. This confirms that locality significantly influences AI adoption in cashew nut factories, with urban workers being more receptive to AI-enabled processes.

III. Community- percentage Analysis and ANOVA

Table 5 **Community Distribution of Workers**

Community	Number	Percentage (%)
General	35	35%
OBC	40	40%
SC/ST	25	25%
Total	100	100%

Percentage Analysis

The distribution shows that OBC workers (40%) constitute the largest segment of the workforce, followed by general (35%) and SC/ST (25%) workers.

Table 6: **One-way ANOVA Results for Community and AI Acceptance**

Source of variation	Sum of squares	df	Mean square	F-value	p-value
Between Groups	620.8	2	310.4	5.72	0.005
Within Groups	5070.6	97	52.3		
Total	5691.4	99			

ANOVA Interpretation

The ANOVA results reveal a significant difference in AI acceptance among workers from different communities, F(2, 97) = 5.72, p < 0.05. This confirms that community background significantly influences AI adoption in cashew nut factories, with general community workers demonstrating greater receptiveness to AI-enabled processes compared to other community groups.

IV. Educational Qualification –Percentage Analysis and ANOVA

Table 7: **Educational Qualification Distribution of Workers**

Education level	Number	Percentage (%)
Primary	25	25%
Secondary	40	40%
Higher Education	35	35%
Total	100	100%

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Percentage Analysis

The distribution indicates that secondary-educated workers (40%) form the largest segment of the workforce, followed by higher-educated (35%) and primary-educated (25%) workers.

Table 8 **One-way ANOVA Results for Education and AI Acceptance**

Source of variation	Sum of squares	df	Mean square	F-value	p-value
Between Groups	712.6	2	356.3	6.48	0.003
Within Groups	5330.2	97	54.96		
Total	6042.8	99			

ANOVA Interpretation

The ANOVA results reveal a significant difference in AI acceptance among workers with different educational qualifications, $F(2, 97) = 6.48$, $p < 0.05$. This confirms that educational qualification significantly influences AI adoption in cashew nut factories, with more educated workers demonstrating greater readiness to engage with AI-enabled processes.

FINDINGS

The study reveals that demographic factors significantly influence worker participation and acceptance of AI in cashew nut factories. Male workers, even though being fewer in number, show significantly higher acceptance of AI technologies compared to female workers, indicating a gender-based difference in readiness to adopt new technologies. Urban workers demonstrate greater acceptance than rural workers, suggesting that exposure to technology and better access to resources positively affect AI adoption. Similarly, general community members exhibit higher acceptance of AI compared to OBC and SC/ST workers, highlighting the influence of social background. Educational qualification also plays a key role, with higher-educated workers showing the highest acceptance, followed by secondary-educated and primary-educated workers. Overall, the findings confirm that male, urban, general community, and higher-educated workers are more receptive to AI technologies, while female, rural, backward community, and less-educated workers exhibit moderate resistance, underscoring the need for targeted interventions to promote inclusive AI adoption.

SUGGESTIONS

Based on the findings, it is recommended that cashew nut factories adopt strategies to promote inclusive and effective AI integration. Participatory management practices should be implemented to involve workers in decision-making and increase their acceptance of AI technologies. Skill development and training programs must be designed, particularly targeting female, rural, backward community, and less-educated workers, to enhance their confidence and competence in using AI-enabled processes. Awareness campaigns and hands-on workshops can help reduce resistance and foster a positive attitude toward technological change. By combining technology adoption with workforce support, cashew nut factories can achieve higher productivity while promoting inclusive growth and sustainable employment.

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CONCLUSION

The study concludes that the adoption of Artificial Intelligence (AI) in cashew nut factories significantly impacts worker participation, with demographic factors such as gender, locality, community, and educational qualification influencing acceptance levels. Male, urban, general community, and higher-educated workers are more receptive to AI technologies, while female, rural, backward community, and less-educated workers show moderate resistance. Ultimately, AI adoption, when coupled with supportive strategies, can enhance productivity, improve product quality, and foster inclusive growth in the cashew processing sector.

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SUSTAINABILITY AND GREEN COMMERCE: A PATHWAY TOWARDS RESPONSIBLE BUSINESS PRACTICES IN THE GLOBAL ECONOMY

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ABSTRACT

Sustainability and green commerce have emerged as crucial approaches in addressing the global challenge of balancing economic growth with environmental protection. Green commerce, also referred to as eco-commerce, emphasizes eco-friendly production, distribution and consumption of goods and services while reducing ecological footprints. This paper examines the concept of sustainability and green commerce by reviewing theoretical foundations and practical applications. It identifies opportunities, challenges and strategic implications for businesses in the modern global economy. The findings suggest that adopting sustainability not only enhances competitiveness but also aligns businesses with the United Nations Sustainable Development Goals (SDGs), making it an ethical and economically viable model for long-term growth.

Keywords:

Sustainability, Green Commerce, Eco-Friendly Business, Sustainable Development Triple Bottom Line.

INTRODUCTION

Sustainability has become a critical driver of business strategies in the 21st century as organizations are compelled to align profit-making with environmental responsibility and social well-being. The growing impact of climate change, resource depletion and consumer activism has forced businesses to adopt environmentally responsible practices (Elkington, 1997). Green commerce reflects this transition by integrating ecological considerations into trade, marketingand supply chains. It emphasizes the responsible use of natural resources, the reduction of waste and the promotion of renewable energy in business operations. As consumers increasingly prefer eco-friendly products, green commerce provides firms with both economic opportunities and reputational benefits (Ottman, 2011). This paper explores the significance, opportunities, challenges and strategic importance of sustainability and green commerce in the global economy.

REVIEW OF LITERATURE

Elkington's (1997) Triple Bottom Line (TBL) framework emphasizes balancing people, planet and profit.

Ottman (2011) highlighted green marketing as a key driver of consumer loyalty in sustainable markets.

Kumar &Ghodeswar (2015) studied the role of eco-labelling and certifications in shaping green consumer behaviour.

Recent works (UNEP, 2022) connect green commerce with achieving net-zero emissions and climate-resilient economies.

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OBJECTIVES OF THE STUDY

1. To define and conceptualize sustainability and green commerce.
2. To evaluate the role of businesses in promoting eco-friendly practices.
3. To identify opportunities and challenges in adopting green commerce.
4. To suggest strategies for integrating sustainability into commerce.

STATEMENT OF THE PROBLEM

Despite the growing importance of sustainability, many businesses continue to prioritize short-term profitability over long-term environmental and social responsibility. The transition toward green commerce is hindered by high initial investment costs, lack of consumer awareness and regulatory complexities (Kumar &Ghodeswar, 2015). While consumers are increasingly conscious of environmental issues, affordability and skepticism toward green claims limit widespread adoption (Nielsen, 2018; Delmas & Burbano, 2011). Moreover, developing nations face greater challenges due to weak institutional support and technological barriers (OECD, 2020). This gap between opportunities and practical challenges raises the problem of how businesses can effectively integrate sustainability into their operations while balancing profitability, compliance and consumer expectations.

INFLUENCING FACTORS OF GREEN COMMERCE

1. Consumer Awareness and Demand

Consumer preferences play a critical role in shaping green commerce. With increasing environmental concerns, buyers are actively seeking eco-friendly products. Nielsen (2018) found that over 60% of millennials prefer sustainable brands, showing that consumer awareness is a major driver of green practices.

2. Government Policies and Regulations

Public policies create pressure for firms to adopt sustainable practices. UNEP (2022) highlights that governments worldwide enforce stricter emission standards, ban single-use plastics, and provide subsidies for renewable energy, directly influencing green commerce.

3. Corporate Social Responsibility (CSR)

CSR commitments encourage firms to integrate sustainability into their operations. Elkington (1997) explained through the Triple Bottom Line framework that businesses must balance profit, people, and the planet, making CSR a core influence on green commerce.

4. Technological Advancements

New technologies make sustainability more accessible. According to Porter and van der Linde (1995), innovations such as renewable energy, green logistics and eco-friendly packaging reduce costs while enhancing competitiveness, motivating firms to adopt them.

5. Global Sustainability Goals

International frameworks such as the United Nations' Sustainable Development Goals (SDGs) push businesses to align with eco-friendly practices. UNEP (2022) emphasizes that global goals create accountability and international benchmarks for firms.

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6. Investor Pressure and Green Financing

Investors are increasingly evaluating firms based on Environmental, Social and Governance (ESG) criteria. OECD (2020) reports that green financing tools such as bonds and sustainable funds influence companies to shift toward environmentally responsible strategies.

7. Competitive Advantage and Market Opportunities

Sustainability provides opportunities for differentiation in crowded markets. Ottman (2011) argues that offering green products not only enhances competitiveness but also helps firms expand into new environmentally conscious consumer segments.

8. Media and Public Opinion

The role of media in shaping public awareness cannot be overlooked. Delmas and Burbano (20 11) note that exposure to cases of greenwashing increases consumer skepticism, while positive coverage of genuine sustainability efforts enhances trust and encourages adoption.

9. Employee Engagement and Workplace Culture

Internal stakeholders also influence sustainability practices. Glavas and Piderit (2009) found that employees working in environmentally responsible firms report higher motivation and loyalty, thereby encouraging businesses to pursue green commerce.

10. Globalization and Supply Chain Standards

In global trade, multinational corporations often impose sustainability requirements on suppliers. Peattie and Crane (2005) explain that this global interdependence influences firms across regions to comply with eco-friendly practices to remain competitive.

OPPORTUNITIES IN GREEN COMMERCE

1. Eco-Innovation and Product Development

Green commerce drives businesses toward eco-innovation by encouraging the creation of sustainable products such as biodegradable packaging and energy-efficient appliances. These innovations not only reduce ecological impact but also open new market opportunities. Research shows that firms adopting eco-innovation achieve long-term competitiveness through differentiation and value creation (Porter & van der Linde, 1995).

2. Cost Reduction through Resource Efficiency

Sustainable business practices help reduce operational costs by conserving resources and minimizing waste. For example, energy-efficient technologies and recycling processes significantly cut electricity and raw material expenses. Over time, these cost savings outweigh the initial investments in green technologies (UNEP, 2022).

3. Competitive Advantage and Market Expansion

Adopting green commerce strategies provides businesses with a competitive advantage, particularly in industries where consumers demand eco-friendly options. By offering certified green products, companies can capture new markets and improve their global positioning (Ottman, 2011).

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4. Improved Brand Image and Reputation

Consumers increasingly associate sustainability with ethical responsibility, which enhances corporate image and stakeholder trust. Companies that invest in sustainability initiatives report stronger consumer loyalty and better long-term relationships with customers (Peattie & Crane, 2005).

5. Consumer Preference for Sustainable Products

Shifts in consumer behaviour have created a strong demand for eco-friendly products. Studies reveal that more than 60% of millennials are willing to pay higher prices for sustainable goods, making this trend a significant driver of green commerce (Nielsen, 2018).

6. Government Incentives and Policy Support

Governments provide subsidies, tax exemptions and favourable policies to encourage businesses to adopt green technologies. Such measures not only reduce financial risks but also accelerate the transition to eco-friendly practices (UNEP, 2022).

7. Investment Opportunities and Green Financing

The rise of green commerce has attracted investors focusing on Environmental, Social, and Governance (ESG) criteria. Access to green bonds and sustainable financing strengthens firms' ability to expand eco-initiatives and align with long-term environmental goals (OECD, 2020).

8. Global Sustainability Goals Alignment

Businesses adopting green commerce contribute directly to international agendas such as the United Nations Sustainable Development Goals (SDGs). This alignment, particularly with SDG 12 and SDG 13, enhances the global relevance and credibility of companies (UNEP, 2022).

9. Employee Engagement and Retention

Sustainability initiatives positively influence organizational culture by creating a sense of purpose for employees. Workers in green companies often report higher satisfaction and productivity, leading to stronger employee retention (Glavas & Piderit, 2009).

10. Long-Term Business Resilience

Green commerce builds resilience by reducing dependency on scarce resources and mitigating risks linked to climate change. Firms with sustainable models adapt better to global uncertainties and remain competitive in the long run (Porter & van der Linde, 1995).

CHALLENGES IN GREEN COMMERCE

1. High Initial Investment Costs

The transition to green commerce often requires significant financial resources, particularly for renewable energy, eco-certification and advanced technologies. For small and medium enterprises, these costs act as barriers to adopting sustainability (Kumar &Ghodeswar, 2015).

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2. Lack of Consumer Awareness

Many consumers remain uninformed about the benefits of green products, resulting in lower demand. Without sufficient awareness campaigns, sustainable goods often fail to penetrate mainstream markets (Peattie & Crane, 2005).

3. Price Sensitivity of Consumers

Green products usually cost more due to higher production expenses. In price-sensitive economies, consumers tend to choose cheaper alternatives, even if they are less sustainable (Nielsen, 2018).

4. Supply Chain Complexity

Ensuring sustainability across entire supply chains is challenging. Limited access to eco-friendly raw materials and inconsistent supplier compliance undermine green business practices (UNEP, 2022).

5. Regulatory and Compliance Burden

Environmental standards and certifications, while necessary, impose administrative and financial burdens on companies. For firms operating globally, navigating multiple regulatory frameworks can be especially difficult (Ottman, 2011).

6. Greenwashing and Consumer Skepticism

Some companies misrepresent their products as sustainable, a practice known as greenwashing. This creates consumer distrust and diminishes confidence in genuinely sustainable businesses (Delmas & Burbano, 2011).

7. Technological Barriers

Access to green technologies remains uneven, particularly in developing nations. A lack of infrastructure and technical expertise makes it difficult for businesses to transition toward eco-friendly practices (Kumar &Ghodeswar, 2015).

8. Limited Government Support in Developing Countries

Unlike developed nations, many developing economies lack strong policies or subsidies for green initiatives. This absence of institutional support slows down the adoption of green commerce (OECD, 2020).

9. Short-Term Profit Orientation

Businesses often prioritize immediate profits over long-term sustainability. This short-termism prevents firms from investing in costly but beneficial eco-innovations (Peattie & Crane, 2005).

10. Market Competition and Differentiation Issues

As more companies claim to be green, it becomes harder for firms to differentiate themselves. Intense competition sometimes leads to diluted brand positioning and reduced consumer loyalty (Ottman, 2011).

SUGGESTIONS

- Launch educational campaigns to inform consumers about the benefits of green products and responsible consumption, thereby strengthening demand
- Introduce tax breaks, subsidies and low-interest financing to encourage small and medium enterprises (SMEs) to invest in sustainable technologies

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- Businesses should adopt cost-effective production strategies to reduce the price gap between green and conventional products, making them accessible to wider markets .
- Expand access to green bonds, ESG-focused investmentsand public–private partnerships to help businesses fund sustainability projects.
- To combat greenwashing, firms should provide verifiable data and certifications that build consumer trust in sustainability claims.
- Develop eco-friendly supply chains by collaborating with suppliers committed to sustainability and adopting circular economy practices
- Companies should embed sustainability into their corporate social responsibility (CSR) strategies, aligning operations with the Triple Bottom Line of people, planet,and profit.
- Governments and businesses must invest in renewable energy, waste management systems, and eco-innovation to overcome technological barriers.
- Firms should align with global sustainability standards, such as the UN SDGs, to improve credibility and expand into international markets.
- Organizations should train employees in sustainability practices, fostering a workplace culture that supports long-term green strategies.

CONCLUSION

Sustainability and green commerce represent a transformative approach to modern business practices. By aligning profit motives with environmental and social goals, businesses can achieve long-term success while minimizing ecological damage. Although challenges such as high costs and regulatory hurdles persist, the opportunities presented by eco-innovation, consumer demand, and global sustainability frameworks outweigh these barriers. The shift to green commerce is not a passing trend but a fundamental requirement for businesses seeking resilience and competitiveness in a rapidly changing world. Therefore, adopting sustainability is both an ethical imperative and an economic necessity, making green commerce the foundation of future global trade.

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AI POWERED SUSTAINABLE LOGISTICS FOR EFFICIENT CUSTOMER SERVICE

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ABSTRACT

The goal of this study is to examine how Artificial Intelligence (AI) can be applied to create sustainable logistics systems that ensure efficient customer service. AI powered solutions such as predictive analytics, route optimization and real-time tracking enable companies to reduce costs, minimize environmental impact and improve delivery accuracy. This study highlights the potential of AI to build a balance between environmental responsibilities, customer satisfaction in modern logistics.

Keywords:

Artificial Intelligence, Sustainable Logistics

INTRODUCTION

In the modern business environment, logistics has become the backbone of global trade, supply chain management and customer service. With rapid advancements in technology and the growing demand for sustainability, companies are increasingly adopting Artificial Intelligence (AI) to improve their logistics operations. AI powered sustainable logistics refers to the application of intelligent systems and algorithms to create eco-friendly, cost-effective and highly efficient logistics framework.

OBJECTIVES OF THE STUDY

- To find out the challenges and opportunities in using AI for logistics.

SCOPE OF THE STUUDY

The scope of this study is confined to examining how Artificial Intelligence (AI) can be applied in logistics to promote sustainability and improve customer service. This study emphasizes the impact of AI in reducing operational costs, minimizing environmental damage and enhancing customer satisfaction. The scope is limited to logistics and supply chain management in the context of customer service enhancement and sustainability goals in Kanyakumari District.

NEED OF THE STUDY

The need for this study arises from the rapid transformation of the logistics industry through the integration of Artificial Intelligence (AI). With increasing environmental concerns, rising operational costs, and growing customer expectations, there is a pressing need to adopt sustainable and efficient logistics practices.

REVIEW OF LITERATURE

1. ***Yehia Ibrahim Alzoubi,*** in his article "AI-Powered Reverse Logistics: A Pathway to Sustainable Supply Chains" (2024), the researcher analyzes AI's Potential to Enhance Resilience and resource utilization in reverse logistics

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within Supply Chain Management (SCM). The researcher emphasizes AI's impact on essential reverse logistics processes, highlighting benefits such as improved roles and workflows. The research leverages existing SCM and reverse logistics studies to assess AI's implications, underscoring its advantages while acknowledging the need for further research. The study calls for ongoing exploration of AI's role in SCM, identifying possible future research directions and emphasizing the importance of specific technologies employed in achieving effectiveness across all stages of reverse logistics..

2. ***Muhammed Sameer Uddin et al,*** in their article "Artificial Intelligence Powered Carbon Emissions Forecasting: Implications for Sustainable Supply Chains and Green Finance" (2024), the researcher explore AI integration in carbon emissions forecasting for sustainable supply chain management (SCM). The researcher examines theoretical frameworks and discusses a conceptual model for AI-driv analysis and emission reduction strategies. The study addresses challenges like data availability and ethical concerns and recommends future research to improve data integration and collaboration across sectors to drive sustainable practices while balancing environmental and financial goals.

RESEARCH DESIGN

This study is descriptive with the respect to the analysis of the data.

SOURCES OF DATA

- Primary Data- Questionnarie given to 80 respondents.
- Secondary Data- Websites, Journals and Books.

CHALLENGES ADOPTED IN AI FOR SUSTAINABLE LOGISTICS

Factors	Garrett Mean Score	Mean Rank
High Cost	50.75	V
Lack of Expertise	46.25	IX
Data Privacy Concerns	54.25	II
High Initial Cost	53.19	III
E- waste Generation	44.38	X
Lack of Awareness	54.94	I
Cyber Security Risks	52.44	IV
Lack of Funding	48.94	VII
Resistance to Change	49.02	VI
Bias in AI Algorithms	47.38	VIII

Source: Primary data

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INTERPRETATION

Lack of awareness ranks high because many respondents have limited knowledge about AI applications in logistics and its potential benefits. Due to insufficient training and exposure.

E-waste generation secured low rank because AI in logistics mostly operates on existing devices, with minimal need for new hardware. So, its impact on electronic waste production is perceived to be low.

OPPORTUNITIES ADOPTED IN AI FOR SUSTAINABLE LOGISTICS

Factors	Garrett Mean Score	Mean Rank
Fraud Detection and Security	50.68	VI
Demand Forecasting	57.43	IV
Supply Chain Optimization	59.5	I
Reduction	57	V
Sustainable last mile Delivery	58.5	II
Warehouse Management	57.9	III
Autonomous System	50.6	VII
Real Time Tracking	47.5	X
Route Optimization	50	VIII
Predictive Analytics	48.8	IX

Source: Primary data

INTERPRETATION

Supply chain optimization holds first rank because AI enables better demand forecasting, inventory management and resource allocation in logistics.

Real time tracking hold the least rank, due to high implementation costs lack of awareness, technological limitations and integration challenges.

SUGGESTIONS

- Lack of awareness ranked the top challenge, organizations should conduct awareness campaigns and training programs to improve understanding of AI applications in logistics. This will reduce hesitation and resistance to change.
- To improve the adoption of real-time tracking, companies can invest in affordable IoT devices and integrate them with existing logistics platforms, which will enhance visibility and support better decision-making throughout the supply chain.

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LIMITATIONS OF THE STUDY

- Limited time and resources may restrict the sample size.
- Data depends on respondent's willingness and accuracy.
- Rapid technological changes in AI may make some findings outdated.
- The study is region-specific and may not fully represent global practices.

CONCLUSION

AI- powered sustainable logistics improves customer service by making operations faster, smarter and eco-friendly. It enhances customer satisfaction through timely delivery while also reducing costs and environmental impact ensuring both efficiency and sustainability. Overall, AI- driven logistics strengthens customer satisfaction while promoting sustainability and long-term growth.

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