XAVIER INSTITUTE OF BUSINESS ADMINISTRATION
(A Jesuit Business School)

PROCEEDINGS

Business Sustainability in Digitalization Industry 5.0

6 & 7 DECEMBER 2023

XIBA

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XAVIER INSTITUTE OF BUSINESS ADMINISTRATION
(A Jesuit Business School)
St.Xavier's College (Autonomous)
Palayamkottai, Tirunelveli-627002
"College with Potential for Excellence" by UGC
Re-accredited by NAAC with "A" Grade with a CGPA 3.5"

ST. XAVIER'S COLLEGE

St. Xavier's College is run by the Society of St. Francis Xavier, a body registered under the Societies Registration Act, (S.No.3 of 1920 – 21) having its office at Palayamkottai. The College was started in 1923 by the dedicated French Jesuit Missionaries in Palayamkottai which was once considered poor and backward. A School had been functioning for nearly 50 years in this place.

The Jesuit trio, the select task force, responsible for the founding of the College were Fathers Mahe, Lebeau, and Bonhoure. Their zeal had created a tradition of academic excellence and universal service. Fathers Caussanel, Dhanasamy, and Gnanapragasam also played leading roles in the founding and early development of the College. In recognition of its academic excellence, St. Xavier's College was conferred with autonomous status. It is free to determine the course frame, and syllabi for the courses and adopt suitable pedagogy and evaluation methods. The College is an affiliated college under Manonmaniam Sundaranar University which will award degrees with the name of St. Xavier's College mentioned on the degree.

The College was accredited with Five Stars status by the National Assessment and Accreditation Council (NAAC) on 17th April 2000. The college was re-accredited with 'A' Grade by NAAC in April 2006 and with a CGPA of 3.5 in April 2012. UGC conferred on the College the status of "College with Potential for Excellence" in 2004 and for the second time in 2010. Presently, the College is accredited at A++ Grade with a CGPA of 3.66/4 in IV Cycle by NAAC

XAVIER INSTITUTE OF BUSINESS ADMINISTRATION (XIBA)

XIBA was started in August 2012 as the Department of Master of Business Administration, approved by AICTE and affiliated to Manonmaniam Sundaranar University, Tirunelveli. Xavier Institute of Business Administration (XIBA) offers a 2 year Master's programme (M.B.A.).

XIBA is elevated as XIBA Centre for Research in Business Administration, recognized by Manonmaniam Sundaranar University in the year 2019.

Foreword

It is with great pleasure and enthusiasm that we present the conference proceedings of the two-day International Conference on "Business Sustainability in Digitalization – Industry 5.0," hosted by Xavier Institute of Business Administration (XIBA), a Jesuit Business School under the aegis of St. Xavier's College.

In the ever-evolving landscape of the digital era, the conference aimed to unravel the intricate relationship between business sustainability and the relentless wave of digital transformation. Held on December 6th and 7th, 2023, the event brought together eminent scholars, industry experts, and thought leaders to deliberate on the pressing issues at the intersection of sustainable business practices and the advent of Industry 5.0.

Over the course of two days, the conference unfolded with captivating sessions that explored Digital Transformation, Sustainable Business Models, Leveraging Technology for Environmental Impact, and the crucial Policy and Regulation for Sustainable Digital Transformation. Esteemed speakers from renowned institutions and industry experts shared their wealth of knowledge, providing a comprehensive understanding of the challenges and opportunities presented by the dynamic landscape of Industry 5.0.

The panel discussions were a highlight, fostering engaging conversations on reimagining business models, examining policy implications, and nurturing sustainability in the digital realm. Distinguished panelists, representing a diverse spectrum of expertise, offered valuable insights and perspectives, enriching the discourse on how businesses can thrive responsibly in the digital age. As we compile these conference proceedings, we extend our gratitude to all the speakers, panelists, participants, and collaborators who contributed to the success of this event.

May these proceedings serve as a repository of knowledge, guiding future endeavors in the pursuit of sustainable practices in the dynamic and ever-evolving world of digitalization.

Rev.Dr.Michael John SJ
Editor in Chief

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St. Xavier's College (Autonomous), Palayamkottai– 627 002.

CONFERENCE PROCEEDINGS

International Conference on
"Business Sustainability in Digitalisation – Industry 5.0"

6 & 7 December 2023

Editorial Board

Rev.Dr.A.Michael John SJ

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XAVIER INSTITUTE OF BUSINESS ADMINISTRATION
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International Conference on "Business Sustainability in Digitalisation – Industry 5.0"
on 6 & 7 December 2023

Xavier Institute of Business Administration (XIBA), a Jesuit Business School under the aegis of St. Xavier's College, hosted a two-day International Conference on "Business Sustainability in Digitalization – Industry 5.0" on December 6th and 7th, 2023.

The Inaugural Ceremony commenced with a warm welcome by Rev. Dr. Michael John SJ, the Director of XIBA. Rev. Dr. V. Henry Jerome SJ, Rector of St. Xavier's Institutions, delivered the Inaugural Address, emphasizing the importance of aligning business practices with sustainable principles. The Chief Guest, Mrs. M. Sharmaila, Regional Manager of State Bank of India, Tirunelveli, shared insights on the role of financial institutions in fostering sustainable business practices.

The first day featured enlightening sessions on Digital Transformation and Sustainable Business Models by Dr. Karuppasamy Ramanathan from the Hindustan Institute of Technology and Science, and Leveraging Technology for Environmental Impact by Mr. Deepan, Senior Product Manager at Double Cloud, Netherlands. A panel discussion followed, with esteemed panelists sharing their views on "Reimagining Business Models for a Sustainable Industry 5.0."

Day two delved into Policy and Regulation for Sustainable Digital Transformation with Dr. Shaju G M from MIANZ International College, Maldives, sharing insights on regulatory frameworks. Dr. Jeyanthi Abraham from VIT Technology, Vellore, discussed the longevity and resilience of businesses operating at the intersection of bioscience and Industry 5.0. Dr. Meji Tony from DMI-St. Eugene University, Zambia, shed light on the transformative digitalization journey in Zambian businesses.

The conference concluded with a dynamic panel discussion on "Policy Implications for Nurturing Business Sustainability in Digitalization." Panellists, including, Dr. Selvalakshmi, Principal & Professor Thiagarajar School of Management, Madurai. Dr. S. Madhavan, Professor, Department of Management Studies, Dean of Arts, MS University Tirunelveli. Mr.Sanjay Gunasingh Managing Director, Bellpins, Tirunelveli Dr. Sylas Sargunam from Anna University and Mr. Thomas Antony from Jacobi Power India Limited, Mr. Ajith Christopher, Director, SGJ Group of Companies, Tirunelveli and

Mrs. Sylvia John Regional Member – Project Massom YI-CII, Managing Director, Arvinth Auto Agency, Tuticorin shared valuable perspectives on fostering sustainable practices in the digital landscape.

The Closing Ceremony featured a summary of key takeaways, recognition of outstanding research, and insightful remarks by Rev. Dr. A. Michael John SJ, the Director of XIBA. The event concluded with the announcement of future initiatives and collaborations, leaving participants inspired and eager to contribute to the evolving world of Digitalization.

E-BIKES: TRENDS AND CHALLENGES IN THE INDIAN CONTEXT

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ABSTRACT

In terms of global two-wheeler production and manufacture, India comes in second. There is an expectation that the global electric market will grow significantly in 2026 as a result of numerous government efforts and programs. Market expansion is anticipated during the projection period because this industry is eligible for 100% foreign direct investment under the automatic method. The fuel price continues to increase globally, the level of pollutants and traffic congestion, particularly in urban areas. In addition, the expenses associated with maintaining and operating vehicles are also rising. Electric bikes and scooters might gain popularity as personal transportation options.

INTRODUCTION

One of the most popular forms of transportation is the bike because it makes traveling easier. Two-wheelers have a diverse market that never ceases to astound people with its cutting-edge technology and improved mileage. The Indian e-bike market aims to meet their needs. The Indian men and women choose bikes, scooters, and mopeds that symbolize flair and class. The Indian two-wheeler industry has grown tremendously in the last few years. In the two-wheeler production and domestic sales, Japan and China stand first. In terms of global two-wheeler production and manufacture, India comes in second.

Electric bikes and scooters are well-known forms of personal transportation in industrialized nations like the United States, Japan, and China. The fuel price continues to increase globally, the level of pollutants and traffic congestion, particularly in urban areas. In addition, the expenses associated with maintaining and operating vehicles are also rising. Electric bikes and scooters might gain popularity as personal transportation options.

Over the previous several decades, peak oil prices and the environmental effects of petroleum-based transportation infrastructure have rekindled interest in electric transportation in infrastructure. There are various varieties of sources from which electric vehicles generate electricity, those are nuclear power, fossil fuels, tidal power, solar power, wind power, or any of those combinations.

Upgradation in technology and innovation not only gives comfort but also the fear that environmental pollution is rising. The effects of pollution on humans manifestas global warming.Numerous vehicles contribute to the air pollution caused by carbon dioxide and impure carbon particles, worsening the situation. Almost all vehicles run on fossil fuels, and the quantity of fuel availability is decreasing.

It made the automobile company innovate motorpad vehicles that will not rely upon fossil fuels and run on electricity. It led many automobile companies to invest in research and development to develop an electric bike that will enable users to conserve fuel.

INDIAN CONTEXT

With major automakers and a sharp rise in electric car startups during the previous five years, India hopes to become a global leader in the electric vehicle market. There is an expectation that the global electric market will grow significantly in 2026 as a result of numerous government efforts and programs.

To boost the market for electric vehicles, the government has offered many incentives to manufacturers and consumers. India is the largest unexplored market in the world, particularly for electric motorcycles. Market expansion is anticipated during the projection period because this industry is eligible for 100% foreign direct investment under the automatic method.

By 2030, India wants to shift 30% of its private automobiles, 70% of its commercial vehicles, and 80% of its two- and three-wheelers to electric vehicles. The central and state governments are providing customers and manufacturers with various incentives.

TRENDS

i) Rapid Urbanization and Commuting Solutions

In the growth of urban areas e-bikes have emerged as a practical solution to improve traffic congestion and reduce emissions. Cities worldwide are investing in bike-friendly infrastructure and bike-sharing programs, fueling the demand for electric bikes.

ii) Advancements in Battery Technology

Improvements in battery technology have extended e-bike range and reduced charging times. Lithium-ion batteries, in particular, have become lighter and more powerful, making e-bikes a viable choice for longer commutes.

iii) Integration of IoT and Connectivity

Electric bikes are increasingly integrated with Internet of Things (IoT) technology. This enables features such as GPS tracking, remote diagnostics, and smartphone connectivity, enhancing the user experience and security.

iv) Innovation in Design and Form Factors

E-bike manufacturers are experimenting with innovative designs, including foldable e-bikes and sleek, minimalist aesthetics. These designs cater to different consumer preferences and urban lifestyles.

v) E-Bike Sharing Services

The rise of e-bike-sharing services is similar to traditional bike-sharing programs and is providing convenient access to electric bikes in urban areas. This trend may grow in densely populated cities.

vi) Sustainability Initiatives

Environmental awareness is driving consumers and businesses to choose electric bikes as part of their sustainability efforts. Governments and organizations are incentivizing the adoption of e-bikes through subsidies and tax incentives.

CHALLENGES

The electric bike market in India has been growing steadily over the past few years, with the rise in awareness about the environmental benefits of electric vehicles and the hike in petrol prices. On the other side, India's electric bike market is facing significant challenges despite the government's push towards promoting electric vehicles. Certain challenges faced by the Indian electric bike market are discussed below.

i) Inadequate Charging Infrastructure

There is only limited charging infrastructure available to electric bike owners. The charging time is longer for electric bikes, which upsets the potential buyers.

ii) High Cost of Electric Bikes

The cost of electric bikes is comparatively higher than the petrol price. The upfront cost of purchasing an electric bike is higher, while the operating cost of electric bikes is lower than petrol bikes. The potential buyers who are price-sensitive may be affected.

iii) Limited Range of Electric Bikes

Most electric bikes available in the market today have a range of around 60-70 km on a single charge, which may not be sufficient for long-distance travel. This is not suitable for buyers who rely on bikes for their daily use.

iv) Lack of Awareness among Consumers

Another challenge faced by the electric bike market in India is the lack of awareness among consumers about the benefits of electric bikes. While there is increasing awareness about the environmental benefits of electric vehicles, many consumers are still unaware of the cost savings and other benefits of electric bikes.

CONCLUSION

Being an environmentally friendly product, it is more suited for cities because it may lessen the pollution in the air by reducing the production of dangerous gases. Compared to conventional automobiles, electrically charged vehicles appear to be the most affordable due to the constant increases in fuel prices. In rural locations without enough gas stations, e-bikes are a better option because their owners can charge their vehicles using electricity.

The Electric Bike Market is experiencing a dynamic transformation, driven by the need for sustainable urban transportation solutions. The growth of trends rapid urbanization and technological advancements need to be addressed the challenges such as regulatory complexities and infrastructure development. While the market continues to develop the future of transportation and eco-friendly alternatives need to be addressed as they help in shaping the future environmental concerns of our cities.

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AN EMPIRICAL STUDY TOWARDS CUSTOMER DELIGHT IN READYMADE GARMENTS - APPLICATION OF METAVERSE TOOL

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ABSTRACT

The metaverse is a tool for innovation and the growth of digital networks. Through the use of a digital identity, it offers the opportunity to experience virtual and augmented reality by fusing digital virtuality with actual reality. There are many reasons why the apparel retail industry finds the metaverse to be so appealing. First of all, avatars 3D representations of oneself that might vary from cartoonish approximations to photo-realistic models that are nearly identical in every way will typically be used to represent people in the metaverse. The rise in popularity of online worlds and the metaverse has also given rise to another recent creation that is fully virtual. This article examines the unique applications of metaverse in the fashion sector. In this industry, the metaverse is being evaluated as a marketing tool despite its technical limitations. In virtual worlds, fashion firms should focus on numerous important aspects, including branding, products, digital skins and virtual fashion, logistics and distribution methods, consumer interaction, and customer data. This study article explores the fascinating area where AI and clothing design meet.

KEYWORDS

Metaverse, Artificial Intelligence, Retail Garments and Customer Delight

INTRODUCTION

The apparel industry must contend with escalating international competition and erratic shifts in consumer demand. In order to provide the final product on schedule and at the lowest possible cost of production, manufacturers are under constant pressure to enhance the effectiveness of their manufacturing process. However, it might be challenging to find ideal and reliable solutions in a complicated and ambiguous production environment. The fashion industry can benefit from the metaverse by creating and personalizing virtual retail environments that appeal to new customer demographics. They can blur the lines between real and virtual environments, include customers in the retail environment, and emphasize their brand vision by modifying the virtual reality in the metaverse. Companies can engage clients in a favourable and personalized online experience that entices them to return to the virtual world by providing a strong sense of realism and immersion.

REVIEW OF LITERATURE

According to Kayumovich et al. (2020), conventional marketing entails engaging with the target audience in person and promoting a company's goods or services to consumers through offline.

Civelek et al. (2021) Regarding the traditional marketing communication tools, point out that these include offline marketing communication and advertising activities via traditional media channels, like print, radio, television, newspapers, pamphlets, posters, business cards, magazines, billboards, and billboards.

According to Lee (2022), there is evidence that shoppers who shop in immersive environments are more likely to make purchases and stay engaged for longer than those who browse on standard or mobile websites (Yoo et al., 2023).

RESEARCH METHODOLOGY

It is an empirical study. The data were collected through primary and from Secondary sources. The primary data were collected through structural questionnaires from different levels of respondents like working employees, Entrepreneurs, and students.300 samples were selected from Chennai using convenience sampling method. The data were collected and analyzed using IBM SPSS software 25. Tools like percentage analysis, chi-square, and cross-tabulation were used for this study. The secondary data were collected using books, journals, and websites.

ANALYSIS

Table 1: Cross Tabulation between Gender and Age of the Respondents

		Age			Total
		Less than 25 years old	26 to 45 years old	46 and above years	
Gender	Male	49	91	40	180
	Female	12	50	38	100
Total		61	141	78	280

Source: Primary Data

Inference

Among 280 respondents, the majority of the respondents of 141 are belongs to age group 26 to 45 years old, followed by 78 respondents belongs to above 46 years old.61 respondents belongs to less than 25 years old.

Table 2: Cross tabulation between Gender and Income of the respondents

		Income		Total
		Less than INR ₹ 50,000 pm	INR ₹ 50,001 and above pm	
Gender	Male	57	123	180
	Female	61	39	100
Total		118	162	280

Source: Primary Data

Inference

Among 280 respondents, the majority of the respondents are earning less than INR ₹ 50,000 as a family income per month. They are female respondents. 123 respondents belong to male respondents and earning more than ₹ 50,000 as a family income.

Hypothesis framed

H_0:There is no association between Gender and respondents engaged in online purchase.
H_1:There is an association between Gender and respondents engaged in online purchase.

Table 3: Association between Gender and Customer satisfaction towards Metaverse Tool

Chi-Square Tests			
	Value	Df	Asymp.Sig (2-sided)
Pearson Chi-Square	12.112[a]	3	.000
Likelihood Ratio	12.612	3	.005
Linear-by-Linear Association	6.145	1	.008
N of Valid Cases	300		
a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 16.42.			

Source: Computed data

Inference

From the above Table.3 shows that chi- square test at 5% level of significance p-value is less than the 0.05. So, null hypothesis is rejected. Hence, there is a significant difference between Gender and Customer satisfaction towards Metaverse Tool

CONCLUSION

Meta's proposal may have a significant chance of success if virtual and augmented reality products and services are adopted. Although it's unclear at this time if these gadgets are required to access Metaverse, they should improve the user experience. Since virtual and augmented reality technologies facilitate the blending of the physical and digital worlds, the project's entire concept is meant to be utilized with them. Within the metaverse, marketing strategy innovation is rife. An important development in fashion marketing is the metaverse. Its capacity to revolutionize communication tactics, enhance client involvement, and create new avenues for communication cannot be disputed. The benefits outweigh the disadvantages in spite of the difficulties. The fashion industry is changing as a result of the metaverse's unprecedented chances for creativity, individualization, and teamwork.

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AN ANALYSIS ON BUSINESSES ORIENTED DIGITAL TRANSFORMATION IN COVID – 19 PANDEMIC SITUATION

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ABSTRACT

The rise and prominence of India's digital economy are both fueled by technological advancements. Despite their importance to India's economy, employment, and GDP, SMEs have taken a major hit from the COVID-19 outbreak. In order to gauge the present situation, identify obstacles, and propose policies for digital transformation of India's SMEs, a survey was conducted. A total of 925 SME manufacturing firm principals were polled. This formed the basis of the investigation. Among the difficulties encountered by India's SMEs, according to the survey, are a lack of vision for digital transformation, an inadequate digital infrastructure, and formidable barriers to entry. They are categorized according to development stage, location, and scale, disparities in operational issues, digital transformation effectiveness, status quo, technology adoption, and driving forces become apparent. The government should prioritize policy and guideline support, speed up infrastructure construction, and lay a strong groundwork for digital transformation if it wants SMEs to embrace it. Boost digital transformation efforts, employ cutting-edge training strategies, and fill the digital talent gap. Facilitate the digital transformation and growth of SMEs by building a digital platform and network, establishing collaboration across industries.

KEYWORDS

obstacles, digital transformation and strategies.

1. INTRODUCTION

This represents nearly all of the country's businesses, and it is mostly due to Chinese investment [1]. Nearly three years have passed since the COVID-19 pandemic began in December 2019. Worldwide, 647.6 million people have tested positive for COVID-19, with over 6.6 million losing their lives to the virus. Of the 69 countries or regions with over a million confirmed cases. Meanwhile, at least 30 nations and areas are seeing over a thousand new cases of COVID-19 every single day, and the trend shows no signs of slowing down. India became a major player in the fight against the rising tide of the worldwide economic downturn that the epidemic ushered in because of its scientifically sound and stringently enforced prevention and control methods, which allowed the

country to swiftly regain control of the epidemic and resume work and production sooner than expected[2]. Domestic epidemicprevention and controlhas become more standardized recently, but the situation is still quite precarious due to the virus's mutability and the instability of the epidemic itself.All the businesses in India stay afloat and grow due to the pandemicscenario, which is made even more difficult by foreign imports [3]. The term "digital economy" refers to a relatively new economic model in which digital information and knowledge serve as the primary commodities [4]. The "digital economy" is a buzzword in the business and social spheres in recent years. The digital economy— embodied by cutting-edge technologies like the Internet, IoT, big data, AI, etc.—has unleashed a torrent of development-driven energy, demonstrating the importance of this sector in the fight against the virus. [5].

These days, everyone is talking about how the digital economy is taking over the world, and how digital technology has helped with epidemic management and prevention. Despite SMEs' status as a "fresh force" in the national economy, the road to digital transformation is not likely to be easy for the majority of them as they reach the point of full implementation [6],[7].

2. REVIEW OF LITERATURE

2.1 Digital transformation benefits

According to [8], businesses can benefit from digital transformation in terms of operational efficiency, which in turn boosts their market position and impact through happier customers and better products.According to [9], businesses can boost their performance throughdigital transformation. According to [10], genuine businesses should undergo digital transformation in order to boost performance by cutting costs, increasing efficiency, and introducing new ideas. Digital transformation and development, accordingto Tan Songtao et al. [12], can help businesses successfully cut expenses.

2.2 Digital Technology

In order for businesses to fully embrace the digital age, [11] advocated for a new generation of digital technology to support information structures that are timely, continuous, detailed, and complete. [12], digital technology in particular is seen as crucial for digital transformation in enterprises. Enterprise management transformation has been prompted, [13], and SMEs are encouraged to participate in the value chain by the digital economy. However, small businesses often find themselves stuck at the bottom of the digitalization-based production network as their involvement in the chain grows due to their lack of core technology and the high fixed costs associated with participating. It is extremely important to investigate issues connected to the digital economy and businesses, particularly in light of the fact that India is actively pushing for the growth of its digital economy. Little research and analysis has focused on the

current state of digital applications used by SMEs, and even fewer have addressed the issue of digital transformation of SMEs specifically. Due to their importance to India's economic growth, particularly in light of the current pandemic, small and medium-sized businesses are in a particularly precarious position in terms of their demands for digital transformation.

3. METHODOLOGY

3.1 Data Source

Eleven questions make up the poll, including topics such as company history, digital technology use, digital transformation efficacy, policy appeals, and more. Details can be found in Table 1. To conduct a survey of SME principals who rely on government agencies, trade groups, and social media for resources (e.g., statistics, industrial and information departments, and small and medium-sized enterprise management departments), we used the questionnaire star platform and the targeted questionnaire distribution and recovery method. We conducted an investigation into 925 SME manufacturing business owners and managers from October 2022 to November 2023 to make sure our data accurately reflects their companies' digital development.

Table.1 - Questionnaire on Digital Transformation of SMEs

Research project	Questionnaire items
Enterprise background information	1. Enterprise scale
	2. Enterprise location
	3. Enterprise type
	4. Development stage of the enterprise
	5. Industries of enterprise
Enterprise digital cognition and appeal content	1. Difficulties in enterprise operation
	2. The effectiveness of digital transformation in solving business difficulties
	3. Present situation of enterprise digital transformation
	4. What digital technologies have enterprises applied
	5. Drivers of enterprises' digital transformation
	6. Enterprises' policy demands for digital transformation

Table.2 – Sample Enterprises

Enterprise types		Quantity (piece)	Proportion (%)
Enterprise location	Eastern region	450	48.65
	Central region	170	18.38
	Western region	305	32.98
Enterprise scale	Medium-sized enterprise	280	30.27
	small enterprise	375	40.54
	Microenterprise	270	29.19
Enterprise development stage	Initial period	210	22.70
	Growth period	265	28.65
	Mature period	255	27.57
	Transformation period	195	21.08

DIGITAL TRANSFORMATION OF SMES

3.1.1 Problems Small and Medium-sized Businesses Face

A. Sample Analysis

Table 3 shows that among small and medium-sized businesses, 58.23% consider pressure from the market to be their greatest operational challenge. The transformation burden on operational businesses is severe, according to 38.26% of SMEs; There are problems with employment and technological innovation, according to 28.18% and 26.45% of SMEs, respectively. These are the most common kinds of operational challenges that SMEs encounter.

Table3 - Difficulties Faced by SMEs in Operation

Facing difficult	Total sample	Enterprise development stage				Enterprise location			Enterprise scale		
		Initial period	Growth period	Mature period	Transformation period	Eastern region	Central region	Western region	sized enterprise	small enterprise	Micro Enterprise
No difficulty	4.92	1.25	5.24	12.72	2.13	4.06	7.65	8.12	3.17	9.34	5.78
Financing difficulties	14.32	19.36	16.94	3.89	5.25	15.22	20.15	10.1	5.18	20.15	16.23
Supply chain Pressure	19.58	20.54	26.15	12.53	8.84	17.24	28.75	13.2	13.21	24.32	18.55
High cost of raw materials and equipment	15.73	25.32	14.81	7.32	10.1	9.18	25.91	15.3	8.56	19.73	15.22
Labor Shortage	28.18	22.18	38.32	20.24	15.1	27.53	22.44	24.0	15.58	33.36	38.15
Difficulty in technologicall innovation	26.45	13.55	32.28	22.35	30.5	22.39	38.85	25.4	27.54	32.43	15.28
Enterprise transformation on pressure	38.26	14.42	28.54	48.42	57.9	45.29	20.32	41.4	42.26	39.65	29.14
Market competition pressure	58.23	40.31	58.46	62.46	65.4	60.45	55.24	64	65.36	52.34	63.38

B. Analysis by Enterprise Development Stage

In the early stages of their operations, small and medium-sized businesses often encounter challenges related to labour costs, raw material and equipment prices, and the intensity of market rivalry. Market competition pressure, employment issues, and technology innovation obstacles are the key challenges that rising SMEs encounter. Market competitiveness, enterprise change, and technical innovation are the primary challenges that mature SMEs face. During this time of transition, small and medium-sized enterprises (SMEs) confront three primary challenges: pressure from market rivalry, pressure from enterprise change, and difficulty from technical innovation.

Small and medium-sized enterprises (SMEs) perform differently at different phases of development when looking at sub-items. When comparing the start-up and growth periods, the proportion of SMEs experiencing financing difficulties was 19.36% and 16.94%, respectively, while the proportion in the mature period was 3.89% and 5.25%. On the other hand, when comparing the proportion of SMEs SMEs experiencing supply

chain pressure, the proportion in the transition period was 8.84%, much greater (25.32%) when considering raw materials, equipment, and other costs compared to the mature period (7.32%) and transition period (10.15%); During the expansion phase, the proportion of SMEs in terms of employment was 38.32%, which was much greater than the transition period's 15.15%; During the expansion period (32.28%) and the transition period (30.56%), a large percentage of technological innovation was contributed by SMEs; and transition (57.95%) phases were the most heavily impactedby enterprise transformation pressure; nevertheless, SMEs across all stages are facing intense pressure from market competitiveness. Compared to the overall sample, the proportion of SMEs in the transition phase is much greater at 65.42%, while the start- up period has the lowest share at 40.31 percent and very little pressure.

3.2 Digital Transformation's Business

3.2.1 Total Sample Analysis

Most SMEs think digital transformation hasn't helped much with the aforementioned business problems, according to the poll (Table 4). Forty-four percent of SMEs think digital transformation can help with business problems sometimes, 38.16 percent think it can help with business problems a lot, and very few think it can help with business problems a lot or all at once.

Table.4 - Effectiveness of Digital Transformation in Solving Business Difficulties

Effectiveness	Total sample	Enterprise development stage				Enterprise location			Enterprise scale		
		Initial period	Growth period	Mature period	action period	Eastern region	Central region	Western region	Macro sized enterprise	Small enterprisee	Micro enterprise
Can not solve	15.25	25.4	10.2	5.7	16.79	9.61	11.4	22.56	3.68	8.57	25.93
Occasionallyy solve	40.42	30.7	40.6	34.1	55.64	39.26	42.7	36.76	32.65	46.18	40.36
Solve to some extent	38.16	44.6	26.7	55.6	10.28	42.90	29.2	32.05	45.46	42.08	21.26
Solve to a large extent	12.52	5.67	15.9	7.2	20.38	10.26	17.8	12.06	21.28	6.87	3.07
Completely solved	3.15	1.25	7.25	2.2	3.06	1.53	5.13	1.26	1.89	2.06	4.45

3.2.2 Analysis Based on Enterprise Development Stage

The overall sample and the evaluation of digital transformation effectiveness by SMEs at various stages of development are comparable from an enterprise development stage viewpoint; however, there are notable differences and variations among SMEs at different stages of development. SMEs across all stages of development have a tendency to believe that they can solve business problems on occasion. However, when it comes to the belief that they can solve business problems to a greater extent, SMEs in the transition period have the lowest proportion at 10.28%, which is significantly lower than other stages. Compared to other phases of development, the percentage of SMEs that thought digital transformation might greatly alleviate firms' business problems during the transition era was substantially greater at 20.38%.

It demonstrates that at this time of transition, SMEs favour digital transformation as a means to accomplish enterprise innovation, development, reform, and upgrading.

3.3 Using Digital Technology in SME

3.3.1 Analysis Based on Total Samples

Table 6 shows that the majority of SMEs are making use of e-commerce and big data at the moment. Among SMEs, 45.88% make use of big data technologies, while 41.16% rely on e-commerce platforms. Furthermore, SMEs do make use of cloud computing, AI, and the Internet of Things to varying degrees; in fact, the percentage of SMEs using these technologies surpasses 20%. Generally speaking, SMEs do not make extensive use of digital technologies. Not surprisingly, 20.41 percent of small and medium-sized businesses (SMEs) report not using any digital technology at all. Different digital technologies, like 5G (10.29%), blockchain (6.35%), 3D printing (2.42%), and quantum technology(2.06%), are also not widely used.

Table.5 - Application of Digital Technology in SMEs

Digital technique	Total sample	Enterprise development stage				Enterprise location			Enterprise scale		
		Initial period	Growth period	Mature period	action	Eastern region	Central region	Western region	sized enterprise	enterprise	Enterprise
No digital technology applied	20.41	28.21	25.82	18.95	12.5	15.38	30.22	12.09	5.62	16.14	38.67
Big data	45.88	20.51	51.62	57.86	62.2	48.03	41.87	57.81	74.16	45.17	25.21
Cloud computing	21.52	17.05	19.63	26.52	28.7	22.58	17.26	23.62	30.82	15.92	12.45
5G	10.29	11.56	8.42	10.73	13.0	8.61	2.18	15.29	16.89	7.78	5.18
Artificial intelligence	26.35	15.92	20.86	34.67	40.8	28.75	25.46	22.72	42.32	24.84	10.65
Internet of Things	23.46	26.75	10.83	37.92	28.4	20.74	31.92	25.38	40.16	13.34	21.58
Blockchain	6.35	4.68	3.15	8.41	8.06	5.38	7.86	6.53	3.98	8.56	5.03
3D printing	2.42	0.00	2.24	4.06	1.86	3.56	1.89	1.56	1.84	4.06	0.00
Quantum technology	2.06	0.00	4.48	2.12	0.00	1.12	2.16	2.52	1.56	3.42	1.28
Electronic commerce	41.16	46.62	30.65	51.75	36.1	52.04	26.12	34.27	44.82	48.25	28.24

3.4 Problems Faced by Digital Transformation of SMEs

3.4.1 Obvious Obstacles to Digital Transformation of SMEs

In addition to intense pressure from competitors in the market, small and medium-sized businesses in India confront formidable obstacles when trying to modernize their operations and use new technologies. A larger percentage of SMEs meet market needs. Digital transformation can minimize market competition, transformation and development, and technological innovation issues for SMEs. This can be achieved in a number of ways, including better production efficiency, lower costs, and more accurate supply and demand matching. In other words, this proves without a reasonable doubt that digital transformation helps SMEs achieve their goals. On the other hand, the poll found that SMEs in India are not very digitally transformed and that digital transformation presents many challenges, making it even more difficult for SMEs to digitally convert. Lastly, digital technology's scope and depth of application are also indicative of a low application level.

3.4.2 SME's Lack Digital Transformation Thinkings

It is apparent that Indian SMEs are missing in digital transformation thinking, which is delaying digital technology adoption. Small and medium-sized enterprises' strategic awareness, knowledge reserves, managerial competencies, and other variables limit their digital transformation awareness. In addition to not knowing the term "digital transformation," small and medium-sized organizations (SMEs) don't recognize its benefits, requirements, or implementation stages. The results of the poll make it crystal clear that SMEs in India are not interested in undergoing digital transformation. Nearly half of all SMEs have not yet undergone digital transformation, and even fewer proactively seek to do so; this suggests that SMEs lack the intrinsic motivation necessary to make the change. The mindset of business operators has a significant impact on the growth of organizations. This would weakenSMEs' ability to withstand crises and rebuild the COVID-19. Specifically, COVID-19's immediate and long-term effects bring to light the shortcomings of SMEs' digital deployment, supply chain management, and Omni channel operations. In particular, it reflects intelligent decision-making and other crucial use cases of digital technology.

CONCLUSION

The tremendous advancements in modern information and communication technologies have caused a sea change, known as the digital transformation of organizations. Particularly for long-standing SMEs without a competitive advantage at their heart, this shift will affect every business. We can only seize the first chance and gain a competitive edge by speeding up the digital transition, actively adjusting to this change, and courageously embracing it. In addition to being an ongoing process of promotion, the digital transformation of SMEs is a plan that is both complex and long-term. You won't see results right away. But the most crucial issue is that every old business must jump on the bandwagon of digital transformation immediately or perish in the face of technological obsolescence.

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SCHEMES FOR THE WELFARE OF WOMEN POLICE IN TAMIL NADU IN THE YEAR 2023

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ABSTRACT

The objectives of the study is to analyze the special schemes given by the Tamil Nadu government in the year 2023 for the welfare of women police in Tamil Nadu. To Increase the efficiency of women police and to helps in establishing work place, family place peace the need of welfare facilities is increasingly pertinent topic in the modern world. Welfare facilities and services for employees are increasingly becoming important in every organisation. Satisfaction of employees is a major determinant of the success of any organization, therefore, success is a state of well-being of the workers. This article looks at the welfare facilities and services to the women police. The article presents the Tamil Nadu government schemes for the welfare of the women police in Tamil Nadu.

KEYWORDS

Police , Women, Welfare facilities

INTRODUCTION

> **The World cannot sustain itself without water**
> **Peace will not prevail sans effective Policing**
> **Growth will not be there without Peace and Prosperity.**

The Police Department has ensured that a peaceful environment prevails in the state and has enabled law-abiding citizens to carry out their daily pursuits without fear in their minds. Women policing job is considered to be one of the most stressful roles ambiguity and excess overload occupation. Women are playing great role in their family , socio –economic and political environment. Women are the main stream of progress for a country and for a family.

TAMIL NADU POLICE

Tamil Nadu Police Department is the primary law enforcement agency of the state of Tamil Nadu, India. It is over 150 years old and is the fifth-largest state police force in India. Tamil Nadu has a police-population ratio of 1:632.

General nature: Local civilian police; Local civilian agency | Population: 7,21,38,958
Operations jurisdiction: Tamil Nadu | Headquarters: Mylapore, Chennai |

WOMEN POLICE

To especially cater to the complaints and grievances of women, the first all-women Police station was set up in 1992 by the Government. At present 200 all-women Police stations are functioning in the state, with one such station the grievances of women. In fact about 40% of the All Women Police stations in the country are located in Tamil Nadu. In addition, every Police station has been ordered to have one Woman Sub-Inspector and two Women Police Constables.

WOMEN POLICE IN INDIA

In India, the first Woman Police Officer was appointed in Kerala, in the Travancore Royal Police in 1933. The first Woman IPS Officer was appointed in 1972. Today, of the 1,722,786 Police Officers in the country, only 105,325 are women across all ranks. This amounts, on average to a mere 6.11% of the total police force in India, as of 1st January 2014 (as per the date with the Bureau of Police Research and Development, Ministry of Home Affairs). The numbers and proportion of women police officers vary significantly between the states, with Chandigarh having the highest (14.6%) followed by Tamil Nadu (12.4%) and Andaman & Nicobar (11.2%). Lowest among the states are Meghalaya (2.8%), Nagaland (1%) and Assam (0.9%). The numbers have grown, albeit marginally, in the last 5 years, yet they are woefully short of the 33% threshold recommended repeatedly by the Ministry of Home Affairs. In 2008, women made up 3.9% of the total police officers, which has grown to 6.11% in 2014.

WOMEN POLICE IN TAMIL NADU

The administrative control of Tamil Nadu Police vests with the Home Minister. Tamil Nadu police force is headed by a Director General of Police (Law and order). He may be assisted by an Additional Director General of Police (Law & Order). For administrative purposes, the state has been divided into four police zones - North, South, West, and Central each headed by an Inspector General of Police. The IG may be assisted by a Deputy Inspector General of Police. Each district is headed by a Superintendent of Police whereas major metropolitan cities such as Chennai Madurai Salem Tirunelveli Tiruppur and Coimbatore have a separate police force headed by a City Police Commissioner equivalent to the rank of Inspector General of Police.

Policies and practices followed by the police department For women police

- All postings and ranks in the police department are common both to women and men police officers.
- They are eligible to be posted to Sub-divisions, Criminal Investigation Department, Intelligence, Law & Order, Traffic, and Detective.
- Women police officers are eligible for leave, medical facilities, and all other amenities to which women employees of Government are entitled.

- Women Police stationsare established to focus on effective investigation of crimes against women and protection of women and to inspire confidence.
- The uniform rules are applicable to women police officers except for those who complete sixteen weeks of pregnancy. In such cases separate uniform as prescribed for IPS officers (women) or Khaki colour Saree and Blouse or Khaki colour Salwar - Kameez can be worn.

The privacy and other personal inconveniences peculiar to women will be respected and necessary relief and amenities would be provided by the officers in charge.

SCHEMES FOR THE WELFARE OF WOMEN POLICE

1. Navaratna scheme

Marking the 50th anniversary of enlisting women into the police force in Tamil Nadu, Chief Minister MK Stalin has made 'Navaratna' announcement for women police. Stalin, while speaking at the 50th year anniversary of the induction of women into the police force, said the women's police force had a humble beginning with 22 cadets in 1973, now fifty years later the force is 35,329 cadet-strong. The women cops are now serving and sacrificing on par with their male counterparts. The event hosted in Jawaharlal Nehru indoor stadium featured a parade by a contingent of women cops. During the event, the Chief Minister announced a nine-point scheme 'Navaratna' for women in the police force.

Here are the announcements

- Roll-call, a long-standing demand of women constables, will be shifted to 8 am.
- Women guards and hostels will be set up soon in Chennai and Madurai
- A separate restroom with toilet facilities will be constructed for women constables in all police stations
- For the children of women constables, police nurseries have been started in some districts. To improve this, the archive will soon be set up at all required locations
- Kalaignar Karunanidhi Police Service Award and trophy will be presented annually
- The authorities will be directed to provide leave and transfer of duty to women constables according to their family circumstances
- Shooting competitions will be held annually for women constables and prizes will be awarded. A National Level Women Guard Shooting Competition will be organized in Tamil Nadu
- A national conference on "Women in Police Department" will be held annually in Tamil Nadu to discuss the needs, problems, and performance of women police officers.
- An advisory committee will be set up in the DGP office to further improve the performance of women constables.

2. AVAL (Avoid Violence through Awareness and Learning) Scheme:

The CM also launched the Aval project, which aims to safeguard and improve the self-defense skills of girls. The project was initiated by the Greater Chennai City Police. "Women police deserve a double salute when compared to men for they protect the state while taking care of their families," said Stalin.

- Development of Police Juvenile Forums in Chennai Metropolis
- Skill Development Training for Police
- Public relations through social media
- Self-defense training for women and children

CONCLUSION

This study attempts to analyze the women police in India, Tamil Nadu, the Policies and practices followed by the police department for women police, and welfare schemes for women police in Tamil Nadu such as the Navarathna scheme and AVAL scheme. With the new schemes, senior police officials will prioritize women police officers in terms of shifting of workplaces and leave concessions. It will help the women police in many ways to satisfy their family life and work lives.

"Women police deserve a double salute when compared to men for they protect the state while taking care of their families," said Stalin.

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CYBER SECURITY IN THE AGE OF INDUSTRY 5.0: OPPORTUNITIES AND CHALLENGES IN A HYPER CONNECTED WORLD

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ABSTRACT

The manufacturing industry is on the brink of a transformative era, Industry 5.0, characterized by pervasive hyperconnectivity, automation, and artificial intelligence. While this transformation presents immense opportunities for heightened efficiency, productivity, and innovation, it also introduces unprecedented cybersecurity challenges. This paper delves into the intricate relationship between cyber security and Industry 5.0, highlighting the opportunities and challenges that emerge in this hyper-connected manufacturing landscape. Blockchain technology emerges as a transformative force in securing Industry 5.0 ecosystems. Its decentralized and immutable nature fosters an environment of trust and transparency across the supply chain. Blockchain-enabled applications can revolutionize digital identity management, intellectual property protection, and secure data sharing among stakeholders. Digital twins, virtual representations of physical assets and processes, play a pivotal role in enhancing cyber security resilience in Industry 5.0. By continuously mirroring the real-world behavior of manufacturing systems, digital twins facilitate real-time monitoring, anomaly detection, and threat mitigation. Leveraging digital twins, organizations can proactively address potential cybersecurity risks before they materialize into significant disruptions.

KEYWORDS

Industry 5.0, cyber security, block chain, digital twins, manufacturing

1. INTRODUCTION

The Industrial Revolution sparked a significant transformation in the 18th century, marking a shift from traditional handicraft methods to mechanized production. This revolution, known as Industry 1.0, originated in England in 1760 and spread to United States by the end of the century. It revolutionized industries such as mining, textiles, agriculture, and glass manufacturing. Next phase, Industry 2.0, emerged between 1871 and 1914, characterized by advancements in transportation and communication infrastructure. This era facilitated the rapid movement of people and ideas, fueling economic growth and business productivity. However, it also led to a surge in unemployment as machines replaced factory workers. Industry 3.0, the digital revolution, took hold in the 1970s,introducing the automation of memory-programmable

controls and computers. This period emphasized mass production and the utilization of digital logic, integrated circuit chips, and other technologies. It brought about innovations such as computers, digital cellular phones, and the internet, fundamentally altering traditional products and business processes. Industry 4.0 represents the convergence of physical assets with advanced technologies like artificial intelligence, the Internet of Things (IoT), robotics, 3D printing, cloud computing, and more.

Organizations that embrace Industry 4.0 gain the flexibility and data-driven insights required to thrive in the modern era. Looking ahead, Industry 5.0 promises to further enhance efficiency and intelligence through the next generation of technological advancements. This revolution is poised to transform industries and society as we know it. Industry 4.0 introduced cyber-physical systems (CPS) and paved the way for Industry 5.0, which emphasizes human-machine collaboration and AI integration for enhanced production quality and sustainability. Blockchain technology can address the cyber security challenges arising from this convergence of physical and digital worlds. Digital twins, virtual representations of physical assets and processes, empower organizations with unprecedented control over their manufacturing operations.

2. LITERATURE REVIEW

J. Granados, P. Fraga, and C. Alarcon (2016) provide a survey of cyber security challenges and solutions for the Industrial Internet of Things (IIoT). The authors discuss the resource-constrained nature of IIoT devices, the lack of standardized security protocols, and the potential for physical attacks on IIoT infrastructure. They also discuss a number of potential solutions, such as lightweight cryptography, intrusion detection, and security gateways.

Al-Fuqaha, M. Guizani, M. Mohammadi, M. K. Rehmani, and S. Al-Turki (2017) provide a comprehensive overview of cybersecurity for cyber-physical systems (CPS). The authors discuss the unique security challenges of CPS, such as the tight coupling of physical and digital systems, the real-time nature of CPS operations, and the potential for physical harm from cyberattacks. They also discuss a number of potential solutions, such as secure system design, intrusion detection, and secure data management.

Z. Wan, Y. Xu, and Z. Li (2018) provide a survey of cyber security challenges and solutions for manufacturing. The authors discuss the increasing reliance on automation and IT systems in manufacturing, the growing complexity of supply chains, and the need for secure data sharing. They also discuss a number of potential solutions, such as risk management, access control, and incident response.

Y. Lu, X. Wang, Y. Zhang, T. Lin, and Z. Choo (2022) provide a comprehensive overview of cybersecurity challenges and solutions in Industry 5.0. The authors discuss the expanded attack surface, data integrity and manipulation concerns, supply chain vulnerabilities, access control and authentication vulnerabilities, edge computing

security concerns, legacy system integration challenges, AI and ML vulnerabilities, human error and insider threats, and cybersecurity skills gap. They also present a number of promising solutions, such as secure development and deployment, access control and authentication, data encryption and privacy protection, vulnerability management and patching, continuous monitoring, and incident response, regulatory compliance and governance, and education and awareness.

M. N. Aman, A. Zomaya, and S. Varadarajan (2022) explore cyber security challenges and opportunities in Industry 5.0 from a multi-disciplinary perspective. The authors discuss the convergence of IT and OT systems, increasing reliance on third-party services, data governance and privacy compliance, skills shortages and cyber security awareness, regulatory complexity and compliance, and international collaboration and information sharing. They also highlight the potential of Industry 5.0 to enhance cyber security, such as through the use of AI, machine learning, and blockchain.

S. L. Keoh, T. C. Chu, H. Zhang, and W. Zhang (2023) propose a holistic approach to cyber security in Industry 5.0. The authors discuss the need for a multi-stakeholder approach, the importance of risk management, and the potential of using AI to enhance cyber security. They also emphasize the importance of education and awareness, regulatory compliance, and international cooperation.

3. HYPER CONNECTED WORLD

The hyper-connected world is characterized by a dense network of interconnected devices, systems, and individuals. This pervasive connectivity, enabled by the proliferation of the Internet of Things (IoT) and other technologies, has revolutionized various aspects of our lives, from communication and commerce to education and entertainment. This interconnectedness, while offering immense opportunities for innovation and efficiency, also presents significant cybersecurity challenges. The expanded attack surface created by the hyper-connected world increases the vulnerability to cyber attacks, making it crucial to implement robust cyber security measures to protect critical infrastructure, safeguard sensitive data, and maintain the integrity of networks and services.

4.BLOCK CHAIN, DIGITAL TWINS, AND CYBER PHYSICAL SYSTEM: INDUSTRIAL APPLICATIONS

The Industrial Internet of Things (IIoT) has revolutionized industrial processes by enabling the seamless integration of physical and digital worlds. However, the increasing volume and complexity of IIoT data pose significant challenges in terms of data security, privacy, and real-time decision-making. Block chain, digital twins, and edge computing have emerged as promising technologies to address these challenges and enhance the efficiency and security of industrial applications.

4.1 Blockchain: A Distributed Ledger for Secure Data Management

Blockchain is a decentralized, distributed ledger technology that provides a tamper-proof and transparent record of transactions. In the context of IIoT, blockchain can be used to securely store and manage sensor data, ensuring data integrity and preventing unauthorized access. Additionally, blockchain can be used to track the provenance of data, providing traceability and accountability throughout the industrial supply chain.

4.2 Digital Twins: Virtual Representations for Real-time Insights

Digital twins are virtual representations of physical assets that mirror their real-world counterparts in real-time. By leveraging sensor data and advanced analytics, digital twins provide insights into the health, performance, and potential issues of physical assets, enabling proactive maintenance and predictive analytics.

4.3 Cyber Physical System (CPS)

Cyber-physical systems (CPS) are tightly integrated systems that bridge the gap between the physical and digital worlds. They comprise interconnected physical objects equipped with sensors, actuators, and computational capabilities that communicate and collaborate with each other over a network. This seamless integration enables real-time data exchange, analysis, and decision-making, transforming various industries, including manufacturing, healthcare, and transportation. The integration of blockchain, digital twins, and cyber-physical system creates a powerful synergy that can revolutionize industrial applications.

Blockchain provides the security and transparency required for secure data management, while digital twins offer real-time insights into the physical world. Edge computing brings intelligence to the edge, enabling real-time decision-making and control. The integration of blockchain, digital twins, and edge computing has the potential to revolutionize industrial applications by enhancing security, improving efficiency, and enabling real-time decision-making. As these technologies mature and adoption increases, we can expect to see even more innovative and transformative use cases emerge.

5. APPLICATIONS IN MANUFACTURING INDUSTRY

5.1 Block chain

5.1.1. Supply Chain Traceability and Provenance Tracking

Blockchain technology provides an unparalleled track-and-trace system, enabling manufacturers to monitor the movement of goods and materials from raw materials to finished products. This transparency ensures product authenticity, prevents counterfeiting, and facilitates recalls in case of defects. By embedding unique identifiers into the blockchain, manufacturers can track the origin and history of each product, allowing them to verify the provenance of components and ensure ethical sourcing.

For instance, a furniture manufacturer can use blockchain to track the origin of the wood used in their products, ensuring that it is sourced from sustainably managed forests. Similarly, a food producer can use blockchain to track the movement of their products, ensuring that they meet food safety regulations and prevent recalls.

5.1.2. Smart Contracts for Automated Transactions and Reduced Costs:

Blockchain-based smart contracts automate agreements and transactions between participants in the supply chain, eliminating intermediaries and reducing administrative costs. These contracts self-execute upon predefined conditions, ensuring timely and secure payments and streamlining operations. Smart contracts can be used to automate payments between suppliers and manufacturers, eliminating the need for manual invoicing and reconciliation. This automation reduces costs, improves efficiency, and reduces the risk of errors.

For example, a clothing manufacturer can use smart contracts to automate payments to its suppliers based on the delivery of goods. Once the goods are delivered and verified, the smart contract automatically releases payment to the supplier, eliminating the need for manual processing.

5.2 Digital Twins:

5.2.1 Predictive Maintenance and Reliability Enhancement:

Predictive maintenance is a crucial aspect of Industry 5.0, emphasizing proactive measures to prevent asset failures and ensure continuous production. Digital twins play a pivotal role in achieving predictive maintenance by providing real-time insights into the health and performance of manufacturing assets. By continuously monitoring sensor data, digital twins can identify potential issues and anomalies, enabling predictive maintenance schedules. This proactive approach prevents unexpected downtime, reduces maintenance costs, and extends asset lifespan.

For instance, a digital twin of a turbine can continuously analyse vibration data, temperature readings, and other key parameters. By identifying subtle changes in these parameters, the digital twin can predict potential failures, allowing maintenance personnel to schedule corrective actions before the turbine breaks down.

5.2.2 Collaborative Manufacturing and Knowledge Sharing:

Industry 5.0 emphasizes collaboration and knowledge sharing among stakeholders to optimize manufacturing processes and enhance decision-making. Digital twins serve as shared repositories of knowledge, facilitating collaboration across various departments and organizations. By providing a single, comprehensive view of assets, processes, and historical data, digital twins enable engineers, technicians, and managers to access and share insights collaboratively. This shared knowledge base facilitates informed decision-making, troubleshooting, and continuous improvement across the manufacturing value

chain. For example, a digital twin of a production line can be used to visualize the entire process, including the interactions between machines, operators, and materials. This shared view allows engineers to identify bottlenecks and inefficiencies, while operators can provide feedback on process issues and suggest improvements.

5.3 Cyber Physical System (CPS)

5.3.1 Smart Manufacturing and Process Optimization

Industry 5.0 emphasizes the integration of physical and digital worlds to create intelligent manufacturing systems. CPS plays a key role in realizing smart manufacturing by enabling real-time data collection, analysis, and control of manufacturing processes. CPS seamlessly integrates sensors, actuators, and control systems into the physical manufacturing environment, enabling real-time data acquisition from machines, robots, and other assets. This data is then analyzed using advanced algorithms and machine learning techniques to provide insights into process performance, identify potential issues, and optimize production parameters.

For instance, a CPS implementation in a plastics injection moulding process can monitor injection pressure, temperature, and cooling cycles in real time. By analysing this data, the CPS can adjust process parameters to optimize product quality, reduce cycle times, and minimize material waste.

5.3.2 Predictive Maintenance and Proactive Asset Management:

Predictive maintenance is a cornerstone of Industry 5.0, aiming to prevent asset failures and ensure continuous production. CPS contributes significantly to predictive maintenance by providing real-time monitoring and predictive analytics capabilities. CPS continuously collects sensor data from manufacturing assets, including vibration, temperature, and current consumption. This data is fed into predictive models that analyze historical patterns, identify anomalies, and predict potential failures before they occur.

For example, a CPS monitoring a rotating machine can analyze vibration data to detect subtle changes that indicate potential bearing wear or other mechanical issues. Proactive maintenance actions can be scheduled based on these predictions, preventing unplanned downtime, and extending asset lifespan.

6. OPPORTUNITIES OF INDUSTRY 5.0 IN HYPER CONNECTED WORLD

6.1 Blockchain

6.1.1 Personalized Manufacturing and Mass Customization

Block chain can facilitate personalized manufacturing by enabling secure and controlled sharing of customer data and preferences among supply chain partners. This data-driven approach allows manufacturers to produce customized products tailored to individual consumer needs, ushering in a new era of mass customization.

6.1.2 Decentralized Manufacturing and Supply Chain Networks

Blockchain can facilitate the development of decentralized manufacturing and supply chain networks, where production is distributed among multiple participants, each with specialized capabilities. This decentralized approach can enhance flexibility, resilience, and responsiveness to changing market demands.

6.1.3 Data Ownership and Monetization

Blockchain can empower manufacturers to securely manage and monetize their data assets. By granting controlled access to valuable data, manufacturers can generate additional revenue streams while maintaining ownership and control over their intellectual property.

6.1.4 Anti-Counterfeiting and Brand Protection

Blockchain's ability to provide a tamper-proof and verifiable record of product authenticity can effectively combat counterfeiting and protect brand reputation. By embedding unique identifiers into the blockchain, manufacturers can issue digital certificates of authenticity that are linked to the product's identity. This verifiable authenticity safeguards consumers from counterfeits and fosters trust in the brand.

6.1.5 Sustainable manufacturing and Circular Supply Chain

Sustainable manufacturing encompasses a holistic approach that integrates environmental considerations into all aspects of manufacturing operations, from product design and production to distribution and end-of-life management. Circular supply chains adopt a systems approach to minimize waste and maximize resource recovery by closing the loop in the product lifecycle.

6.2 Digital Twins

6.2.1 Enhanced Process Optimization and Simulation

Digital twins can replicate and simulate manufacturing processes, allowing engineers to test new configurations, optimize production parameters, and identify potential bottlenecks before implementing changes in the physical environment. This virtual experimentation can significantly improve process efficiency and reduce trial-and-error efforts.

6.2.2 Product Lifecycle Management and Digital Thread

Digital twins can provide a digital thread that connects product design, manufacturing, and service phases, enabling a seamless flow of information throughout the product lifecycle. This digital thread can facilitate data-driven decision-making, enhance product quality, and improve customer service.

6.2.3 Closed-Loop Manufacturing and Circular Supply Chains

Digital twins can track the movement and status of materials and products throughout the supply chain, enabling the implementation of closed-loop manufacturing and circular supply chain practices.

6.2.4 Predictive Cyber security and Anomaly Detection

Digital twins can be used to create predictive cyber security models that can identify anomalous behavior in manufacturing systems, potentially indicating cyber attacks. This proactive approach can enhance cyber security resilience and minimize the impact of cyber attacks on manufacturing operations.

6.3 Cyber Physical System (CPS)

6.3.1 Hyper connected Manufacturing Ecosystems

CPS will enable the creation of hyper-connected manufacturing ecosystems, where physical and digital worlds are seamlessly integrated, allowing for real-time data exchange, analysis, and decision-making. This hyper connectivity will drive unprecedented levels of efficiency, automation, and collaboration across the manufacturing value chain.

6.3.2 Manufacturing and Self-Optimizing Processes

CPS will empower autonomous manufacturing systems that can operate independently, adapt to changing conditions, and optimize production processes in real-time. This autonomous capability will lead to reduced human intervention, increased flexibility, and enhanced responsiveness to market demands.

6.3.3 Collaborative Manufacturing and Distributed Production

CPS will promote collaborative manufacturing ecosystems, where multiple manufacturers and suppliers can collaborate seamlessly, sharing resources, expertise, and production capabilities. This distributed production model will enable greater flexibility, adaptability, and resilience in response to changing market dynamics.

6.3.4 AI-Powered CPS and Adaptive Manufacturing

CPS will be integrated with artificial intelligence (AI) and machine learning (ML) algorithms to enable adaptive manufacturing systems. AI-powered CPS will continuously learn from data, adapt to changing conditions, and optimize production processes in real-time, leading to increased efficiency, productivity, and quality.

6.3.5 Cyber security for CPS-Enabled Manufacturing

As the adoption of CPS in manufacturing grows, robust cyber security measures will become crucial to protect against cyber attacks that could disrupt operations, compromise data integrity, or manipulate CPS-controlled systems. Advanced security protocols, access control mechanisms, and continuous monitoring will be essential for securing CPS-enabled manufacturing ecosystems.

7. CHALLENGES OF INDUSTRY 5.0 IN HYPER CONNECTED WORLD

7.1 Block chain

7.1.1 Increased Attack Surface

The adoption of block chain technology in manufacturing will expand the attack surface, creating new entry points for cyber attacks. As more devices, systems, and

networks become interconnected through block chain, the potential for unauthorized access, data breaches, and disruptions increases.

7.1.2. Smart Contract Vulnerabilities

Smart contracts, the self-executing agreements embedded in block chain, are not immune to vulnerabilities. Coding errors, malicious intent, and unforeseen interactions can lead to smart contract vulnerabilities that can be exploited to manipulate transactions, steal funds, or disrupt operations.

7.1.3. Supply Chain Vulnerabilities

Block chain-enabled supply chains, while offering transparency and traceability, can also introduce new vulnerabilities. Attackers can target supply chain participants, infiltrate the network, and manipulate data to disrupt production processes, compromise product quality, or introduce counterfeit goods.

7.2 Digital Twins

7.2.1 Artificial Intelligence (AI) and Machine Learning (ML) Vulnerabilities

Digital twins often incorporate AI and ML algorithms to analyse data and optimize operations. However, AI and ML models can be susceptible to adversarial attacks, where malicious input is used to manipulate the model's behaviour.

7.2.2 Human Error and Insider Threats

Human error, such as misconfigurations, improper access control, and lack of cyber security awareness, can create vulnerabilities that cyber attacks can exploit. Insider threats, where employees intentionally compromise systems, also pose a significant risk.

7.3 Cyber Physical System (CPS)

7.3.1 Data Integrity and Manipulation Concerns

CPS rely on real-time data exchange between physical and digital components to make informed decisions and control manufacturing processes. Compromising the integrity of this data could lead to inaccurate or manipulated information being fed into the CPS, potentially causing erroneous decisions, disruptions, or even physical harm.

7.3.2 Edge computing security concerns

Edge computing, where data is processed closer to the source to reduce latency and improve responsiveness, is often employed in CPS applications. While improving efficiency, edge computing introduces additional security considerations, as edge devices may be more vulnerable to cyber attacks due to their distributed nature and limited resources.

8. CONCLUSION

Industry 5.0 presents a transformative opportunity for manufacturing, offering unprecedented levels of efficiency, productivity, and innovation. However, this hyper-connected world also introduces significant cybersecurity challenges that must be addressed to ensure the successful implementation of Industry 5.0. This paper has explored the intricate relationship between Industry 5.0 and cyber security, highlighting the opportunities and challenges that emerge. We have examined the transformative potential of blockchain technology in securing supply chains, enhancing data integrity, and facilitating secure collaboration. We have also explored the crucial role of digital twins in predictive maintenance, process optimization, and anomaly detection, contributing to greater cyber security resilience. Additionally, we have discussed how cyber-physical systems can enable intelligent and adaptive manufacturing ecosystems, emphasizing the need for robust cybersecurity measures to protect these interconnected systems.

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LI - FI TECHNOLOGY

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ABSTRACT

In this paper, we present initial level designs and results of a small-scale model of a vehicle-to-vehicle communication system using light fidelity (Li-Fi) technology, a new technology that was developed recently, which still needs more research on its sustainability for outdoor vehicular networks. Vehicle-to-vehicle communication is the most efficient solution for traffic management in order to reduce vehicles' accidents. The proposed Li-Fi technology in this paper comprises mainly light-emitting diode (LED) bulbs as a means of connectivity by sending data through the light spectrum as an optical wireless medium for signal propagation. In fact, the usage of LED (li-Fi) eliminates the need for complex wireless networks and protocols. Explanations regarding vehicle-to-vehicle communication are explored in this work. Both numerical simulations using the package and experimental results are also presented, which agree as well.

KEYWORDS

Li-Fi, Wi-Fi, Visible Light Communication, Radio Spectrum,LED

INTRODUCTION

Li-Fi is a wireless technology that uses optical networking technology and light-emitting diodes (LEDs) for data transmission.LiFi technology is designed to use LED light bulbs similar to those currently used now in many energy-conscious houses and offices. Since LiFi bulbs are outlined with a chip that modulates the light imperceptibly for optical data transmission the data is transmitted by the LED bulbs and received by photoreceptors. Li-Fi, as it, has already achieved blisteringly high speeds in the lab. Researchers at the Heinrich

Hertz Institute in Berlin, Germany, researched and has reached data rates of over 500 megabytes per second using a standard white-light LED. Researcher Haas has set up a spin-off firm to sell a consumer VLC transmitter that is ready for launch next year. It is capable of transmitting data at 100 mb/s - faster than most United Kingdom (UK) broadband connections.

GENESIS OF LI-FI

Harald Haas, who is a professor at the University of Edinburgh who began his research in the field in 2004, gave a debut demonstration of the so-called Li-Fi prototype at the TED Global conference conducted in Edinburgh on 12th July 2011. He demonstrated with the help of a table lamp with an LED bulb to transmit a video of blooming flowers that was then projected onto a screen behind him.

During the testing he periodically blocked the light from lamp to prove that the lamp was indeed with the source of incoming data. At TED Global conference , Researcher Haas demonstrated a data rate of transmission of around 10 mbps comparitively to a fairly good UK broadband connection. AfterTwo months he achieved 123Mbps.

HOW LI-FI WORKS?

Li-Fi is carried out using white light LED bulbs at the downlink transmitter. These devices are predominantly used for illumination only by applying a constant current. At the same time, by fast and slight variations of the current, the optical output is made to vary at extremely high speeds. This property of the optical current is enacted in the Li-Fi setup. This operational procedure is very simple, that is, if the LED is on, you transmit a digital 1, if it's off you transmit a 0. The LEDs can be easily turned on and off very quickly, which paved opportunities for transmitting data. Therefore required thing is some LEDs and a controller that codes data into those LEDs. All that, one has to do is to vary the rate at which the LEDs flicker depending upon the data we want to encode.

HOW IT IS DIFFERENT?

Li-Fi is based on LED's for the transfer of data. The data transfer can be done with the help of all kinds of light, no matter the part of the spectrum to which they belong. In other words, the light can belong to the invisible, ultraviolet, or visible part of the spectrum.

In addition to that the speed of the internet is incredibly high and you can download movies, games, music etc in just a few minutes with the help of this technology.

This technology removes limitations that have been already put on the user by the Wi-Fi. You need not be in a region that is Wi-Fi enabled to access the internet. Users can simply stand under any form of light and surf the internet since the connection is made in case of any light presence. Hence there cannot be anything better than this type of technology.

Comparison of Wi-Fi and Li-Fi

Parameter	Li-Fi	Wi-Fi
Spectrum Used	Visible Light	RF
Standard	IEEE 802.15.7	IEEE 802.11
Range	Based on Light Intensity(< 10m)	Based on Radio propagation & interference(< 300 m)
Data Transfer Rate	Very High (Gbps)	Low (100Mbps-1Gbps)
Power Consumption	Low	High
Cost	Low	High
Bandwidth	Unlimited	Limited

USES OF LI-FI TECHNOLOGY

This can be utilized in places where it is very difficult to lay the optical fiber like in hospitals. In the operation theatre, Li-Fi technology can be connected with modern medical instruments. In traffic signals LiFi can be practiced which will communicate with the LED lights of the cars and the accident rate can be brought down. In addition to that, thousands and millions of street lamps can be transferred to LiFi lamps for transferring data. In aircraft also LiFi can be used for transmitting data. It is very helpful in petroleum or chemical plants where other transmission or frequencies could be hazardous.

Further developments can be made in this method, like using an array of LEDs for parallel data transmission, or else using mixtures of red, green, and blue LEDs to vary the light's frequency with each frequency encoding and a different data channel. Such advancements provided a theoretical speed of 10 Gbps –which means that one can download a full high-definition film in just 30 seconds.

REAL TIME APPLICATION OF LI-FI TECHNOLOGY

1. Hospitals

Operating theatres do not allow Wi-Fi because of radiation concerns, and there is also a lack of dedicated spectrum. While Wi-Fi is located in many hospitals, that makes interference from cell phones and computers which can block signals from monitoring equipment. Li-Fi solves two problems: lights are not only allowed in operating rooms but tend to be the most glaring fixtures in the room. Li-Fi has 10,000 times the spectrum of Wi-Fi, delegates red light to priority medical data. Code Red! Operation theatres (OTs) prohibit Wi-Fi due to radiation concerns. Using Wi-Fi at hospitals blocks the signals for monitoring equipments. So, it may cause hazardous effects to the patient's health, due to improper working of medical equipment. To rectify this and to make OT tech safe, Li-Fi can be used to access the internet and also to control medical apparatus. This will be much beneficial for conducting future robotic surgeries and other automated procedures.

2.Airlines

LiFi can be implemented in airlines for providing internet connectivity to passengers during their journey. By installation of LiFi-enabled LED lights throughout the cabin, airlines can offer high-speed internet access to their passengers using their own personal devices. This means that passengers can stream movies, surf the web, and stay connected with their loved ones without experiencing the frustrating lag often associated with traditional Wi-Fi.

Moreover, LiFi technology is not limited only to providing internet access. It can also be incorporated for various other applications within the aircraft. For example: LiFi can be made to enable real-time communication between crew members, enhancing coordination and ensuring a smooth operation. Additionally, it can facilitate critical data transmission such as weather updates or maintenance reports, to the cockpit, enabling pilots to make informed decisions quickly. The implementation of LiFi in airlines also provides significant security benefits. Unlike WiFi, this can be susceptible to hacking and interference, LiFi offers a protected connection. Since LiFi signals are confined to the particular space covered by the LED lights, the risk of unauthorized access or data breaches is predominantly reduced. This feature makes LiFi an attractive option for airlines that prioritize passenger's privacy and data security. Several reputed airlines have already recognized the capability of LiFi technology and have started infusing it into their aircraft. For example, Air France conducted a successful trial of LiFi on one of its Airbus A321 aircraft, providing passengers with high-speed internet during the flight. Similarly, Emirates Airlines has also partnered with a tech company to explore the possibility of implementing LiFi on its aircraft.

3.Smarter Power Plants

Wi-Fi and many other radiation types are bad for sensitive areas like power plants. Power plants require fast, inter-connected data systems to monitor things like demand, grid integrity, and (in nuclear plants) core temperature. The savings from proper monitoring of a single power plant can add up to thousands of dollars. Li-Fi always provides safe, abundant connectivity for all areas of these sensitive locations. Not only this would save money related to presently implemented solutions, but the power plant's own reserves could be lessened if they haven't yet converted to LED lighting.

4.Underwater Communication

Underwater ships that operate using large cables supply their power and allow them to receive signals from their pilots. Marine Communication works great, except when there isn't long enough to explore an area, or when it gets stuck on something.

By removing wires and replaced with light in a submerged, high-powered lamp then it would be much freer to explore. They could also use their headlights to communicate with each other, processing data autonomously and referring the periodical findings

back to the surface, once it obtains their next batch of orders. This will keep you informed and Save Lives with Li-Fi in Subway stations, tunnels, common dead zones for most emergency communications, poses no obstruction. Sometimes less stressing cities could provide cheap high speed Web access to every street corner.

5.Security

In a closed room environment, the access area of each channel is the width of the light pool, hence it can be accessed by multiple users. Each of the user can receive higher data rates than through equivalent Wi-Fi channel. In Wi-Fi , each user or group of users directly competes for access to bandwidth. But the result is that more the connections, slower the download speeds are for all. On Contrary, in the case of LiFi, with more access points, each pool of light provides full channel data rates with fewer simultaneous users. The overall benefit to each user is 1000 times greater speeds. To avoid theft from windows security is fundamentally enhanced as compared with Wi-Fi.

6.Dense Urban Environments

Dense or crowded environments by their nature tend to have complete artificial lighting coverage. This lighting infrastructure provides high data rate access for users as they move through that environment. For example, In a hotel corridor or reception hall or in any other area a number of users can receive high data rate downloads at any point. But, high-speed wireless communication would be available in every room because light waves do not propagate through walls. This results in interference-free wireless communication, and spectrum that does not have to be shared among a large number of users in the rooms.

7.Intelligent Transportation Systems

Car headlights and tail lights are being replaced with LED versions. This offers car-to-car communication over LiFi and allowing the development of anti-collision systems, the exchange of information on driving conditions between vehicles.

Traffic signal lights already using LED lighting, so that there is also the prospect offered for city-wide traffic management systems. This would enable car systems to have real-time information on optimal routes to take, and update the network regarding conditions recently experienced by individual vehicles.

PROS OF LI-FI

- Li-Fi can solve problems related to insufficiency of radio frequency bandwidth because it uses a visible light spectrum that has not been fully utilized.
- High-speed data transmission rates of up to 10 Gbps can be achieved.
- Light cannot penetrate walls, hence it provides privacy and security that Wi-Fi cannot.
- Implementation of Li-Fi has low maintenance costs.
- It is much safer for humans since light, cannot penetrate the human body, unlike

radio frequencies.

CONS OF LI-FI

- Light cannot pass through opaque objects. The major problem facing Li-Fi is how the receiving device will transmit back to the transmitter.
- High installation cost of the VLC systems. Interferences through external light sources like sun, light, normal bulbs, and opaque materials.
- It requires a near or on-line-of-sight to transmit data.

FUTURE SCOPE

Since light is everywhere and free to use, there is a greater scope for the usage and evolution of LiFi technology. If this technology becomes developed, each Li-Fi bulb can be used to transmit wireless data. As the Li-Fi technology becomes recently popular, it will lead to a greener, safer communications and have a bright future and environment. The concept of Li-Fi is acquiring many people as it is free (require no license) and faster means of data transfer. If it develops faster,people will use this technology more

CONCLUSION

There are numerous possibilities that can be further explored. If this Li-Fi technology can be put into practical use, every bulb can be used as a Wi-Fi hotspot to transmit wireless data and will proceed towards the cleaner, greener, safer, and brighter future.

The concept of Li-Fi is currently attracting a more people's interest, because it may offer a genuine and very efficient alternative to radio-based wireless technology. As the growing population and their many devices access wireless internet, the airwaves are becoming increasingly clogged, making it more difficult to get a reliable and high-speed signal. This may solve problems such as the shortage of radio-frequency bandwidth where traditional radio-based wireless isn't allowed such as aircraft or hospitals. One of the major shortcomings is that it only works in direct line of sight.

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A GLANCE AT THE APPLICATIONS OF BLOCK CHAIN TECHNOLOGY IN FINANCIAL SERVICES.

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ABSTRACT

Blockchain technology provides benefits to financial service providers in improving risk management, privacy, and reliability. Because blockchain works so well as a platform without middlemen, it has recently become a popular information system technology. Blockchain is being used by a number of institutions in trade and finance systems in order to create smart contracts between participants, enhance productivity and openness, and create new revenue streams. Because of blockchain's special recording capabilities, the current clearing and settlement procedure is no longer necessary. In this study, pertinent papers about blockchain technology for finance are found and examined. Blockchain technology is the main topic of this essay, along with its significance for financial services. It also explores further tools, tactics, and services offered by Blockchain-based financial services. At the end of the study, the major applications of Blockchain technology in financial services are identified and assessed. Clients' financial situations are greatly impacted by credit reports. The better security of block chain- based credit reporting over traditional server-based reporting is demonstrated by recent hacking attempts. Blockchain-based solutions make it possible to issue digital assets more quickly, more affordably, and more precisely. The adoption of blockchain technology has the potential to revolutionize the financial industry by expanding the market for investors, reducing costs for issuers, and mitigating counterparty risk. This technology enables the customization of digital financial instruments to meet the specific needs of investors, fostering greater market participation and diversification.

INTRODUCTION

Blockchain technology offers a decentralized system that eliminates the need for a central authority or intermediary to control and manage data. This decentralized nature provides several advantages, including, such as enhanced security and resilience. Since data is distributed across multiple nodes, it makes it difficult for attackers to take control of the entire network. This decentralized architecture makes it more resistant to cyber-attacks and disruptions. Moreover, blockchain's immutable and transparent nature ensures that all transactions are publicly viewable and verifiable, fostering trust among network participants and reducing the risk of fraud or errors. Additionally, by eliminating intermediaries, blockchain streamlines processes and reduces transaction

costs, resulting in improved efficiency and significant cost savings. This efficiency is particularly beneficial for cross-border payments, trade finance, and other areas where intermediaries typically add significant costs and delays. Finally, blockchain empowers individuals to have greater control over their personal data and assets. This decentralized approach reduces reliance on third-party intermediaries and promotes financial inclusion, providing greater user control and empowerment.

OBJECTIVES

1. To describe blockchain technology and its necessity for financial services.
2. To discuss financial services using the distributed ledger technology and its tools.
3. To examine the distinct services offered by blockchain technology in the financial sector.
4. To recognize and research important uses of blockchain technology in financial services

Here are some specific examples of how blockchain's decentralized nature is being applied in various industries:

- Finance: Decentralized finance (DeFi) allows for peer-to-peer lending, borrowing, and trading without traditional financial institutions.
- Supply Chain Management: Blockchain is used to track goods from origin to destination, ensuring authenticity and preventing counterfeiting, without relying on a central authority.
- Identity Management: People relying less on centralized identity providers can take control of their personal data and securely share it with authorized parties by using blockchain-based self-sovereign identity(SSI) solutions.
- Voting Systems: By providing an accountable and impermeable record of votes, blockchain technology can improve election security and transparency by lowering the possibility of fraud and guaranteeing that every vote is counted precisely.

Overall, block chain's decentralized nature offers numerous benefits, including enhanced security, transparency, efficiency, user control, and resilience. As block chain technology continues to mature, we can expect to see even more innovative applications that leverage its decentralized characteristics to transform various industries and empower individuals.

Blockchain offers a safe network for conducting transactions. Many different types of organizations find blockchain technology appealing due to its strong security mechanism. Accounting operations are now performed individually by each organization, and data reconciliation takes manpower and time. This technology can support the preservation of the harmony between technology, user data, and privacy as the digital revolution progresses.

Confidentiality may be prioritized more, and data management may gain as well.

When accounting records between counterparties are reliable and up to date, the audit process runs more smoothly and quickly. (Nordgren A.I.N.O., Weckstrom E.L.L.E.N., Martikainen., Lehner O.M., 2019) Blockchain technology makes it possible for parties to transactions to communicate with one another without interruption, doing away with the necessity for documentation in the procure-to-pay, record-to-report, and order-to-cash processes. (Bogucharskov A.V.,Pokamestov I.E., 2018)

Smart contracts are self-executing contracts that are stored on a block chain network. They are written in code and can be used to automate a wide variety of transactions and agreements. Smart contracts are particularly well-suited for applications that require a high degree of security and transparency, such as financial transactions, supply chain management, and voting systems.

KEY FEATURES OF SMART CONTRACTS

1. Self-Executing: When specific conditions are fulfilled, smart contracts automatically carry out the terms of an agreement. This lowers the possibility of mistakes or disagreements and does away with the need for middlemen.

2. Immutable: A smart contract cannot be changed or removed once it is implemented on a blockchain. This guarantees that the terms of the agreement are impervious to manipulation and cannot be altered unambiguously by any party.

3. Transparent: A smart contract's related transactions and data are all visible to the public on the blockchain. This openness lowers the possibility of scams and errors while stimulating trust.

4. Secure: The distributed consensus mechanisms and strong encryption methods used in blockchain technology provide security for smart contracts. As a result, smart contracts are very difficult to manipulate or deceptively use.

Applications of Smart Contracts

1. Financial Transactions: Implementing financial transactions, including loans, investments, and payments, is possible with smart contracts. This can lower transaction costs, boost productivity, and lower the chance of mistakes or fraud.

2. Supply Chain Management: To verify product authenticity and stop counterfeiting, smart contracts can be used to track the movement of goods from the point of creation to the point of the intended location. This can lower the risk of fraud and increase the efficiency of the supply chain.

3. Voting Systems: Smart contracts can be used to enhance the security and transparency of elections by providing an auditable and tamper-proof record of votes. This can reduce the risk of fraud and ensure that each vote is counted accurately.

4. Identity Management: By establishing virtual identities that are safe and accessible, smart contracts can lessen the need for conventional middlemen like governments or social media companies. This can enable safe online interactions and provide people

more control over their personal data.

5. Intellectual Property Management: By tracking intellectual property ownership and usage, smart contracts can stop unapproved distribution and guarantee that creators receive just compensation. This can safeguard intellectual property rights and make digital rights management easier.

Challenges of Smart Contract Development:

1. Complexity: Developing smart contracts requires expertise in programming and blockchain technology. This can limit the accessibility of smart contracts to a narrow range of developers.

2. Security Vulnerabilities: Smart contracts can be susceptible to security vulnerabilities if not properly designed and tested. These vulnerabilities can be exploited to steal funds or manipulate the execution of the contract.

3. Legal Implications: The legal implications of smart contracts are complex and still evolving. This can create uncertainty for businesses and individuals considering the use of smart contracts.

Despite these challenges, smart contracts offer a promising technology with the potential to transform variousindustries. As the technology matures and adoptionincreases, we can expect to see even more innovative applications emerge that leverage smart contracts to automate transactions, enhance security,and foster trust in variousaspects of our lives. Digitaltechnology has openedup new avenues for greaterteamwork. Cloud-based apps with analytics tailored for specific use cases, like contract administration, reporting, account payables and receivables, have changed financial accounting processes. Wire transfers, cash, and cashier's checks are the safestways to pay. Cannot, however,handle cash and wire transfers, which take time. Payments made with block chain technology eliminate these issues and boost client confidence. Real-time cash transfers between financial institutions are made feasible by technology, which reduces friction and speeds up settlement. This technology is perfect for tracking transactions and has the ability to be automated. Smart contracts can be used by financial service providers to keep an eye on vendor deliverables and buyer payments. (Hilary G., Liu L.X.,2021) The necessity, features,tools, and importantaspects of block chain technology are covered in this article.

WHAT IS BLOCKCHAIN?

Blockchain is a distributed ledger that records transactions on a peer-to-peer network. This means that there is no single, centralized authority that controls the blockchain.

Instead, the blockchain is maintained by a network of computers that are all connected to each other. Each computer on the network has a copy of the blockchain, and whenever a new transaction is made, it broadcasts to all of the other computers on the network. The computers then work together to verify the transaction and add it to the

block chain. Once a transaction is added to the block chain, it cannot be altered or deleted. This is because the block chain is immutable, meaning that it cannotbe changed. This immutability is what makes block chain so secure. It is also what makes it so transparent, as everyone on the networkcan see all of the transactions on the block chain. Block chain technology has the potential to revolutionize many industries, including finance, supply chain management, and healthcare. It is still a relatively new technology, but it has already been used to create a number of successful applications

Here are some of the key benefits of blockchain technology

- **Security:** The distributed and unchangeable nature block chain makes it extremely safe. This indicates that it is exceedingly challenging to hack or alter the blockchain.
- **Transparency:** Since every transaction on the blockchain is visible to the public, blockchain technology is transparent. This implies that fraud and mistakes are not allowed.
- **Efficiency:** Since blockchain can automate many of the manual procedures currently engaged in transactions, it has the potential to be extremely efficient.
- **Trust:** As a transparent and safe method of recording transactions, blockchain technology can contribute to the development of trust.

Blockchain technology can be classified into four main types: public, private, consortium, and hybrid. Each type has its own unique characteristics and use cases.

Public Blockchains: Public blockchains are open, unfettered networks that are accessible to anybody who wants to join and take part. On a public blockchain, every transaction is clear and accessible to all users of the network. Applications like cryptocurrency trading and decentralized finance (DeFi), which demand a high level of security and transparency, frequently use public blockchains.

Examples of public blockchains:
- Bitcoin
- Ethereum
- Lit coin

Private Blockchains: Private blockchains are permission-based networks that are closed, allowing only authorized users to join and take part. A private blockchain prevents the public from seeing transactions. Applications like supply chain management and enterprise resource planning (ERP) that demand a higher level of privacy and control are frequently implemented with private blockchains.

Examples of private blockchains
- Hyper ledger Fabric
- R3 Corda
- IBM Block chain

Consortium blockchains

Consortium blockchains are semi-permission-less networks, meaning that only a group of pre-approved organizations can join and participate in the network. Transactions on a consortium blockchain are visible to all participants on the network, but not to the public. Consortium blockchains are frequently utilized in industries like trade finance and healthcare where a balance between security, transparency, and control is necessary.

Examples of consortium blockchains

- Ethereum Enterprise Alliance (EEA)
- Hyperledger Fabric Consortium
- Corda Consortium

Hybrid Blockchains

Hybrid blockchains are a combination of public and private blockchains. They combine the positive aspects of both kinds of blockchains, like control and privacy from a private chain along with reliability and openness from a public blockchain.
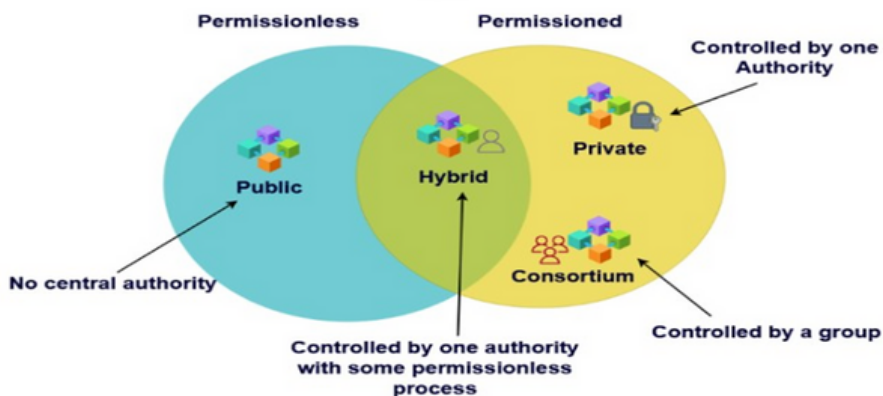
Applications like cross-border payments and identity management, which call for a combination of public and private features, frequently use hybrid blockchains.

Examples of hybrid blockchains

- Quorum
- Komodo and Wanchai

NEED OF BLOCKCHAIN

Every day, the global financial system handles trillions of dollars' worth of transactions while serving billions of people. Such lofty goals are accompanied by a number of challenges that the finance industry has long had to overcome. These problems include the cost of having several parties involved, delays, additional paperwork, and data breaches, which cause the company to suffer significant losses every year. Block chain technology may be able to overcome the problems that the global financial system is currently facing. (Gan Q., Lau R.Y.K.,Hong., 2021)

The banking industry has endured numerous challenges over an extendedperiod of time.Great technology advancements have solved a lot of problems, but some breakthroughs have created new ones. Choosing the ideal fintech solution can be difficult for financial service companies due to the abundance of options accessible today. They search for an all-encompassing answerthat can address all of the urgent issues as a result. Block chain technology is being used in financial services, which is quite interesting and has the ability to solve important business problems (Karim S., Rabbani M R., Bawazir H., 2022). Owing to centralization, the financial sector is forced to distribute a sizable amount of capital across multiple companies. Financial service providers need to make investments in value transfer systems, accounting, database maintenance, centraldatabase procurement, and database security.

Tools and strategies in blockchain for the financial services.

Blockchain technology is revolutionizing the financial services industry by providing a secure, transparent, and efficient way to conduct transactions. Here are some of the key tools and strategies that are being used to implement blockchain in finance

Tools

- **Smart contracts:** Self-executing contracts are computer programs that automatically execute transactions between parties. They eliminate the need for intermediaries and increase efficiency.
- **Distributed ledger technology (DLT):** The blockchain technology provides a reliable and unalterable record of transactions.
- **Cryptocurrencies:** Digital assets that can be used for payments and storing value on a blockchain.
- **Tokenization:** The process of tokenizing assets, such as securities or real estate, for trading on a blockchain. Decentralized finance (DeFi): A new financial ecosystem that is built on blockchain technology and provides peer-to-peer financial services without the need for traditional intermediaries.

Strategies

Proof of concept (PoC): Developing small-scale blockchain applications to test the feasibility and potential of the technology.

Pilot programs: Implementing blockchain solutions in specific areas of financial services, such as cross-border payments or trade finance, to evaluate their effectiveness and scalability.

Consortiums: Collaborating with other financial institutions and industry partners to develop and implement blockchain standards and solutions.

Regulatory engagement: Working with regulators to develop clear guidelines and frameworks for blockchain applications in finance.

Examples of blockchain tools and strategies in finance

- Cross-border payments: Blockchain-based solutions are being used to streamline cross-border payments, reducing costs, and improving transaction times.
- Trade finance: Blockchain is being used to automate and streamline trade finance processes, such as letter-of-credit issuance and payment processing.
- Securities trading: Blockchain is being explored for its potential to enhance the efficiency and transparency of securities trading.
- Regulatory compliance: Blockchain-based solutions are being developed to help financial institutions comply with regulations, such as Know Your Customer (KYC) and Anti-Money Laundering (AML) requirements.
- Fractional ownership: Blockchain is facilitating fractional ownership of assets, such as real estate or artwork, making it easier for investors to access a wider range of investment opportunities.

As blockchain technology continues to mature and adoption increases, we can expect to see even more innovative tools and strategies emerge that transform the way we conduct financial transactions and interact with financial services.

Nature of blockchain services in finance

Blockchain technology is revolutionizing the financial domain by introducing a multitude of innovative features that enhance security, transparency, and efficiency. Here are some of the key featured services of blockchain technology in finance:

- **Cross-border payments:**Traditional cross-border payments often involve intermediaries, complex processes, and high transaction costs. Blockchain technology eliminates these intermediaries and streamlines the process, enabling direct peer-to-peer transactions and reducing costs significantly. Blockchain-based solutions like Ripple and Stellar are already making cross-border payments faster, cheaper, and more secure.
- **Trade finance:**Trade finance involves numerous parties and intermediaries, leading to delays, errors, and high costs. Blockchain can automate many of the manual processes involved in trade finance, such as document verification and payment processing, reducing errors and delays. Platforms like Komgo and TradeLens are leveraging blockchain to streamline trade finance processes and enhance efficiency.

- **Securities trading:** Securities trading, especially in global markets, can be complex and inefficient due to the involvement of multiple intermediaries and clearinghouses. Blockchain can enhance the efficiency and transparency of securities trading by providing a tamper-proof record of all transactions and facilitating direct peer-to-peer trading. Platforms like tZERO and Alpha Point are exploring blockchain-based securities trading solutions.

- **Regulatory compliance:** Financial institutions face increasing regulatory scrutiny, requiring them to maintain accurate records and demonstrate compliance with various regulations. Blockchain's inherent transparency and record-keeping capabilities can simplify regulatory reporting and make it easier to demonstrate compliance to regulators. Solutions like RegTech Finboot are utilizing blockchain to enhance regulatory compliance in finance.

- **Fractional ownership:** Traditional ownership of assets, such as real estate or artwork, can be illiquid and inaccessible to many investors. Blockchain facilitates fractional ownership of assets by allowing them to be tokenized and traded on a blockchain network. Platforms like Polymath and Harbor are enabling fractional ownership of assets, and democratizing access to investment opportunities.

- **Decentralized finance (DeFi):** DeFi protocols are emerging as a decentralized alternative to traditional financial services. These protocols enable peer-to-peer lending, borrowing, and trading without the need for intermediaries, fostering financial inclusion and accessibility. Platforms like Uniswap and Aave are leading the DeFi revolution.

- **Insurance:** Blockchain can be used to streamline insurance processes, such as claims processing and underwriting. This can help to reduce fraud, improve risk assessment, and make insurance more accessible. Platforms like B3i and Etherisc are exploring blockchain-based insurance solutions.

- **Capital markets:** Blockchain can be used to improve the efficiency of capital markets by automating many of the manual processes involved in securities issuance and trading. This can reduce costs, increase liquidity, and make capital markets more accessible to a wider range of investors. Platforms like Open Finance and Main Street are developing blockchain-based capital markets solutions.

- **Central bank digital currencies (CBDCs):** Central banks around the world are exploring the use of blockchain to issue CBDCs, digital representations of their fiat currencies. CBDCs could potentially offer faster payments, reduced transaction costs, and increased financial inclusion.

- **Stablecoins:** Stablecoins are cryptocurrencies that are pegged to a fiat currency or other asset, such as gold. They offer a more stable value than traditional cryptocurrencies, making them more suitable for use in everyday transactions. Blockchain technology plays a crucial role in maintaining stability and transparency

These are just a few examples of the many featured services of blockchain technology in finance. As the technology continues to mature and adoption increases, we can expect to see even more innovative and transformative applications emerge in this rapidly evolving field. In addition to the numerous innovations and breakthroughs in the field of blockchain practices for the financial industry, there are a number of featured services that help make financial services relevant in real-time applications. The several highlighted services are trade finance and cross-border financial transaction platforms, accurate credit reporting, clearing and settlement procedures, and digital confirmation of identification. These highlighted offerings and advancements in the blockchain industry will provide strong blockchain-based banking. (Sheth H., Dattani.J., 2019). Conventionally, financial institutions have served as a conduit between many parties, and entail labor-intensive, intricate procedures that cause transactions to move slowly. Blockchain technology allows companies and regulators to obtain real-time record updates, cutting down on delays and simplifying the process of identifying abnormalities. For record management, blockchain's central encryption is especially helpful since it gets rid of duplicate data, fraudulent entries, and other problems. (Li D.,Han D.,Crespi N., Minerva R., Li.,K.C 2022) Furthermore, the total costs of the Blockchain and its supporting ecosystem may be greater when banks work together on it than the individual expenses related to processing transactions at a specific bank. Nonetheless, because the costs are divided among all participating institutions, there is a notable cost saving. When smart contracts are used by banks and other financial institutions, they improve contractual term performance since they automatically execute when certain pre-established conditions are met. Blockchain technology can be useful in complicated financial asset transfers that are governed by a set of fixed business rules that can automatically resolve some kinds of disputes. One of the primary benefits of Blockchain is that it eliminates the need for a trustworthy intermediary, enabling peer-to-peer transactions. Financial services industry fee-charging intermediaries like custodian banks and clearers may become obsolete due to blockchain technology. Conventional fraud prevention methods that need several parties to confirm transactions can be bypassed by blockchain technology. Because of its peer-to-peer network and anti-tampering properties, blockchain is one of the greatest technologies for any industry that benefits from the quick movement of verified, fraud-free information and transactions. (M. Kherbouche., G. Pisoni., B. Molnar., 2022)

Block chain financialinstitutions are alreadybeing used by banks and other financialorganizations to improve their services, reduce fraud, and reduce client fees. International money transfers have historically been costly and delayed since systems frequently pass throughnumerous banks en route to the payment's final destination. (Y. Guo, C. Liang .,2016)

Blockchain has the ability to improve the accuracy, affordability, and efficiency of international transactions. Blockchain technology is being rapidly used by the financial industry. Many financial companies promote the use of blockchain technology and invest in blockchain equities, ranging from small enterprises to the largest names in the industry. Blockchains must be widely used for the best results. Companies may be able to compute credit scores using non-traditional criteria thanks to blockchain technology. The blockchain might be used to manage credit scores, hence achieving system transparency. Lenders have the ability to utilize immutable blockchain records of financial transactions to evaluate an individual's creditworthiness.

Its hybrid and private networks are designed to handle hundreds of transactions per second and frequent spikes in network activity. Certain payments in the present banking system may not clear for up to a week. Every transaction must pass through at least two intermediaries due to the current financial system's numerous levels before it can be settled. This technology could lead to automated contracts, faster and less costly transactions, and more security for financial service providers. With Blockchain, money may be sent and received without the need for several middlemen. Blockchain will protect openness and ensure the morality and honesty of individuals who provide financial services. Any suspicious transaction activity is easy to identify. Because all information will be readily available, auditing processes will proceed more rapidly. In the financial services industry, Blockchain offers the potential to lower fraud risk, boost transparency, and make products more affordable for clients. Blockchain allows users to execute transactions on a public ledger, which can boost the financial sector's transparency. By exposing fraud and other inefficiencies, this transparency can help financial organizations lower their risk by facilitating the resolution of issues. Blockchain money transfers eliminate the need for consumers to travel to a money transfer center, stand in line, and pay transaction fees by enabling them to send and receive money online using their mobile devices. The majority of money transfers take place via banks or companies that accept credit cards. Blockchain technology is undergoing a global revolution. Businesses can be certain that transactions utilizing Blockchain technology will be completed within a matter of minutes or seconds. Blockchain enables it to eliminate financial middlemen, save costs, and simplify a number of processes. Faster transaction settlements enabled by Blockchain technology can enhance a number of financial services. Lenders will be able to fund loans faster, vendors will receive payments sooner, and stock exchanges will be able to settle stock purchases and sells promptly. Numerous financial institutions are acknowledging the potential of Blockchain technology and cryptocurrencies, despite the fact that banking is governed by numerous laws and guidelines. Blockchain companies are removing barriers to entry and providing a smooth exchange of the most popular cryptocurrencies as an alternative to traditional banking, even though digital currency

is already in use. (F. Liu., H Y Fan., J Y Qi., 2022) Many financial institutions are beginning to see the potential of Blockchain technology and crypto currencies, despite the fact that banking is governed by a number of laws. Blockchain might extend the application of accounting by taking into account more variables that are now thought to be too difficult or unreliable to quantify, such the value of a company's data, by eliminating reconciliations and offering confidence over transaction history. Financial organizations can use Blockchains to maintain books and records while still abiding by the law since they provide distributed, immutable data about transactions. Digital currency transactions, such as bit coin transfers, are the most common use case for Blockchain technology. The risk of currency inflation or devaluation is reduced by its independence from a country or institution. Using Blockchain for financial transactions eliminates the need for transaction verification by a central authority. Blockchain presents a diverse array of opportunities and challenges. Blockchain applications are already available to settle financial transactions and facilitate the exchange of several financial assets. Shortly after, the transaction was completed.

On the other hand, a similar transaction carried out using a paper-based method can take a week to finish. Due to its distributed ledger architecture, Blockchain can improve security, speed, and operational efficiency for banks in a number of business domains, such as payments, asset management, loyalty, and lending.

LIMITATIONS

The adoption of Blockchain technology can be a daunting and expensive task, especially for smaller financial institutions that may lack the necessary expertise to implement it. One of the key advantages of Blockchain is that once data is stored on it, it cannot be altered. However, this attribute may pose a challenge for financial companies that require regular modifications to their stored data. Furthermore, to integrate Blockchain technology into their systems, companies would need to modify their existing procedures. Blockchain technology has two major innovations that are worth paying attention to - transaction processing and interoperability advancements. Both of these innovations have the potential to increase the utility of Blockchain technology for financial institutions. However, it is unlikely that Blockchains will replace the current financial systems in the near future. Instead, financial institutions will test Blockchain technology to assess its potential before gradually implementing it as an addition to their current systems. In today's world, cyberspace is filled with numerous unknown threats. Thus, protecting business and financial big data has become a necessity. As a result, new and growing Blockchain security attacks have been identified, such as ledger and consensus-based, smart contract-based, peer-to-peer network-based, and wallet- based attacks. Although Blockchain technology intervenes to address these issues, it is still at an immature stage to convince the public to embrace it confidently. The interoperability of Blockchain in finance is hindered by

energy consumption, privacy concerns, compliance rules, supervision, and network integration. The lack of rules, regulations, and strategic governance enforcement causes mistrust in Blockchain.On the other hand, a similar transaction carried out using a paper-based method can take a week to finish. Due to its distributed ledger architecture, Blockchain can improve security, speed, and operational efficiency for banks in a number of business domains, such as payments, asset management, loyalty, and lending.

FUTURE PROSPECTS

Implementing Blockchain technology can be challenging. Despite these difficulties, hundreds of financial institutions use it, and Blockchain stocks are now accepted as a form of investment. The financial sector recognizes the potential benefits of Blockchain technology, and it is expected to play a more significant role in financial services in the future. Blockchain uses a decentralized ledger and is a form of distributed ledger technology secured with public and private security keys. The public key is available to all network users, while the private key is only accessible to the transaction's stakeholders. Blockchain technology has the potential to revolutionize the way large institutions handle their intercompany relationships and transactions. It can provide a single source of truth that cannot be changed, automate transactions using smart contracts and consensus mechanisms, and offer visibility across disparate systems. This can significantly reduce intercompany imbalances and streamline supply chain processes. By ensuring that updated data is consistent across systems and creating an audit trail of changes, Blockchain can alleviate these problems in the future. Financial leaders believe that using Blockchain for intercompany transactions can increase transparency, reduce friction, speed up transactions, save money, and enhance security. It can also help reduce financial crimes. In the future, Blockchain could enable tools like "smart contracts," which are self-executing contracts built on the Blockchain that can automate various human operations ranging from compliance to dispersing a will's contents.

The financial sector has attempted to test Blockchain technology by duplicating its current asset transactions. However, this approach ignores how it will affect the ecosystem. Blockchain software is used as infrastructure for real-time digital asset transfer between market participants. By increasing transparency among market participants, Blockchain technology can level the playing field and challenge established business model orthodoxies. As Blockchain applications proliferate across numerous industries, its function in the banking sector in the following years is imperative to consider. Blockchain technology offers a unique opportunity for the banking sector to redraw procedures, increase transparency, and enhance efficiency.

CONCLUSION

As factories become increasingly linked, Blockchain technology is being utilized by them. A broad network of equipment, accessories, items, and value-chain partners, such as equipment suppliers and logistics businesses, will compose the future factory. This technology's primary purpose is to create a tamper-proof ledger for digital assets such as bit coins. Blockchain applications provide data integrity, allowing marketers to target relevant consumer segments and musicians to receive fair royalties for creative compositions. This technology is making inroads into banking payments.People exchange money mostly through their bank accounts; thus, payments are critical. Banks have long been at the vanguard of the digital revolution, adopting disruptive innovations in exchange for dependable payments and printing digital currencies. Blockchain technology has the potential to revolutionize the way we share information and transfer property. In particular, it could significantly transform the way we approach mobility. By utilizing smart contracts on the Blockchain, it is possible to pay for and use a car directly, while also finding solutions to issues like electro mobility. Additionally, businesses can use smart contracts on the Blockchain to upload invoices, containing data like payment due dates, amounts, and client information. When the customer pays the bill, the smart contract updates the invoice status to "paid" and notifies the businesses that the payment has been received. Furthermore, Blockchain technology in financial services can assist in assessing a client's trustworthiness before trading. It is clear that in the future, Blockchain will play a critical role in managing various activities in the finance sector.

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SUSTAINABLE BUSINESS MODELS FOR COASTAL VILLAGES OF THOOTHUKUDI DISTRICT

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ABSTRACT

Coastal regions face unique and escalating challenges due to climate change, rising sea levels, and increased human activities. People inthese regions also depend on the sea for livelihood like fishing , salt pans , dry fish processing , and fish processing units for exports with cold storage. During monsoon season, annual fish ban period source of income of these people is highly affected. By examining the intersection of environmental sustainability and business innovation in coastal regions, the paper aims to provide actionable insights for businesses, policymakers, and local communities and to foster resilient economies that not only thrive in harmony with coastal ecosystems but also contribute to the overall well-being of the communities that depend on these vital regions. This research paper focuses on the development and analysis of sustainable business models specifically tailored to address the complex environmental and socio-economic dynamics of coastal areas.

KEYWORDS

Sustainable, Coastal, business, Fishermen, development

INTRODUCTION

Coastal villages play a pivotal role in the economic and social fabric of many regions worldwide which is rich in biodiversity and cultural heritage. However, these communities face increasing vulnerabilities due to climate change, environmental degradation, and socio-economic challenges. In Tuticorin District, there are more than 23 fishing villages. Those villages have a population close to 70,000. The majority of the people are depending on the sea for a source of income. But due to natural calamities and poor weather conditions, these residents aren't able to earn money throughout the year. This study aims to explore and propose innovative business models tailored to the unique context of Thoothukudi District. By closely examining the interplay between business innovation, environmental sustainability, and social impact, we aspire to uncover strategies that not only bolster the resilience of these coastal villages but also contribute to their long-term prosperity. The objective of this paper is to identify sustainable business models for coastal villages of Thoothukudi District

RESEARCH METHODOLOGY

For this conceptual research, secondary data was collected from journals, Research articles and Government reports like Coastal Economic Zones perspective plan. The researcher has extracted selected 5 research works done by various expert members and Professors on sustainable business models and made analysis.

INNOVATING BUSINESS MODELS

Snacks & Ready-to-Eat Products Made with Seafood

Making seafood snacks and ready-to-eat goods can be a profitable business venture in coastal areas with an abundance of fish. Fish pickles, fish crackers, and dried fish nibbles are well-liked options that appeal to both locals and visitors. Additionally, investigating the manufacturing of seafood products that are ready to eat can satisfy the increasing demand for convenience foods and the fast-paced lifestyle.

Tourism

Tuticorin coastal region was surrounded by many small islands. If tourism business is developed in those islands we can increase the income of the people. Based on that, many new businesses also start to develop in that region. It is observed that by starting a beach resort it can create new employment opportunities for unemployed youth.

Adventure Sports

This research suggested adventurous sports activities for Parasailing, Scuba diving, Kayaking, Surfing, Canoeing, Catamaran ride, Rowing, Paramotoring, Paragliding, and Float slide. These kinds of sports activities will create job opportunities for local fishermen and trained swimmers. Adventurous sports activities will generate income throughout the year. Based on that other retail businesses also start to develop.

Art and crafts

Women in this region are able to become entrepreneurs by starting businesses like crafts from seashells, seaweeds, broken corals, crab shells, shell jewelry, figurines, etc. It is a great opportunity for homemakers to earn money from home. Using these sea products also reduces the dumping of waste on the seashore.

Fishing tours

This research also suggests that, in this coastal region fishing tours also can be opted as the business opportunity. Large boat and steamer owners can utilize this opportunity to start a business with their own boats for fishing tours.

CONCLUSION

The main purpose of this study is to identify the sustainable business model for coastal villages of Tuticorin District. There were numerous business opportunities in from coastal regions . The literary review clarifies that socio economic and environment friendly business are a major need for that region. Instead of depending only on fishing for their survival , people can focus on some other business like , eco tourism, Beach resorts , art and crafts from sea products . By concentrating on these kinds of businesses their livelihood will improve and at the same time coastal ecosystems also can be protected.

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LIQUID3: A GATEWAY FOR ECO-CONSCIOUS MANUFACTURING IN THE ERA OF INDUSTRY 5.0

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ABSTRACT

The manufacturing sector faces increasing pressure to adopt sustainable practices to mitigate its environmental impact. Industry 5.0, characterized by the integration of advanced technologies for sustainability and resilience, presents an opportunity to address these challenges. The Liquid3 bioreactor, a novel technology that utilizes microalgae to capture carbon dioxide (CO_2) and release oxygen (O_2), aligns with the principles of Industry 5.0 by promoting sustainable manufacturing practices. This research paper delves into the Liquid3 bioreactor's innovative design, operational efficiency, and environmental benefits. It explores how the bioreactor aligns with Industry 5.0 principles, such as sustainability, data-driven optimization, adaptability, human-machine collaboration, and cyber-physical integration. The paper also highlights the potential benefits of adopting the Liquid3 bioreactor in Industry 5.0 manufacturing, including environmental sustainability, regulatory compliance, cost savings, and enhanced brand reputation. In conclusion, the research paper underscores the Liquid3 bioreactor's transformative potential in shaping sustainable manufacturing practices within the industry 5.0 paradigm.

KEYWORDS

Liquid3 bioreactor, microalgae, sustainability, Environmental impact, pollution control

INTRODUCTION

The manufacturing sector, while a driving force of economic progress, has also become a significant contributor to environmental degradation. Manufacturing processes often result in the release of harmful pollutants into the environment, leading to water pollution, air pollution, and deforestation. These environmental issues pose severe threats to human health, ecosystems, and the planet's overall sustainability. As the world transitions towards Industry 5.0, characterized by the integration of advanced technologies for sustainable and resilient manufacturing practices, the need for innovative solutions to address these environmental challenges is paramount. Industrial activities often generate wastewater containing hazardous chemicals, heavy metals, and organic matter, which can contaminate water sources, disrupt aquatic ecosystems, and pose risks to human health. The Liquid3 bioreactor can help address water

pollution concerns by treating industrial wastewater using microalgae. Microalgae have the remarkable ability to bioremediate wastewater, removing pollutants and transforming them into valuable biomass. This technology can significantly reduce the environmental impact of industrial wastewater discharge, promoting cleaner and more sustainable manufacturing practices.

The manufacturing sector is a major source of air pollution, releasing greenhouse gases, particulate matter, and volatile organic compounds that contribute to climate change, respiratory illnesses, and acid rain. The Liquid3 bioreactor offers a solution to air pollution by capturing carbon dioxide (CO_2), a primary greenhouse gas, from industrial emissions. Microalgae within the bioreactor utilize CO_2 for photosynthesis, converting it into biomass and releasing oxygen (O_2) into the atmosphere. This process effectively reduces greenhouse gas emissions and improves air quality, promoting a cleaner and healthier environment.

The environmental impact of manufacturing poses a significant threat to the planet's health and the well-being of its inhabitants. The transition towards Industry 5.0 presents an opportunity to address these challenges by integrating advanced technologies that promote sustainable manufacturing practices. Sustainable manufacturing aims to minimize the environmental footprint of manufacturing processes, reducing pollution and resource consumption while ensuring economic viability and social responsibility.

GIST OF LIQUID3

The term "liquid3" is a microalgae that refers to a class of ionic liquid-based mixtures that possess unique properties making them promising alternatives to conventional solvents and catalysts in various applications, particularly to act as a solution for the environmental impacts that destroy human life. Liquid3 offers a more environmental- friendly and sustainable approach to various chemical processes.

ENVIRONMENTAL IMPACTS CREATED BY MANUFACTURING INDUSTRIES

Air pollution - Air pollution, the contamination of the air we breathe, is a major environmental and public health concern, particularly in urban areas. It is caused by the release of harmful substances into the atmosphere, primarily from human activities. One of the major contributors to air pollution is carbon emission from factories. As factories burn fossil fuels to generate power and operate machinery, they release carbon dioxide (CO_2) and other greenhouse gases into the air. These gases trap heat in the atmosphere, leading to global warming and climate change. In addition to greenhouse gases, factories also emit particulate matter, sulphur dioxide, nitrogen oxides, and other pollutants. These pollutants can cause a variety of health problems, including respiratory illnesses, cardiovascular diseases, and even cancer. The effects of air pollution are not limited to human health. It can also damage ecosystems, reduce visibility, and contribute to acid rain.

Water pollution - The harmful effects of hazardous chemicals from manufacturing on water resources are extensive and far-reaching. These chemicals, which include heavy metals, solvents, and pesticides, can enter waterways through various pathways, including wastewater discharges, spills, and leaks. Once in the water, these toxic substances can wreak havoc on aquatic ecosystems, causing widespread damage to plant and animal life. Moreover, the consumption of contaminated water poses serious health risks to humans, potentially leading to a range of ailments, including neurological disorders, reproductive problems, and cancer. The impact of manufacturing activities on water quality underscores the urgent need for stricter environmental regulations, adoption of cleaner production technologies, and investment in effective wastewater treatment systems to safeguard our precious water resources.

Deforestation - Deforestation, the clearing of forested land, is a major environmental problem that contributes to climate change, biodiversity loss, and soil erosion. One of the main causes of deforestation is the cutting of trees for manufacturing industries. Manufacturing factories play a significant role in driving deforestation worldwide. The demand for raw materials and land expansion to accommodate industrial activities contributes to the clearing of forests, leading to a range of environmental consequences. As industries grow and demand for production space increases, forests are often cleared to make way for factories, warehouses, and transportation networks. This land conversion leads to the loss of forest cover and fragmentation of habitats.

Liquid3 as a solution for manufacturing industry's environmental impacts

Eradicating Air Pollution

Liquid3 bioreactors offer a promising solution to address air pollution caused by manufacturing industries. Liquid3 bioreactors use microalgae to capture CO_2 emissions from manufacturing plants, reducing greenhouse gas emissions and improving air quality. Manufacturing industries can install Liquid 3 in their manufacturing units which help them to absorb the CO_2 emitted by their units and convert those CO_2 emissions into oxygen. Liquid3 bioreactors can be integrated directly into industrial processes to capture CO_2 emissions and other pollutants at the source, effectively reducing air pollution emissions from manufacturing facilities and contributing to sustainable manufacturing practices. Adopting Liquid3 bioreactors as part of a comprehensive green manufacturing strategy can significantly reduce the environmental footprint of manufacturing industries, aligning with the principles of Industry 5.0, which emphasizes sustainability and environmental responsibility. Additionally, implementing Liquid3 bioreactors can lead to cost savings for manufacturing industries by reducing reliance

on conventional air pollution control technologies. It can also enhance brand reputation and attract environmentally conscious consumers.

Eradicating Water Pollution

Liquid3 bioreactors offer a promising solution to address water pollution by effectively removing the pollutants from wastewater and improving water quality. Liquid3 bioreactors effectively remove heavy metals, biodegrade organic pollutants, and reduce excess nutrients, preventing eutrophication and its detrimental effects on aquatic ecosystems. Integrating Liquid3 bioreactors into industrial processes captures pollutants at the source, reducing reliance on chemical treatment. Manufacturing industries waste water is dumped into river causing health hazards to lives of humans and the aquatic ecosystems. Improved water quality protects aquatic ecosystems and reduces health risks. Liquid3 bioreactors emerge as a transformative technology that offers a viable solution to address water pollution caused by manufacturing industries, contributing to cleaner water, healthier ecosystems, and a more sustainable manufacturing landscape. Liquid3 bioreactors utilize microalgae, microscopic organisms with remarkable abilities to capture and absorb nutrients from wastewater. These microalgae not only purify the wastewater but also accumulate biomass, transforming a waste product into a valuable resource. The biomass produced from Liquid3 bioreactors can be utilized for various purposes, microalgae biomass can be processed into organic fertilizers, providing a natural and eco-friendly alternative to synthetic fertilizers for nutrient supplementation in agriculture. The microalgae biomass can be used as a feedstock for bioplastic production, offering an eco-friendly alternative to conventional plastics derived from fossil fuels.

Countermeasure for Deforestation

Manufacturing industries can install Liquid 3 bioreactors as a solution for the deforestation caused by them. At the heart of Liquid3 bioreactors lies the remarkable efficiency of microalgae in converting sunlight into oxygen. These microscopic photosynthetic organisms, unlike terrestrial plants, can produce up to 100 times more oxygen per unit area, making Liquid3 bioreactors a far more potent source of oxygen. This efficiency is a crucial factor in addressing the growing need for alternative oxygen sources, especially in areas with limited access to conventional methods. Unbound by the constraints of seasonal changes and environmental factors that affect traditional oxygen-producing systems like trees, Liquid3 bioreactors offer a consistent supply of oxygen throughout the year. This unwavering reliability is a testament to the technological advancements that have enabled Liquid3 bioreactors to operate continuously, ensuring a steady flow of oxygen regardless of external conditions. This consistency is particularly valuable in critical environments where oxygen deprivation poses significant health risks. Liquid3 bioreactors represent a transformative approach to oxygen production, harnessing the power of microalgae to deliver efficient,

consistent, and adaptable oxygen generation. Their ability to thrive in diverse environments and provide a reliable supply of oxygen makes them a promising solution for addressing the growing need for alternative oxygen sources, particularly in areas that face challenges with conventional methods.

Benefits of using LIQUID3 Bioreactor in Manufacturing Industries

The LIQUID3 bioreactor offers several benefits over traditional treatment methods

Compact Design: The bioreactor's compact size makes it suitable for urban environments where space is limited. The Liquid3 Bioreactor's compact footprint allows it to be seamlessly integrated into existing urban landscapes, transforming underutilized spaces into vibrant green areas. These bioreactors can be incorporated into parks, plazas, rooftops, and even along sidewalks, providing much-needed greenery and enhancing the aesthetic appeal of urban environments. This increase in green spaces fosters a sense of connection with nature, reduces stress levels, and improves overall well-being among urban residents. The bioreactor's ability to fit into tight spaces allows it to transform neglected or underutilized areas, such as abandoned lots, alleyways, or even traffic medians, into thriving green oases. By reclaiming these forgotten spaces, the bioreactor breathes new life into urban environments, creating inviting and refreshing pockets of greenery amidst the urban sprawl.

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Energy Efficiency: The bioreactor relies on sunlight to power its operations, reducing energy consumption and environmental impact. Unlike traditional biomass production methods, which are often limited by seasonal changes, Liquid3 Bioreactors can operate year-round, regardless of weather conditions. This is achieved through controlled environmental conditions within the bioreactor, ensuring that the microalgae maintain optimal growth rates and energy production throughout the year. Liquid3 Bioreactors can be integrated with other renewable energy technologies, such as solar panels and wind turbines, to create a comprehensive renewable energy system. This integration optimizes energy production and utilization, further enhancing the energy efficiency of

the overall system.

Promoting Sustainable Agriculture: The Liquid3 Bioreactor aligns with the principles of sustainable agriculture by reducing reliance on synthetic fertilizers and pesticides. Its natural nutrient production and pest control capabilities minimize environmental impact while promoting sustainable farming practices. The Liquid3 Bioreactor contributes to improved soil health by enhancing soil nutrient content and promoting microbial activity. Furthermore, the Liquid3 Bioreactor effectively treats agricultural wastewater, removing pollutants and recovering valuable nutrients. This treated wastewater can be reused for irrigation, reducing freshwater withdrawals and minimizing environmental pollution.

LIQUID3 ADOPTION IN ESG PRACTICES

Environmental practices

- Carbon Emission Reduction: Liquid3 bioreactors generate oxygen, offsetting carbon emissions from manufacturing processes and contributing to greenhouse gas reduction efforts.
- Air Quality Improvement: The oxygen production from Liquid3 bioreactors enhances air quality in industrial areas, mitigating the impact of harmful pollutants.
- Circularity Promotion: Liquid3 bioreactors recycle wastewater and convert it into valuable biomass, minimizing waste generation and promoting resource recovery.
- Water Resource Conservation: By utilizing wastewater as a water source, Liquid3 bioreactors reduce reliance on freshwater resources, conserving this precious commodity.

Social practices

- Employee Well-being Enhancement: The improved air quality and reduced noise levels provided by Liquid3 bioreactors create a healthier and more comfortable work environment for employees.
- Local Community Support: Liquid3 bioreactors can be integrated into local infrastructure, providing localized oxygen production and contributing to community health and well-being.
- Employment Opportunity Creation: The development and operation of Liquid3 bioreactors generate employment opportunities in manufacturing, maintenance, and research fields, boosting local economies.
- Sustainable Practices Empowerment: Liquid3 bioreactors encourage sustainable manufacturing practices among industries, fostering a culture of environmental responsibility and social consciousness.

Governance practices

- ESG Commitment Demonstration: Liquid3 bioreactors serve as a visible symbol of a company's commitment to ESG principles, enhancing its reputation and brand

image.

- ESG-conscious Investor Attraction: Liquid3 bioreactor adoption can attract investors who prioritize ESG factors in their investment decisions, broadening the company's investor base.
- Regulatory Compliance Enhancement: Adopting Liquid3 bioreactors can help companies meet environmental regulations and demonstrate compliance with ESG standards, reducing regulatory risks.
- Stakeholder Relationship Strengthening: Liquid3 bioreactors can foster positive relationships with stakeholders, including employees, community members, and regulatory bodies, by demonstrating a commitment to sustainability.

Initiatives government can take to promote adoption of Liquid3 bioreactor in ESG practices

To encourage widespread adoption of Liquid3 bioreactors and integrate them into ESG practices, the following strategies can be implemented:

Government Incentives: Governments can provide financial incentives, such as tax breaks or subsidies, to promote the adoption of Liquid3 bioreactors by companies.

Regulatory Requirements: Governments can introduce regulations that mandate the use of Liquid3 bioreactors in specific industries or for certain manufacturing processes.

Industry Collaborations: Industry associations and consortiums can promote the sharing of best practices and knowledge related to Liquid3 bioreactor implementation.

Public Awareness Campaigns: Educational campaigns can raise awareness about the benefits of Liquid3 bioreactors and their role in enhancing ESG practices.

Technology Advancements: Continuous research and development efforts can further enhance the efficiency and cost-effectiveness of Liquid3 bioreactors.

REAL TIME ILLUSTRATION

Serbia has taken a pivotal step towards environmental sustainability by becoming the first country to install a Liquid3 bioreactor. This groundbreaking technology harnesses the power of microalgae to capture carbon dioxide (CO_2), a primary greenhouse gas, and release oxygen (O_2), contributing to cleaner air and a healthier environment. To maximize the bioreactor's impact on air quality, Serbia has strategically positioned it in front of the Municipality of Stari Grad in Belgrade, a densely populated urban area with high CO_2 concentrations. This placement ensures that the bioreactor can effectively capture CO_2 emissions from a significant number of people and vehicles. Serbia's Liquid3 bioreactor is estimated to capture the equivalent of CO_2 emissions from 200 square meters of lawn or one adult tree. This substantial reduction in CO_2 emissions translates to cleaner air and a healthier environment for the residents of Belgrade. Serbia's adoption of the Liquid3 bioreactor aligns with the principles of Industry 5.0. The bioreactor embodies these principles through its ability to capture CO_2, its data-driven monitoring systems, and its potential for integration with industrial

automation systems. Serbia's successful implementation of the Liquid3 bioreactor demonstrates its commitment to sustainable manufacturing practices and its readiness to embrace Industry 5.0 technologies. As the technology matures, Serbia is poised to expand its use of Liquid3 bioreactors, further improving air quality and contributing to a more sustainable future.

ADOPTION OF LIQUID3 MICROALGAE BY INDIAN COMPANIES

- Tata Motors: Tata Motors is using liquid3 to replace hazardous solvents in its paint and degreasing processes.
- Sun Pharma Limited: Sun Pharma, a leading pharmaceutical company, is using liquid 3 in the production of pharmaceutical formulations. Liquid3 is being used as a solvent and stabilizer in the preparation of pharmaceutical formulations, which are the final forms of drugs that are administered to patients.

FUTURE OPPORTUNITIES OF LIQUID3

The future of LIQUID3 holds immense promise for sustainable innovation. Potential opportunities include Development of next-generation biofuels with higher energy density and lower emissions, Production of advanced biomaterials for various industrial applications, such as packaging, construction, and textiles, Integration with artificial intelligence for real-time monitoring, predictive maintenance, and autonomous control of LIQUID3 systems, Establishment of LIQUID3-based biorefineries for the production of a diverse range of value-added products from microalgae biomass Expansion of LIQUID3 applications to other sectors, such as agriculture, aquaculture, and waste management.

CONCLUSION

Given its compelling environmental benefits, incorporating Liquid3 Bioreactors into manufacturing industries should be an integral component of Environmental, Social, and Governance (ESG) strategies. Reputed companies adopting this technology can serve as exemplars, encouraging widespread adoption and accelerating the transition towards a more sustainable industrial landscape. The implementation of Liquid3 Bioreactors not only mitigates the environmental impact of manufacturing operations but also positions industries for long-term successLiquid3 Bioreactors offer a tangible pathway towards sustainable manufacturing practices. Its integration into ESG strategies and adoption by reputed companies can foster a ripple effect, driving widespread implementation and propelling industries towards a greener and more environmentally responsible future. The adoption of Liquid3 Bioreactors aligns with the broader need for manufacturing industries to embrace innovation and adapt to sustainable practices. Manufacturing industries should research and implement more innovative techniques for sustainability like Liquid3. This can make a greater impact in the society when many companies start adopting this practice.

Liquid3 Bioreactors exemplify this innovative spirit, demonstrating the potential to revolutionize wastewater treatment and promote a more harmonious relationship between manufacturing and the environment.

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EMPOWERING SUSTAINABILITY IN BANKING: THE NEXUS OF KNOWLEDGE MANAGEMENT CAPABILITY AND DIGITAL ORGANIZATIONAL INNOVATION

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ABSTRACT

The financial sector is of critical importance in facilitating the expansion of a country's economy. Economic liberalization implemented by the Indian government in 1991 prompted structural reforms in the nation's economy, which in turn resulted in significant operational modifications within the banking sector. Due to technological progress, banks have experienced a profound metamorphosis, wherein they now provide an extensive array of services to their staff. 'KM Capabilities'—which are indispensable from a knowledge-based standpoint—often determine the extent to which this sector facilitates organizational performance. Both KM Infrastructure and KM Process Capabilities are essential in influencing the effectiveness of an organization. Notwithstanding their considerable importance, the banking industry in developing countries, such as India, has encountered internal management difficulties in the midst of worldwide economic transformations. The presence of these challenges has hindered the progress of innovation and presented obstacles to the improvement of service quality.

With this in mind, the purpose of this research is to investigate the impact and correlation between organizational innovation and knowledge management capability in the banking industry of Sivakasi. The knowledge management capability and its subsets—KM Infrastructure Capabilities, KM Process Capabilities, KM Measurement Practices, and KM Effectiveness—are comprised of the independent variables. In the interim, the dependent variables consist of Technological Innovation (ADI) and Administrative Innovation (TI), which are subsets of Organizational Innovation. The data collection methodology for this descriptive study will involve the distribution of a questionnaire to 378 employees working in the Sivakasi banking sector. The employees will employ correlation and regression techniques in the analysis.The results of this study indicate that Knowledge Management Capability has a significant and favorable impact on Organizational Innovation in the Sivakasi finance industry.

KEYWORDS

Banking Sector, Knowledge Management Capability, Organizational Innovation

1.INTRODUCTION

The financial sector in Sivakasi, Tamil Nadu, India, is an essential component of the region's economic progress, consisting of both public and private institutions. HDFC Bank, ICICI Bank, and Axis Bank, in addition to prominent institutions such as State Bank of India, Indian Bank, and Bank of Baroda, make substantial contributions to the wide array of financial services offered, encompassing specialized loans and savings accounts. Sivakasi's financial environment is undergoing substantial technological integration, as both public and private sectors adopt mobile services and digital banking. This transition signifies a significant change in finance procedures.These institutions function within a regulated framework, which is overseen by the Reserve Bank of India. This framework guarantees stability and compliance with regulatory requirements. Upon analysis, the banking sector of Sivakasi's development trajectory, obstacles, and contributions to the advancement of the region become apparent. A city frequently referred to as "Mini Japan," Sivakasi's proficiency in the printing, safety match, and cracker manufacturing sectors is enhanced through the collaboration of public and private finance institutions. By integrating the context of sustainability and digital organizational innovation within the banking sector, one can underscore the industry's progression towards more environmentally conscious and technologically advanced methodologies.

1.1 KNOWLEDGE MANAGEMENT CAPABILITY

Knowledge management entails the strategic exploitation and augmentation of the knowledge repositories of an organization in order to accomplish its objectives. It incorporates both explicit and implicit forms of knowledge and requires members of a community of practice to store, share, refine, and generate information. This procedure is responsible for regulating the information transfer within an organization. Organizations must prioritize the implementation of efficient knowledge management strategies in order to improve performance and attain a competitive advantage. Organizations that prioritize knowledge consider it a valuable resource and implement policies and principles that facilitate its generation and distribution (Metaxiotis et al., 2005; Meyer et al., 2002).

The knowledge management capability (KMC) functions as an organizational mechanism that facilitates the ongoing and intentional generation of knowledge. Knowledge management (KM) process and infrastructure capabilities, according to Gold et al. (2001), are direct predictors of organizational effectiveness. They contend that organizations must leverage their extant knowledge management capabilities and integrate knowledge into operations in order to remain competitive. Prior research has classified KMC into two primary categories: knowledge processes and capabilities pertaining to knowledge infrastructure.

1.2 ORGANIZATIONAL INNOVATION

Knowledge management involves the deliberate utilization and expansion of an organization's repositories of knowledge with the purpose of achieving its goals. It mandates the storage, sharing, refinement, and generation of information by members of a community of practice and incorporates both explicit and implicit forms of knowledge. The function of this process is to govern the transmission of information within an organization. Ensuring optimal knowledge management strategy implementation is of utmost importance for organizations seeking to enhance operations and gain a competitive edge. Organizations that place a high value on knowledge recognize it as a valuable asset and establish policies and principles to promote its production and dissemination (Metaxiotis et al., 2005; Meyer et al., 2002).

The purpose of the knowledge management capability (KMC) is to facilitate the continuous and deliberate production of knowledge as an organizational mechanism. The capabilities of the knowledge management (KM) process and infrastructure are direct predictors of organizational effectiveness, according to Gold et al. (2001). They argue that in order to maintain competitiveness, organizations must utilize their current knowledge management capabilities and incorporate knowledge into their operations. Previous studies have categorized KMC into two main classifications: knowledge processes and knowledge infrastructure capabilities.

2. REVIEW OF LITERATURE

A methodical approach is essential for knowledge management, according to Dalcher and Sandhawalia (2010), in order to develop the capacity to utilize knowledge as an invaluable resource for organizations. The Knowledge Management (KM) Framework proposes corrective actions in response to identified KM capability deficiencies. By utilizing this framework, organizations are able to determine whether enhancing KM process capabilities or developing KM infrastructure capabilities should take precedence. Scott and Davis (1997) provide the definition of organizational innovation as technological advancements that substantially enhance the performance of an organization. In order to successfully navigate changing environmental conditions, organizations must engage in innovative practices. In order to adapt to changing operational circumstances, businesses require a variety of approaches to promoting and capitalizing on technology. As technology's creators, users, and consumers of products and services facilitated by technology, humans occupy a crucial position.

The relationship between KM capability and enterprise innovation has been investigated by researchers. Saini (2015) investigated the effect of KM processes on the innovation of SMBs (including knowledge capture, sharing, transmission, storage, and utilization).

Innovation comprises the following components: improved customer relations, development of new products and services, flexibility in production, and adaptation to consumer demands. A survey of 300 small and medium-sized enterprises (SMEs) located in Punjab, Haryana, and Himachal Pradesh revealed positive trends in innovation performance and the implementation of KM. In their study, Ode et al. (2019) examined the correlation between organizational innovation performance and knowledge processes (diffusion, creation, storage).

They specifically focused on the mediating function of knowledge application-oriented processes. In Nigerian service organizations, KM processes contributed both directly and indirectly to organizational innovation, according to the study.

3. RESEARCH METHODOLOGY

3.1 Research Design

Utilizing a descriptive research design, this study seeks to delineate and elaborate on particular attributes and qualities possessed by a selected group or individual. The primary focus of this study is to examine the manner in which organizational innovation influences the efficacy of knowledge management in the banking industry of Sivakasi City. Its objective is to provide a thorough analysis of the current state of knowledge management and organizational innovation capability in the finance sector of Sivakasi City.

3.2 Objectives of the Study

- Investigate the organizational innovation that has occurred in the Sivakasi City finance industry.
- Evaluate divergent viewpoints present in the finance industry of Sivakasi City with respect to the impact of knowledge management capability on innovation within organizations.
- Construct a conceptual framework that elucidates the correlation between knowledge management capability and organizational innovation in the financial industry of Sivakasi City.

3.2 Hypotheses of the Study

- Regarding knowledge management capability, there is an absence of statistically significant variation in the demographic profile of the banking sector in Sivakasi City.
- In a similar vein, there is an absence of statistically significant variation in the demographic profile of the banking sector in Sivakasi City with respect to organizational innovation.
- Neither organizational innovation nor knowledge management capability appear to have a discernible effect.

Figure 1: Framework of the research
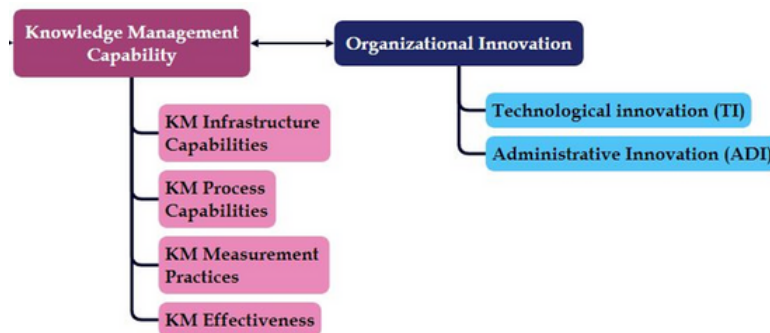
3.4 Data Collection:

The researcher gathered primary data from employees through the administration of a meticulously designed questionnaire. The survey is divided into three sections:

- The initial segment is dedicated to collecting demographic information regarding the staff
- The subsequent segment explores the staff's capability in managing knowledge.
- Organizational Innovation is the subject of the third section.

3.5 Reliability Analysis

Furthermore, reliability analysis was utilized to evaluate the dependability of these factors. In order to meet the criteria for satisfactory Cronbach's alpha dependability, the range of values should ideally span from 0.83 to 0.88, surpassing the minimum threshold of 0.70.

Table 1: Reliability Analysis

S.No.	Variable	Item	Reliability
I	Knowledge Management Capability	29	0.83
II	Organizational Innovation	35	0.88

3.6 Sampling Technique

For the customer process probability model study, questionnaire respondents were selected using a straightforward random sampling technique. The procedure of collecting data is uncomplicated and economically efficient. The methodology employed an equal opportunity approach in order to involve proficient individuals in the financial industry. The purpose of this research inspection was to guarantee the presence of representatives from the financial industry in Sivakasi City.

3.7 Sample Size

There were 405 questionnaires distributed in total. A total of 389 questionnaires were collected in a successful manner, with the non-return of 16. Three-sixteen of the 389 documents gathered satisfied the eligibility requirements, while eleven contained deficiencies. As a result, 378 samples were taken into consideration for the analysis.

3.8. Data Analysis

In order to ascertain the impact of independent variables on the dependent variable, correlation analysis is utilized. This approach posits that knowledge management capability functions as an independent variable, whereas organizational innovation, in conjunction with other variables, is considered the dependent variable.

4. CORRELATION ANALYSIS

Table 2: Inter Relationship between Knowledge Management Capability and Organizational Innovation Factors

Factors	KM_IC	KM_PC	KM_MP	KM_EF
OI_TI	0.348 0.001**	0.440 0.001**	0.346 0.001**	0.329 0.001**
OI_AI	0.552 0.001**	0.527 0.001**	0.554 0.001**	0.380 0.001**

NS Not Significant;   * Significant at 0.05 level;   ** Significant at 0.01 level

- Null hypothesis Ho = There is no significant relationship between the factors of Knowledge Management Capability and Organizational Innovation.
- Alternate hypothesis H1 = There is a significant relationship between the factors Knowledge Management Capability and Organizational Innovation.
- Validating the stated hypothesis, the study examined the relationship between Knowledge Management Capability and Organizational Innovation using a Pearson correlation test on a sample of 378 employees. These variables exhibit a robust positive correlation, as shown in the data table. Nonetheless, the examination also failed to uncover any noteworthy correlations between the variables.
- As shown in the table, all variables possess P values that are statistically significant at the 1% level. Therefore, this indicates that knowledge management capability and organizational innovation are significantly correlated. This discovery is consistent with prior investigations conducted by Aujirapongpan S, Vadhanasindhu P, Chandrachai A, and Cooparat P (2010). It further supports the conclusions drawn by numerous authors who have examined the correlation between organizational innovation and knowledge management capability as perceived by academics, employees, and other participants.

4.1 Regression Analysis

Table 3: Impact of dimensions of Knowledge Management Capability on Technological innovation of Organizational Innovation

Independent Variable	Dependent Variable	R	R²	Adj. R²	F	p
'KM Infrastructure Capabilities', 'KM Process Capabilities' and 'KM Measurement Practices', 'KM Effectiveness'	Technological innovation of Organizational Innovation	0.863	0.745	0.742	297	0.001

Source: Primary data

- The table presents an analysis of the influence that knowledge management capability factors have on employee technological advancements within the health sector. The text specifically emphasizes the knowledge management capability's four fundamental components: 'KM Infrastructure Capabilities,' 'KM Process Capabilities,' 'KM Measurement Practices,' and 'KM Effectiveness'. Out of the factors considered, 'KM Process Capabilities' seems to have a comparatively lesser impact in contrast to 'KM Infrastructure Capabilities,' 'KM Measurement Practices,' and 'KM Effectiveness'. Remarkably, the contribution of 'KM Process Capabilities' to technological innovation within organizations operating in the health sector appears to be negligible.

- The product moment interactions are denoted by the squared value of the coefficient of determination (R2). An augmentation in R2 is indicative of R. R2 is typically less than its adjusted value. The acceptability of the model is determined by the smallest possible discrepancy between the adjusted R2 and R2. As a result, an additional hypothesis was developed in order to substantiate this viewpoint.

- HO: The research conducted on employees in the health sector did not identify any noteworthy effects of knowledge management capability-related factors on technological innovation within the context of organizational innovation.

- The factors 'KM Infrastructure Capabilities,' 'KM Process Capabilities,' 'KM Measurement Practices,' and 'KM Effectiveness' have respective R values of 0.863 and 0.745, which suggest that technological innovation within organizational innovation can be predicted with an accuracy of 74.5 percent. R2 and the adjusted R2 value of 0.742 differ by a negligible amount of 0.003, indicating that the sample size is a good representation of the population. Based on the obtained F-value of 297 at a significance level of 0.001, the following regression equation was formulated.

Table 4 Co-efficient table

S.No.	Model	Un-standardized Coefficients		Standardized Coefficients	t	p
		B	Std. Error	Beta		
	Constant	-0.1017	0.1594		-0.638	0.524
1	KM Infrastructure Capabilities	1.0675	0.1439	0.7385	7.421	0.001
2	KM Process Capabilities	0.0803	0.0870	0.0559	0.923	0.357
3	KM Measurement Practices	-0.9045	0.0931	-0.5634	-9.715	0.001
4	KM Effectiveness	0.7537	0.1490	0.5396	5.057	0.001

Source: Primary data

The regression equation illustrates the influence of different factors related to knowledge management capability on technological innovation as it relates to organizational innovation among employees in the health sector.

- The beta value of 0.7385 indicates that KM Infrastructure Capabilities have a 73.85% impact on Technological Innovation. This is supported by the significant standardized regression coefficient (t-value of 7.421, p-value of 0.001).
- The KM Process Capabilities exhibit a beta value of 0.0559, indicating a 5.59% impact. However, this value is not statistically significant (t-value = 0.923, p = 0.357), suggesting that there is no substantial impact.
- KM measurement practices have a substantial impact on technological innovation, as evidenced by their -56.34% impact value of -0.5634 (t-value of -9.715, p-value of 0.001).
- The effectiveness of KM is indicated by a significant standardized regression coefficient (t-value of 5.057, p-value of 0.001), which is supported by the beta value of 0.5396 (indicating a 53.96% influence).

Positive effects of KM Infrastructure Capabilities, KM Measurement Practices, and Interpersonal Behavior on Technological Innovation were identified. In their study, Abdar, Mashayekhi, and Emadzade (2012) observed that school administrators exhibited 'KM Process Capabilities' with less frequency. In the study conducted by Damanpour (1991), the author emphasized the significance of three factors: 'KM Infrastructure Capabilities,' 'KM Measurement Practices,' and 'KM Effectiveness' as mediators between technological innovation and procedural and distributive justice. Furthermore, the examination unveiled that the 'KM Process Capabilities' do not demonstrate any significant influence of organizational innovation on technological innovation within the Tamil Nadu health sector. Khalifa M, Liu V (2003), Jain AK, Jeppesen HJ (2013), Lee, Ruby P., and Joseph L. Cavinato (2017) have all conducted research that underscores the correlation between knowledge management capability and organizational innovation.

5. SUGGESTIONS

- Establish specialized training initiatives that prioritize the effective dissemination and application of knowledge among banking personnel.
- Construct sophisticated technological instruments to optimize the process of sharing information and fostering cooperation among industry stakeholders.
- Promote a hierarchical culture of idea exchange and transparency.
- Conduct routine audits and assessments of KM practices in the banking sector of Sivakasi in order to identify areas that require improvement and to encourage ongoing innovation.
- Foster an environment that promotes interdepartmental cooperation and the exchange of ideas, thereby cultivating a range of viewpoints and novel resolutions within the banking industry in Sivakasi.

CONCLUSION

The results of this research symbolize an original investigation into a neglected correlation between knowledge management capabilities and organizational innovation among banking sector employees in Sivakasi. This study illuminates the critical correlation between knowledge management practices and organizational innovation, with a particular focus on knowledge management capability, as suggested by Jain AK and Jeppesen HJ (2013). A thorough examination reveals that an efficient knowledge management system has a substantial impact on the rate and characteristics of innovation in the financial industry of this region. The findings of this study emphasize the critical importance of knowledge creation, dissemination, and application in nurturing an innovative environment within financial institutions. Furthermore, the research emphasizes the significance of harnessing the expertise of both internal and external sources in order to foster enduring innovation within the banking sector. In order to increase adaptability and competitiveness, the research findings support the strategic allocation of resources toward comprehensive knowledge management practices and systems. Overall, this investigation underscores the critical interconnectedness that exists between knowledge management capabilities and the development of inventive approaches in the banking industry of Sivakasi. It advocates for sustained attention and financial commitment towards these domains in order to facilitate forthcoming progress.

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BEHAVIOURAL BIASES IN INVESTMENT DECISIONS AND SUSTAINABLE INVESTING

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ABSTRACT

The objective of this article is to make an explorative study of how rational investment decisions helps in sustainable investment practices. The article highlights the investment decision making as a systematic process involving application of rational skills and certain theories of financial investment decision that helps the investors to make long term decision. In present world, due to increase in stock market traders and interplay of different levels of investors, there is high volatility in the market. Opposed to rational decision making, the human psychology pushes the investors to behave in an emotional manner, thus giving raise to different kinds of biases in investment. This situation termed as behavioral finance highlights some of the biases involved in investment decisions that both positively and negatively contribute to market behaviour. Understanding these biases and irrational behaviour patterns have given rise to some ways and means of mitigating them. Thus, to arrive at sustainable investment practices, it is important to know what biases are active and how they could be mitigated.

INTRODUCTION

Investment decision-making is a systematic process that involves evaluating opportunities, assessing risks, and seeking a balance between risk and return. Investors diversify portfolios, analyse markets, and consider time horizons, with short-term and long-term perspectives guiding decisions. Liquidity, regulatory understanding, and alignment with financial goals are key factors. Successful decision-making requires financial knowledge, market awareness, and a clear understanding of individual goals. In this way, rational decision-making is crucial for overcoming challenges and approaching opportunities objectively. It allows investors to maximize benefits while minimizing economic costs and saving valuable time and resources. But given the nature of Human behaviour, it is obvious that people often deviate from rationality, leading to biases that affect decision-making. This departure from perfect rationality is a central concern in behavioural finance, challenging traditional economic and financial theories. The acknowledgment that decisions may not always be solely based on rational analysis has prompted a deeper exploration of psychological factors and cognitive biases impacting choices, particularly in finance and investments. Recognizing

and understanding these deviations is crucial for gaining insights into decision patterns and enhancing the accuracy of models explaining economic and financial behaviours.

SUSTAINABLE INVESTING

Sustainable investing is the practice of making investment decisions based on environmental, social, and governance (ESG) factors, alongside traditional financial metrics. It aims to generate long-term financial returns while contributing to positive environmental and social outcomes. The key principles of sustainable investing include long-term value creation, active ownership, transparency, and stakeholder engagement. These principles encourage investors to consider the broader implications of their investments and promote responsible corporate behaviour. Sustainable investment is experiencing remarkable growth, with its value reaching $35.3tn in major global financial markets at the beginning of 2020, comprising 36% of all professionally managed assets in the US, Canada, Japan, Australasia, and Europe, according to the Global Sustainable Investment Alliance (GSIA). Over the last two years, there has been a 15% increase in sustainable investment. A sustainable investment is therefore a rational investing process that uses rational and technical skills in assigning value and weightage to the portfolio. This gap therefore propels us to see how rational decision-making deviates and hence to know the how biases play a role in hampering sustainable investment.

BEHAVIORAL FINANCE

Behavioural finance is the study of the influence of psychology on the behaviour of financial practitioners and the subsequent effect on markets." – Martin Sewell

Behavioural finance, emerging in the late 20th century, challenged traditional finance assumptions by addressing market anomalies and deviations from rationality. Pioneered by psychologists Kahneman and Tversky, Prospect Theory highlighted cognitive biases. "Limits to arbitrage" recognized practical constraints hindering investors from exploiting anomalies. Empirical studies identified bubbles and excess volatility, challenging the efficient market hypothesis. The 2002 Nobel Prize in Economics awarded to Kahneman validated behavioural economics. Practical applications in finance, investments, and risk management followed. Behavioural finance aims to complement traditional finance, integrating insights rather than replacing them. Behavioural finance courses in academic programs educated a new generation of professionals. Today, it's integral to economics and finance, influencing decision-making, regulation, and risk management.

TRADITIONAL FINANCE VS. BEHAVIOURAL FINANCE

Traditional finance assumes rationality in investor decisions, processing all information without biases. In contrast, behavioural finance recognizes the impact of psychology, acknowledging irrationality and emotional influence on choices. Three key differences emerge:

- **Rationality:** Traditional finance assumes rational decision-making, while behavioural finance recognizes biases and emotions in investment choices.
- **Information Processing:** Traditional finance posits unlimited knowledge and complete rationality, while behavioural finance acknowledges bounded rationality, where not all information is accurately processed.
- **Market Efficiency:** Traditional finance believes in an efficient market, reflecting actual values, while behavioural finance argues for market volatility and anomalies due to imperfect self-control, resulting in inconsistency.

UNDERSTANDING BEHAVIOURAL BIASES

Understanding behavioural biases is crucial for various aspects of decision-making and has significant implications, particularly in the context of sustainable investing. Let's explore these two points in more detail:

Influence on decision-making

Behavioural biases, influenced by psychological factors, significantly impact decision-making, especially in finance. Key biases include overconfidence, Loss aversion and Herding behaviour and confirmation biases. Understanding these biases is crucial for investors, professionals, and policymakers to mitigate their impact and make more informed, rational decisions.

Implications for Sustainable Investing

Sustainable investing involves considering ESG factors in decisions. Behavioural biases influence how investors engage in these practices, potentially promoting short-term gains over long-term sustainability. Recognizing biases is crucial for fostering a more extended time horizon in sustainable strategies. Socially responsible investing perception may be skewed by biases like over-optimism, and underestimating risks associated with non-sustainable practices. Decision-making processes influenced by biases may overlook broader impacts on the environment, society, and governance. Addressing biases aligns decisions with sustainable principles. Understanding biases empowers investors to encourage positive environmental and social practices, advocating for sustainability. Recognizing and addressing biases is essential for sound financial decisions, fostering informed choices, and contributing to positive societal and environmental outcomes in sustainable investing.

Common Behavioural Biases

The traditional economic and financial theories on investment is based on the fact that individual investors act rationally and consider all the available information in order to make effective decisions in their investment plan. Behavioural finance challenges these assumptions and explores how individuals and markets actually behave in a given situation in time. The term behavioural finance micro distinguishes individual investors from the rational decision-makers. Many prominent researchers have demonstrated that when people are faced with complex decision-making situations that demand substantial time and effort, they have difficulty devising completely rational approaches to developing and analysing various courses of action. Facing uncertainty and an abundance of information to process, individuals may not systematically describe problems, record necessary data, or synthesize information to create rules for making decisions. Instead, individuals may follow a more subjective, suboptimal path of reasoning to determine a course of action consistent with their basic judgments and preferences. They are content to accept a solution that is "good enough" rather than attempting to find the optimal answer. In doing so, they may unintentionally bias the decision-making process. These biases may lead to irrational behaviours and decisions. The following are some of the mentalities and common biases exhibited by investors.

Overconfidence

Overconfidence bias is a cognitive error that leads individuals to overestimate their abilities and knowledge, leading to poor decision-making. In finance and investing, overconfidence bias can result in excessive trading, under-diversification, and taking excessive risks, among other pitfalls. In behavioral finance, overconfidence is a psychological trait that has a substantial impact on individual investment decisions. Those decisions can be stock market investment decisions or other investment decisions. In behavioral finance, overconfidence mirrored as a common psychological bias, which makes financial markets inefficient by creating mispricing in the form of massive volatility and return variability. Overconfidence in investing is a self-attribution bias, which is a common characteristic feature of inexperienced investors who find that their initial investments are profitable.

There is a Wall Street adage, which says: 'Don't confuse brains with a bull market'. Overconfidence can arise from excessive confidence in the quality of one's information and an exaggerated view of one's ability to interpret that information. This leads to an unwarranted degree of certainty about the accuracy of one's forecasts and a corresponding underestimation of risk. In consequence, overconfident investors are prone to invest to a greater extent than would be the case if they properly understood the quality of their forecasts.

Anchoring

Anchoring bias is a well-documented psychological phenomenon that influences people's reliance on initial information (the "anchor") when making subsequent judgments. In the context of investing, anchoring bias can lead investors to make decisions based on recent price changes or high points, rather than conducting thorough fundamental analysis. This bias can result in suboptimal investment decisions, as investors may overestimate the value of stocks based on past performance or ignore potential risks. Researchers have documented the negative impact of anchoring bias on investment decisions, suggesting that investors should be aware of this bias and take steps to mitigate its influence. Some of the common reasons for anchoring bias include Limited time and attention for decision-making in which investors do take shortcuts in processing information on the available data. They rely on mental shortcuts and adjust their valuation based on the primary information instead of waiting for new information that has a great potential to alter their previous decisions. Adding to this, investors give to the tendency of adding to their anchored decision by touching upon information that conforms to their existing opinions and ignoring those that contradict them. This may result in anchoring to prices that may not even fit to the present condition of the market. Anchoring may happen as a result of overconfidence too, wherein the investors rely too much on their own assessment and stick to their investment plan. Anchoring is thus a decision fatigue that harms the investors from proceeding further. Overcoming anchoring bias involves questioning the relevance of the anchor, considering a range of possibilities, and seeking multiple opinions to make informed investment decisions

Loss Aversion

Loss aversion is a behavioral bias that is rooted in a deep-seated instinctual impulse to avoid pain. Making decisions before market volatility has a chance to play on investors' emotions can help keep them from making emotionally charged decisions. Investor feels greater pain for losses rather than feeling happiness for the same amount of profit gain. The bias of loss aversion causes the downside impact of loss to be greater than the upside impact of gain. This tendency can manifest in various aspects of life, from financial decision-making to personal relationships. In financial contexts, loss aversion can lead to risk aversion, where individuals prefer to hold onto their existing wealth rather than invest in potentially profitable ventures due to the fear of potential losses.

Loss aversion also plays a significant role in marketing and consumer behaviour. Businesses often leverage loss aversion by framing products or services in terms of avoiding losses rather than pursuing gains. For instance, emphasizing the negative consequences of inaction or promoting limited-time offers can effectively tap into consumers' loss aversion tendencies and influence their purchasing decisions. While loss aversion can have detrimental consequences, it also serves as a protective mechanism,

preventing individuals from making impulsive decisions that could lead to significant losses. Understanding the nuances of loss aversion can help individuals make more informed decisions in financial matters. The tendency to loss aversion is much visible in young and first-time investors, who are careful about employing money. A slight change in the trend curve can make the investors nervous, that they first plan to sell the stocks rather than getting educated about the reason behind the fall in the price of the stock.

Confirmation Bias

Confirmation bias is a pervasive cognitive bias that can significantly impact investment decisions. It refers to the tendency of individuals to favor information that confirms their existing beliefs and opinions while disregarding or dismissing contradictory evidence. In the context of investing, confirmation bias can lead investors to make irrational decisions based on flawed assumptions and incomplete information. Confirmation bias manifests in various ways among investors:

- **Selective Information Gathering:** Investors tend to seek out and consume news, analyses, and opinions that align with their existing investment beliefs. They may subscribe to newsletters, follow analysts who share their views, and actively engage in online forums that reinforce their perspectives.
- **Interpretation Bias:** When evaluating information, investors often interpret it in a way that supports their existing beliefs. They may overlook or downplay evidence that contradicts their views, even if it is objectively significant.
- **Memory Bias:** Investors tend to recall and remember information that confirms their beliefs more readily than contradictory information. This can create a false impression of the overall strength of their investment thesis.

As a result of confirmation bias investors make decisions based on incomplete or inaccurate information, leading to poor investment choices and potential losses. Confirmation bias can inflate investors' confidence in their abilities, leading them to take excessive risks or disregard appropriate risk management strategies. Similarly, by focusing on information that confirms their beliefs, investors may miss out on potentially lucrative investment opportunities that contradict their existing views.

How to Mitigate These Biases

Mitigating refers to a systemic process of overcoming these biases. In financial decision making to mitigate bias is something very important as it helps in overcoming emotional hurdles, that pull an investor towards a deep rational thinking. The following are some of the ways an investor could mitigate the biases.

Financial Education

Financial education serves as a powerful tool in the ongoing battle against behavioural biases that can adversely impact investment decisions. By imparting a comprehensive understanding of the psychological factors influencing financial choices, education equips individuals with the tools to recognize and counteract biases such as

overconfidence, loss aversion, and herding behaviour. Armed with knowledge, investors are better positioned to make informed, rational decisions that align with their long-term financial goals. Financial education fosters a sense of self-awareness, prompting individuals to critically assess their own biases and cognitive pitfalls. Moreover, it provides the necessary framework for distinguishing between short-term market fluctuations and enduring trends, reducing the propensity for impulsive decision-making based on emotional responses. Through case studies, interactive learning, and real-world examples, financial education instills a disciplined approach to investment, emphasizing the importance of diversification, risk management, and strategic planning. By fostering a culture of continuous learning and critical thinking, financial education acts as a shield against the cognitive errors that can undermine financial success, empowering individuals to navigate the complexities of the financial landscape with resilience and a rational perspective.

Awareness

Investors exhibit many behavioural biases that may hamper them from making accurate investment decisions. To avoid falling for such biases, it is important to be aware of their existence and engage in objective investment strategies. To become aware of the biases is to know that human beings are primarily moved by emotions and that human beings have a strong impulse to react to any news emerging in the market. This awareness helps in building a phycological base, wherein the investor is not easily affected. This awareness in turn helps the investors to enter into a rational decision-making process of equally weighing the pros and cons of any new piece of information. This also develops an open-minded approach, whereby the investor is ready to look into further alternatives instead of brooding over one idea exhibited by herding or overconfident biases. Awareness on a greater scale helps in questioning one's own opinion and by seeking out contrary information that refutes them.

Diversification

Diversification involves spreading investments across a variety of asset classes, industries, and geographic regions, reducing the risk associated with a concentrated portfolio. This strategy helps counteract biases like overconfidence, as a diversified portfolio minimizes the impact of individual investment outcomes on the overall performance. Loss aversion, a common bias where investors fear losses more than they value gains, is also tempered through diversification by cushioning the impact of underperforming assets with the potential gains of others. Furthermore, diversification mitigates the impact of herding behavior, where investors follow the crowd without thorough analysis, by encouraging a more thoughtful and personalized approach to portfolio construction. Investors can avoid the pitfalls of putting all their eggs in one basket, as the performance of different assets tends to be influenced by distinct factors. By embracing diversification, investors can navigate turbulent market

conditions with a more rational mindset, reducing the likelihood of succumbing to impulsive decisions driven by emotional biases. The strategic allocation of assets across a diversified portfolio provides a foundation for long-term stability and resilience against the unpredictable nature of financial markets, fostering a disciplined investment approach that transcends the influence of behavioural biases and promotes more objective decision-making. In essence, diversification acts as a risk management tool that not only enhances the potential for returns but also serves as a powerful antidote to the behavioural pitfalls that can compromise the financial success

CONCLUSION

Navigating the world of investments can be a complex endeavour, as it is often influenced by both rational and irrational factors. While sound financial analysis and risk assessment are crucial, it's equally important to recognize the role of behavioural biases in shaping our investment decisions. These biases, deeply rooted in our psychology, can lead to suboptimal choices that may hinder our long-term financial goals. By understanding and acknowledging these biases, we can take proactive steps to mitigate their influence such as looking for a disciplined investment approach, seeking expert guidance, and employing strategies like diversification through regular view of portfolio news and information. Sustainability in any investment decision is a byproduct of pure rationality, which is a prompt response to market glitches. Biases keep operating as long as human being take decision, but through proper understanding of them, investors can look for open alternatives to make the best possible decision in risk management for a long-time financial decision.

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MAGNANIMITY OF ARTIFICIAL INTELLIGENCE INFLUENCING HR PRACTICES MEDIATING THROUGH ORGANISATIONAL COMMITMENT ON EMPLOYEE PERFORMANCE

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ABSTRACT

Purpose

HR executives and organizational leaders passionately believe that embedding artificial intelligence AIHR processes such as on-boarding and administration of benefits may enhance the overall employee performance by adopting to new technologies.

Design/Methodology/ Approach

The study employs snow ball sampling. The sample size used for this study is 187. Primary data were collected from the Information Technology Sector in Chennai. Structured questionnaire was sent through Google forms to 240 respondents.

Findings

AI in HR practices within the Information Technology sector has brought about significant positive outcomes. From recruitment to performance management and employee well-being, AI-driven tools contribute to a more efficient, personalized, and supportive workplace.

Research Limitation/ Implication

A nuanced understanding of this study will be instrumental in harnessing the full potential of AI while fostering commitment and performance among IT professionals. Managers should work closely with legal teams to address data protection and privacy concerns, mitigating potential risks and promoting a trustworthy work environment. Anticipate future advancements and be prepared to adapt strategies.

KEYWORDS

Artificial Intelligence influencing Human Resource Practices (AIHRM), Organisational Commitment

1.INTRODUCTION

Artificial intelligence (AI) is continuously striving to reach Industry 4.0 standards by transitioning conventional businesses into intelligent factories that maximise human potential and minimise labour costs in order to achieve organisational sustainability (Kshetri, 2021). AI can help automate time-consuming administrative tasks, freeing up HR personnel to focus on other aspects of their job. This can lead to increased productivity for HR personnel, allowing them to spend more time on tasks that require their expertise (Czarnitzki, D., Fernández, G. P., & Rammer, 2023). AI rationality is assisting companies in coordinating several frameworks and moreover providing a platform that may support all Human Resource tasks from recruitment, selection, training, and advancement There is no such thing as remuneration and performance management. "Artificial Intelligence" is characterized as "a perfect 'insightful' machine that is an adaptable sane specialist that sees its condition and takes activities that amplify its risk of accomplishment at some objective." Artificial Intelligence can lessen the work pressure on the employees, for smoothening of the procedure, for analysis of data and so on. AI innovation interfaces individuals to machines and machines to different machines. AI framework can work for applicant screening, worker commitment, re – commitment, career development and so forth.

2.REVIEW OF LITERATURE

 AI is no longer a novel idea in either developed or emerging economies. The science and engineering of creating intelligent devices, particularly computer programmes, is known as artificial intelligence (AI) (McCarthy, 1989). AI may be used to track and gauge energy use in the workplace, as well as identify opportunities for improvement. It is possible to create. AI may also aid with automation and improve HR procedures, such as recruiting and training, which can lead to cost savings Paper and other items are required. Overall, AI may assist organisations in gets a result of technology should be used strategically (Garg, V., Srivastav, S. and Gupta, A., 2018).

H1 : There is a significant difference between AI influencing HR practices and employee performance

Organizational Commitment

Organizational commitment it is an attachment where the Organizational commitment has for their own organization from their experiences. It will indicate the level of satisfaction and engagement among organizations. It is also a crucial to assess Organizational commitment since it is a key element in organizational success. The commitment is defined as the steadying strength which is acts to retain the behavioral move toward fairness conditions and the psychological condition of the commitment is the bonds of the individual towards an organization (Allen, 1990). Employees are more likely to invest personally in their work and contribute to the organization's success

when they have access to social resources (Bakker, Hakanen, Demerouti, & Xanthopoulou, 2007). Support from co-workers and supervisors is a social resource that helps employees satisfy their social and professional needs. Employees who raise their personal investment and dedication to work (Wright & Hobfoll, 2004) are more likely to facilitate resource maintenance as a reciprocal process. Social support creates an environment that encourages employees to invest emotionally. Employees are more likely to engage in effective employee advocacy practices when they have a strong connection to their firm in order to represent their company.

H2 : There is a significant difference between Organizational commitment and the employee performance

3.STATEMENT OF THE PROBLEM

In recent years, Artificial Intelligence (AI) has been included into Human Resource Management (HRM) practices more frequently in recent years as organizations want to improve decision-making and operational efficiency. Although AI has numerous potentials uses in HRM, little is known about how it may affect employees' loyalty to their employers. The swift integration of AI technologies in HRM begs the concerns of how these developments affect the emotive, normative, and continuous commitment of employees and what effect that has on the performance and stability of the organization. This study aims to fill this critical gap by investigating the impact of AI adoption in HRM on employee commitment, providing insights that can inform organizational strategies, policies, and practices to ensure a harmonious integration of AI technologies while fostering a committed and engaged workforce.

4.RESEARCH QUESTIONS

1. How can organizations strategically leverage AI in HRM to foster sustained commitment and performance among employees?
2. To what extent do employees adapt to and learn from AI-driven changes in HRM practices, and how does this relate to their commitment to the organization?
3. How does the integration of AI in HRM practices influence employees' affective, normative, and continuance commitment to the organization?
4. To what extent does perceived fairness in AI-driven HRM practices impact employees' commitment to the organization?

5.RESEARCH OBJECTIVES

1. To understand the demographic variables in the study.
2. To analyse the impact of AIHRM on organizational commitment and measure employee performance.
3. To examine the relationship between Organization Commitment on Employee Performance.

6. RESEARCH METHODOLOGY

Sample size

The sample size used for this study is 187.

Sampling Method

The method adopted for the study is snowball sampling.

Primary data

Primary data were collected from the Information Technology Sector in Chennai.   A structured questionnaire was sent through Google Forms to 240 respondents.

Secondary data

Secondary data were collected from articles, journals, newspapers, magazines, websites and Internet resources.

Statistical Tool

SPSS and SMART-PLS were used in this study as a statistical tool.

Conceptual Diagram on the role of Employee Performance on strengthening Organizational Commitment

Data analysis and Interpretation

Descriptive Statistics

Table: 1 Demographic Profile and Characteristics

S.No	Demographic Variables		Frequency	Percentage
1	Gender	Male	102	55%
		Female	85	45%
		Total	187	100%
2	Age	25-29	47	25%
		30-40	39	21%
		41-50	72	39%
		50 & above	29	15%
		Total	187	100%

3	Educational Background	Diploma	12	6%
		UG	72	39%
		PG	103	55%
		Total	187	100%
4	Marital Status	Married	69	37%
		Unmarried	118	63%
		Total	187	100%
5	Designation	Associate	32	17%
		Team Lead / Project Lead	26	14%
		Assistant manager	46	25%
		Senior manager and above	83	44%
		Total	187	100%
6	Experience	Less than 2 years	45	24%
		3 - 5 years	46	25%
		6 - 10 years	44	24%
		11 - 15 years	27	14%
		Above 16 years	25	13%
		Total	187	100%

According to the table above, male respondents made up 55% of the total, while female respondents made up 45%. In terms of age groups, 25 percent of respondents were between the ages of 25 and 30, 21 percent were between the ages of 30 and 40, 39 percent were between the ages of 41 and 50, and the remaining 13 percent were 50 years and above. When it came to marital status, unmarried 63 percentage respondents and married 37 percentage of respondents. In terms of educational level, respondents with UG degree were more likely to 39 percentage, PG level 55 percentage and the diploma were more likely to participate 6%. According to the respondent's job category senior manager level has the highest participation 44%. assistant manager 25%, Associate 17% Team lead/Project lead 14 percentage.

According to the experience of the respondents less than 2 years 24% employees were employed, 3 – 5 years experienced were 25% of the respondents then 6 – 10 years of experienced were almost 24% of the respondents and 11 – 15 years of experienced employees were about 14% and above 16 years were found to be 13%.

RELIABILITY

We can see from the below table that Cronbach's alpha is found to be 0.907, which indicates a high level of internal consistency for our scale with 21 items that belong to the instrument.

Table 2

Reliability Statistics	
Cronbach's Alpha	N of Items
.907	21

Kaiser-Meyer-Olkin measure of sampling adequacy (KMO)

KMO values determine the sampling adequacy of data. It always ranges within 0 to 1. Closer to 1, indicates that the result is better. In the study, KMO value is found to be 0.726 (table 5.10), which was denoting that the data was having good sampling adequacy and supports factor analysis.

Table 3

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.726
Bartlett's Test of Sphericity	Approx. Chi-Square	622.203
	df	3
	Sig.	.000

REGRESSION

In the regression model, Employee performance (EMP) was taken as dependent variable and artificial intelligence influencing human resource management practices (AIHRM) organisational commitment (OC) were taken as independent variable. This method was used to understand the effect of independent variables on dependent variable.

Table 4

Model Summary[b]					
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.852[a]	.726	.724	2.248	1.664
a. Predictors: (Constant), OC, AIHRM					
b. Dependent Variable: EMP					

According to Hair et al., (2014), "R-squared value is used to determine how strongly the independent variables influence the dependent variables. In regression, the R-squared value was very important because it determines how far the independent variables influence the dependent variables. The adjusted R squared explains how well the model generalizes and it provides cross-validation of the model". Here the R-squared value was found to be 0.726, which emphasized 72.6% of variability in the dependent variable was accounted for by all of the independent variables together. Durbin-Watson is used to determine the autocorrelation among variables. Field (2009) suggested that the Durbin-Watson value for relatively normal values should range from 1.5 to 2.5. In the study, the value was found to be 1.664 clearly indicating that there was no auto-correlation in the above table.

Table 5

ANOVA[a]						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	4198.562	2	2099.281	415.292	.000[b]
	Residual	1587.255	314	5.055		
	Total	5785.817	316			
a. Dependent Variable: EMP						
b. Predictors: (Constant), OC, AIHRM						

ANOVA was conducted to see if the regression equation explained a statistically significant portion of the variability in the dependent variable EMP based on the variability in the independent variables AIHRM and OC.

Table 6

	Coefficients^a					
		Unstandardized Coefficients		Standardized Coefficients		
Model		B	Std. Error	Beta	t	Sig.
1	(Constant)	4.768	.604		7.898	.000
	AIHRM	.472	.043	.850	10.923	.000
	OC	.002	.071	.002	4.028	.030
a. Dependent Variable: EMP						

From the above table, Unstandardized and standardized beta coefficients along with their respective t values were provided. It was found that all the values were above 0.25 in cases of Tolerance and the Variance Inflation factor were less than 4, which indicates that the model was free from multi-collinearity. Co-efficient compares the strength of each variable on the dependent variable. Based on the standardized coefficient values, Artificial intelligence influencing human resource management practices and the of the Organizational commitment are highly influencing employee performance in the organization.

CORRELATION

The results are presented in a matrix such that, Nevertheless the correlation coefficient values generally lie between -1 to +1. From the above table organisational AIHRM is found to be highly positively correlated as 0.925 with the organizational commitment and then the AIHRM is then correlated with employee performance EMP id found to be 0.852 which also attempted to be highly positively correlated. In the study, organisational commitment is found to be 0.788 which is positively correlated.

Table 7

Correlations			
	AIHRM	OC	EMP
AIHRM	1	.925**	.852**
OC		1	.788**
EMP			1
**. Correlation is significant at the 0.01 level (2-tailed).			

ANOVA

The descriptives table below provides some very useful descriptive statistics, including the mean, standard deviation, and 95% confidence intervals for the dependent variable employee performance (EMP) for each separate group based on the experience that they possess.

Table 8

					95% Confidence Interval for Mean			
	N	Mean	Std. Deviation	Std. Error	Lower Bound	Upper Bound	Minimum	Maximum
Less than 2 years	45	20.87	3.659	0.546	19.77	21.97	11	28
2 - 5 years	46	20.61	4.245	0.626	19.35	21.87	10	29
6 - 10 years	44	21.02	5.445	0.821	19.37	22.68	9	30
10 - 15 years	27	22.85	4.435	0.854	21.10	24.61	12	29
Above 16 years	25	21.08	4.856	0.971	19.08	23.08	12	30
Total	187	21.16	4.549	0.333	20.50	21.81	9	30

Descriptives — EMP

(Less than 2 years, 2-5 years, 6 – 10 years, 10-15 years and above 16 years), as well as when all groups are combined together. The above table exhibits the output of the ANOVA analysis and whether there is a statistically significant difference between our group means.

Table 9

ANOVA — EMP

|	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	96.121	4	45.827	4.586	.021
Within Groups	3752.381	183	10.175		
Total	3848.503	187			

We can see that the significance value is 0.021 (i.e., p = .021), which is below 0.05. and, therefore, there is a statistically significant difference in the mean length of time to complete the spreadsheet problem between the different courses taken. This is great to know, but we do not know which of the specific groups differed

SMART PLS

Smart PLS is a software with a graphical user interface for variance-based structural equation modeling (SEM) using the partial least squares (PLS) path modeling method. In bootstrapping, subsamples are created with randomly drawn observations from the original set of data (with replacement). The subsample is then used to estimate the PLS path model.
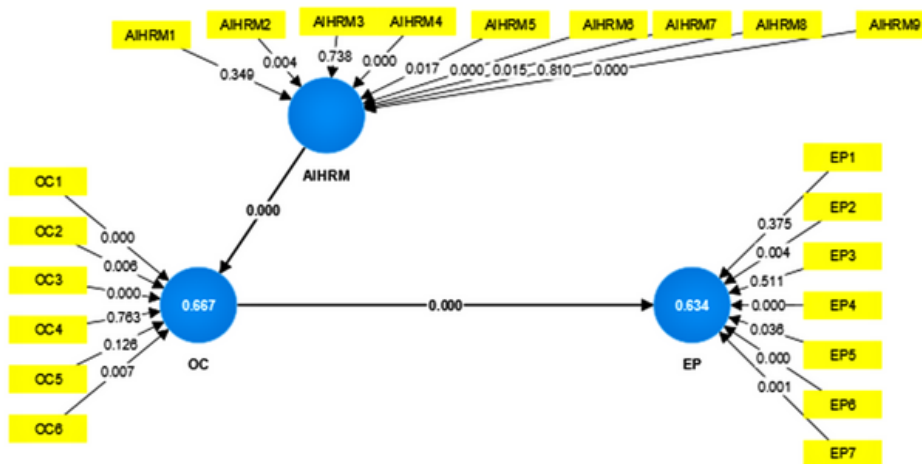
This process is repeated until a large number of random subsamples has been created, typically about 10,000. Bootstrapping is a nonparametric procedure that allows testing the statistical significance of various PLS-SEM results such path coefficients, Cronbach's alpha, HTMT, and R² values. The link between two other variables is explained by a mediator variable. Both the independent and dependent variables change as a result of it. The dependent variable employee performance will be impacted by mediating variable organisational commitment.
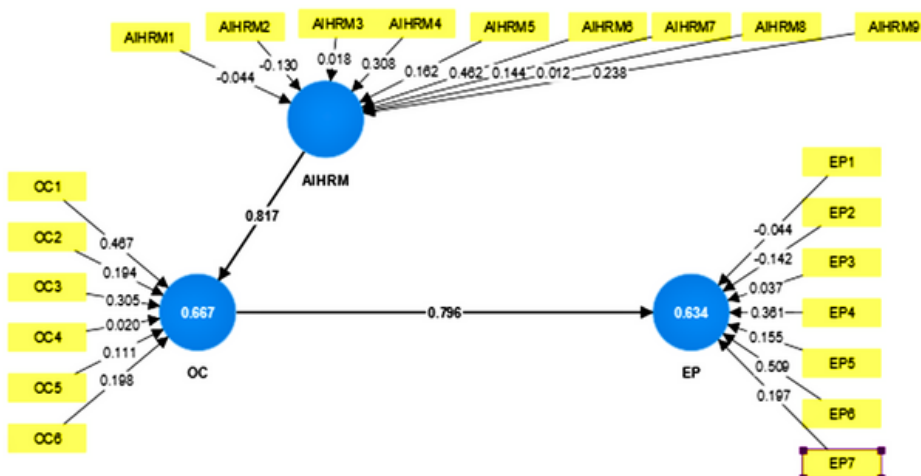
From the obtained output the Cronbach's alpha value is found to be 0.843 and the composite reliability is found to be 0.861. From the collinearity statistics the VIF value is found to be that all the values obtained are below 3. In a regression model, the amount of variation for a dependent variable that is explained by an independent variable is expressed statistically as R-squared (R2). R square value should be above 66.7%. From the table the R square value is found to be 66.7 %. Both the hypothesis was tested and found to be values to be significant and supports the hypothesis. Since the mediating variable is found to significant and it exhibits indirect path in the model. Hence the model shows Goodness of Fit. Here organizational commitment acts as a partial Mediator. AIHRM, OC and EMP is termed as the Interaction Therefore, this model is a Double Moderated Mediated Model

FINDINGS AND DISCUSSION

AI streamlines human resource practices like recruitment process, enhancing the identification of suitable candidates in the IT sector. Employees in the IT sector experience a clearer connection between their contributions and organizational success, leading to increased commitment as they see the impact of their work. AI in HR practices within the Information Technology sector has brought about significant positive outcomes. From recruitment to performance management and employee well-being, AI-driven tools contribute to a more efficient, personalized, and supportive workplace. The findings suggest that organizations leveraging AI in HR practices are likely to experience higher levels of organizational commitment and performance among their IT workforce. Personalized onboarding contributes to increased commitment, fostering a positive work culture that correlates with improved employee performance in the IT sector. However, ethical considerations remain paramount to maintaining trust and ensuring a positive employee experience. Overall, the influence of AI in HR practices in the IT sector is a transformative force with the potential to reshape the dynamics of the workplace positively.

CONCLUSION

Artificial intelligence (AI) has significantly influenced human resources (HR) practices, impacting employee organizational commitment and performance, especially in the realm of information technology (IT). The integration of AI in HR has brought about several changes and enhancements, ultimately shaping the dynamics of the workplace. The integration of AI in HR practices also brings ethical considerations. Ensuring transparency, fairness, and unbiased decision-making in AI algorithms is crucial for maintaining employee trust and commitment. Organizations need to prioritize ethical AI practices to mitigate concerns about job security and fairness. The influence of AI in HR practices has reshaped the employee experience in the IT sector. From recruitment to performance management AI has the potential to enhance organizational commitment by creating a more efficient, personalized, and supportive work environment. However, ethical considerations must be forefront to maintain trust and transparency in the relationship between AI-driven HR practices and IT employees.

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CLOSING THE LOOP: A COMPREHENSIVE ANALYSIS OF CIRCULAR ECONOMY INTEGRATION IN SUSTAINABLE SUPPLY CHAIN MANAGEMENT

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ABSTRACT

While the terms circular economy and sustainability are increasingly gaining traction with academia, industry, and policy makers the similarities and differences between both the concepts remain ambiguous. The relationship between the concepts is not made explicit in the literature which is blurring their conceptual contours and constrains the efficacy of using the approaches in research and practice.

This research paper provides a thorough examination of the integration of circular economy principles into sustainable supply chain management. Through a comprehensive analysis, it explores the strategies, challenges, and benefits associated with closing the loop in supply chain practices. This study contributes valuable insights for businesses and policymakers aiming to foster more environmentally friendly and economically viable supply chain systems. This study focuses on maintaining sustainability in the environment and reproducing products in the flow of the supply chain through various techniques. The main objective of this study is to suggest different industries to adopt and integrate a new model pertaining to bridging the gap between waste management and the production of new materials with new resources.

KEYWORDS

Waste management, circular economy, sustainability, closed loop, circular business model, life cycle assessment.

INTRODUCTION

The circular economy is a sustainable economic model designed to minimize waste and optimize resource use. In contrast to the traditional linear economy, which follows a 'take, make, dispose' approach, the circular economy emphasizes principles such as product longevity, reuse, remanufacturing, and recycling. It aims to create a closed-loop system where products and materials circulate in a continuous cycle, reducing environmental impact and promoting responsible consumption. The significance of the circular economy lies in its potential to address pressing global challenges, including resource depletion, environmental pollution, and climate change. By prioritizing circular practices, businesses and societies can foster economic resilience, promote innovation

and contribute to a more sustainable and equitable future. Circular Economy is an economic model aimed at the efficient use of resources through waste minimization, long-term value retention, reduction of primary resources, and closed loops of products, product parts, and materials within the boundaries of environmental protection and socioeconomic benefits

Supply chain management (SCM) is the process of planning, implementing, and controlling the operations of the supply chain with the purpose to satisfy customer requirements as efficiently as possible. Supply chain management spans all movement and storage of raw materials, work-in-process inventory, and finished goods from point-of-origin to point-of-consumption. (Keith Oliver, 1982) Supply chain management plays a pivotal role in fostering sustainable practices within businesses. It involves the coordination of procurement, production, distribution, and reverse logistics to optimize efficiency and reduce environmental impact. Sustainable supply chain practices encompass ethical sourcing, eco-friendly production processes, and the reduction of waste through effective logistics and recycling initiatives. By integrating sustainability into supply chain management, organizations can enhance their environmental stewardship, ensure social responsibility throughout the value chain, and achieve long-term economic viability. This approach not only aligns with growing consumer expectations for responsible business conduct but also contributes to global efforts in mitigating environmental degradation and promoting a more sustainable future.

CIRCULAR SUPPLY CHAIN MODELS

Closed-Loop Supply Chain

Closed-loop supply chains are supply chains where, in addition to the typical 'forward' flow of materials from suppliers all the way to end customers, there are flows of products back (post-consumer touch or use) to manufacturers" (Ferguson and Souza, 2010). A closed-loop supply chain (CLSC) is nothing more than a combination of two supply chains, first one is our usual supply chain, which we call the 'forward supply chain'; the second supply chain refers to the backward flow of products (used), i.e. from consumer to manufacturer, which is termed as 'reverse supply chain'. So, a reverse supply chain is simply a supply chain where the discarded products are taken back to the manufacturer for possible remanufacturing. Remanufacturing can be defined as the "process of bringing a product to like new condition through replacing and rebuilding component parts" (Haynsworth and Lyons, 1987).

The traditional supply chain is an open loop supply chain as it starts from the manufacturer and ends at the consumers. By adding the remanufacturing part, it closes the loop.
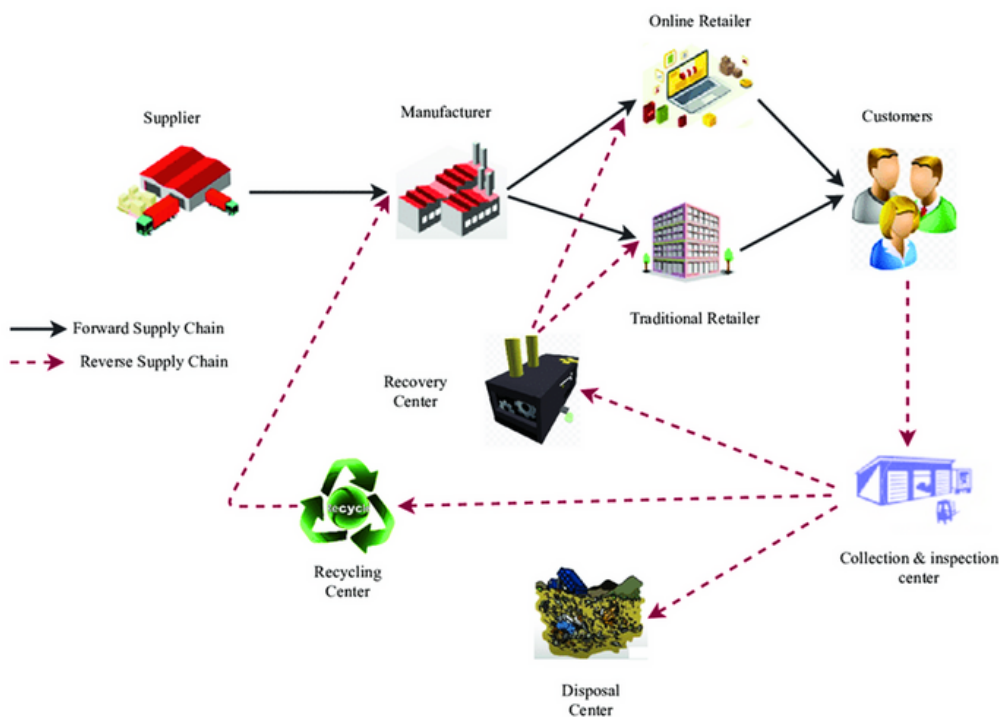
Fig 1.1: Product flow in a closed loop supply chain

Reverse Logistics

The term reverse logistics (RL) refers to collecting products and parts to be used again in the supply chain (Prajapati et al., 2019). A logistics flow opposite to the regular supply chain is created

starting from the end-users. These return products because they are faulty, do not satisfy customers' needs, or because they are no longer needed. Instead of their disposal, RL tries to account for these products in the most environmentally friendly way possible (Govindan and Soleimani, 2017). The European Working Group on Reverse Logistics, REVLOG, provides one of the most common definitions of RL as "the process of planning, implementing and controlling backward flows of raw materials, in-process inventory, packaging, and finished products, from a manufacturing, distribution or use point to a point of recovery or proper disposal.

Product Life Extension

Some product returns have not reached their real end of lifecycle yet, even if they might not be completely intact anymore. Returns in such conditions are recovered in a way that allows for an extension of their lifecycle.

Options for product recovery

1. **Reusing -** Products that can be reused are products that still have enough quality and are in a condition to be used again They only require minor cleaning and maintenance. The reintroduction to the forward supply chain occurs at the product distribution where they are brought to (secondary) retailers together with new products.

2. **Repairing** - Repairing is suitable for broken products that have not yet reached the end of their lifecycle. They are restored, with a loss of quality, and re-turned to the customers. The repair can be done by manufacturers or external repair shops. Then, the product is reintroduced to the forward chain at the very end, at the retailers.

3. **Remanufacturing** - In remanufacturing entire parts are reused to create new usable products. The activities in remanufacturing include cleaning, disassembly, replacement, and reassembly. This usually applies to high-value products where the process is worth it. Due to the specialized knowledge and machines, remanufacturing is usually conducted by manufacturers in their facilities. The reintegration to the forward supply chain happens therefore at the manufacturing

4. **..Recycling -** Recycling means that no parts but only the materials from a product are used to create something new. Product forms are changed into basic components such as plastic, glass, or paper. This way, the new product can differ completely from the original one. Usually, recycling applies to lower-value products and is related to higher costs due to the complex procedure and the advanced technology needed. As only the materials remain from the recycling process, reintroduction into the supply chain happens at an early stage as raw materials.

BENEFITS AND CHALLENGES OF CIRCULAR SUPPLY CHAINS

Environmental Benefits

- **Reduced Resource Depletion:** Circular supply chains prioritize recycling, refurbishment, and closed-loop systems, mitigating resource depletion.
- **Minimized Waste Generation:** By embracing circular practices, businesses contribute to minimizing waste generation, promoting a more sustainable approach.
- **Lower Carbon Emissions:** The emphasis on recycling and closed-loop systems leads to lower carbon emissions, contributing to environmental conservation.

Social Benefits

- **Job Creation:** Circular supply chains have the potential to create employment opportunities, fostering economic growth.
- **Improved Working Conditions:** Responsible sourcing practices enhance working conditions, ensuring a positive impact on labour standards.
- **Community Engagement:** Businesses engaging with communities through initiatives contribute to social development and community well-being.

Economic Advantages

- Efficient Resource Utilization: Circular supply chains optimize resource use, leading to cost savings and improved economic efficiency.
- Reduced Waste Management Costs: Embracing circular practices reduces waste management costs, contributing to overall financial savings.
- Creation of New Revenue Streams: Remanufacturing and recycling initiatives create new revenue streams for businesses, enhancing economic viability.
- Innovation Opportunities: Circular practices foster innovation, enabling businesses to develop new products and services, and contributing to economic growth.

Challenges and Obstacles in Integrating Circular Economy into Supply Chains: Despite the numerous benefits, integrating circular economy principles into supply chains poses several challenges:

- **Complexity:** Implementing circular practices requires a comprehensive understanding of product life cycles, intricate reverse logistics, and collaboration across various stakeholders. For instance: product life cycle, reverse logistics, and collaborations.
- **Infrastructure:** Inadequate infrastructure for waste collection, sorting, and recycling can impede the effectiveness of circular supply chains. For instance: waste collection, waste sorting, and recycling facilities.
- **Consumer Behaviour:** Educating and changing consumer behaviour to embrace circular products and services can be challenging. For instance: price sensitivity, convenience, and perceived quality.
- **Regulatory Hurdles:** Existing regulations and policies may not fully support circular practices, necessitating changes in legislation to incentivize sustainable supply chain initiatives. For instance: waste disposal incentives, lack of clear guidelines, and extended producer responsibility.

CIRCULAR ECONOMY IN DIFFERENT INDUSTRIES

a. Manufacturing

In manufacturing, circular economy practices involve designing products for durability, reparability, and recyclability. Emphasizing the use of recycled materials, adopting modular designs, and implementing closed-loop manufacturing processes can reduce waste and enhance resource efficiency. For instance, Interface, a leading global flooring manufacturer, exemplifies the successful integration of circular economy principles in the manufacturing industry. Central to their approach is the adoption of a modular design for carpet tiles, allowing for easy replacement of individual tiles without the need to discard the entire flooring. Furthermore, Interface has implemented closed-loop manufacturing processes, wherein used carpet tiles are collected, materials are separated for recycling, and the recycled components are reincorporated into the production of new tiles. The company's Re-Entry program facilitates the take-back of used tiles, ensuring proper recycling and contributing to a circular product life cycle. Notably, Interface's Climate Take Back initiative extends its commitment beyond reduction efforts, aiming to create a positive environmental impact

b. Construction

Circular economy principles in construction focus on sustainable material sourcing, modular construction methods, and deconstruction strategies for end-of-life structures. Reusing and recycling construction materials, such as concrete and steel, contribute to reducing the environmental impact of the construction industry. For instance, BAMB (Buildings As Material Banks), a forward-thinking construction company, stands as a compelling real-time exemplar of circular economy principles within the construction industry. At the core of their innovative approach is the introduction of "Material Passports," a digital documentation system detailing the composition of building materials, facilitating efficient identification and recovery during demolition or renovation. BAMB promotes deconstruction over traditional demolition, emphasizing careful disassembly to salvage materials for reuse or recycling. Through initiatives like material passports and a commitment to reuse and remanufacturing, BAMB is reshaping construction practices. Their efforts not only reduce waste and landfill contributions but also enhance transparency in the supply chain, fostering responsible sourcing.

c. Fashion

The fashion industry is adopting circular practices by promoting sustainable materials, designing for longevity, and implementing take-back programs for used clothing. Embracing circularity in fashion involves reducing textile waste, encouraging clothing repair and resale, and exploring innovative recycling methods for fabric. For instance, H&M, a global fashion brand, stands at the forefront of the fashion industry's transition toward circular economy practices through its innovative "Circular Fashion

System." Pioneering garment collection initiatives allow customers to return used clothing, irrespective of the brand, contributing to a closed-loop system where textiles are sorted for reuse, recycling, or energy generation. The introduction of the "Close the Loop" collection showcases the brand's commitment to incorporating recycled fibers into new garments, reducing the reliance on virgin resources. Furthermore, H&M's Conscious Collection exemplifies sustainable design principles, utilizing materials like organic cotton and recycled polyester. This comprehensive approach not only diverts textiles from landfills but also emphasizes the adoption of circular fashion in the mainstream market.

d. Electronics

Circular economy strategies in the electronics industry include designing products with longer lifespans, easy repairability, and recycling-friendly components. E-waste management and responsible disposal are critical aspects, with initiatives like electronics take-back programs and responsible recycling facilities gaining prominence. For instance, Fair phone, a trailblazer in the electronics industry, epitomizes circular economy principles with its commitment to producing ethical and sustainable smartphones. Adopting a modular design approach, Fair phone allows users to easily replace and upgrade individual components, thereby extending the lifespan of their devices and reducing electronic waste. The company goes beyond typical sustainability measures by prioritizing conflict-free and responsibly sourced materials, addressing concerns related to the social and environmental impact of mining. Furthermore, Fair phone actively promotes responsible end-of-life disposal through recycling programs, providing users with a sustainable option for retiring their old phones. By intertwining modular design, responsible sourcing, and recycling initiatives.

e. Food and Agriculture

Circular practices in the food and agriculture sector involve minimizing food waste, promoting regenerative agriculture, and adopting sustainable packaging. Circular economy principles also extend to the recycling of organic waste for energy production or soil enrichment, contributing to a more sustainable and resilient food system. For instance, Too Good To Go, a pioneering force in the food and agriculture industry, exemplifies circular economy principles through its innovative approach to combating food waste. The company's mobile app connects consumers with surplus food from various establishments, including restaurants and grocery stores, offering discounted "surprise bags" to prevent the unnecessary disposal of excess food. This initiative not only contributes significantly to reducing food waste but also actively engages communities in fostering a responsible approach to consumption. By collaborating with a diverse range of food businesses, Too Good to Go establishes a circular model that redirects surplus food to consumers, aligning with the core tenets of circular economy principle.

FUTURE TRENDS AND RECOMMENDATIONS

Emerging Trends in Circular Supply Chain Management

- Digital Technologies Integration: The integration of advanced technologies such as blockchain, Internet of Things (IoT), and artificial intelligence for enhanced traceability, transparency, and efficiency in circular supply chains.
- Collaborative Platforms: Increasing adoption of collaborative platforms and partnerships among supply chain stakeholders for information sharing, resource optimization, and joint circular initiatives.
- Circular Design Thinking: Growing emphasis on circular design thinking at the product development stage to ensure products are inherently circular, easy to disassemble, and recyclable.

Recommendations for Businesses and Policymakers

- **Incentive Structures:** Policymakers should create supportive regulatory frameworks and incentive structures to encourage businesses to adopt circular supply chain practices.
- **Cross-Sector Collaboration:** Businesses are recommended to engage in cross-sector collaborations to share best practices, resources, and expertise in circular supply chain management.
- **Consumer Education:** Both businesses and policymakers should invest in educating consumers about the importance of circular products, influencing purchasing behaviors, and fostering a circular economy mindset.
- **Lifecycle Assessment:** Integrate lifecycle assessments into supply chain decision-making processes to quantify environmental impacts and guide sustainable choices.

Areas for Future Research and Development

- **Circular Metrics Standardization:** Develop standardized metrics for measuring circularity in supply chains, facilitating consistent evaluation and benchmarking across industries.
- **Circular Business Models:** Explore and refine circular business models that align economic incentives with sustainable practices, ensuring the viability of circular initiatives.
- **Circular Economy in Emerging Markets:** Investigate the applicability and challenges of circular supply chain management in emerging markets, considering diverse socio-economic contexts.
- **Behavioural Economics in Circular Consumption:** Research the role of behavioural economics in promoting circular consumption patterns and influencing consumer choices toward sustainable products.
- **Circular Supply Chain Resilience:** Examine the resilience of circular supply chains to external shocks and disruptions, ensuring that circular practices contribute to supply chain robustness.

CONCLUSION

Through this study, the outcome suggests that the policy makers should encourage businesses through supportive incentive structure in incorporating circular economy and supply chain and create space for more cross-sector collaboration. It is also important to educate the consumers on the consumption of recycled products to help in the sustainability of environment for the betterment of future generations. For this, companies and industries may have to come up new business models for that is viable for all stakeholders of the environment. Through these techniques and suggestions there is space for more research in understanding the complexity of consumption patterns and the circular supply chain resilience.

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- *https://www.interface.com/AU/en-AU/sustainability/recycling.html*

- *Building as material banks - https://www.bamb2020.eu/about-bamb/*

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- *H & M Group https://www.ellenmacarthurfoundation.org/circular-examples/*

- *Pioneering the path to circularity - https://www.fairphone.com/en/2021/11/24/product-circularity-fairphone/*

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GREEN BANKING STRATEGIES-A SUSTAINABLE APPROACH

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ABSTRACT

The banking sector is one of the most important sources of financing for investment in business projects, which is one of the most important functions of economic growth. Green banking is a new concept that promotes environmental sustainability. This article focuses on the importance of green banking, green banking products, and its benefits.

It's kind of a new concept. Whatever banking practices a bank adopts, it should be environmentally and socially friendly. Regardless of the transaction made by the bank, especially in terms of lending, we must ensure that the customer's business activities do not harm the environment or society in any way. According to the Bankers Association of India 2014, "green banking is like a conventional bank that takes into account all social and environmental/ecological factors with the aim of protecting the environment and conserving natural resources." It is also known as a sustainable bank. The mission of the bank is banking taking care of the ecology and environment of the Earth.

KEYWORDS

Green banking, green products, Sustainable development and Banks.

OBJECTIVES OF THE STUDY

- Know about green banking and its benefits.
- Know about green banking products.

GREEN BANKING PRODUCTS

Green loans

A green loan is similar to a green bond in that it raises capital for green-eligible projects. But a green loan is usually based on a smaller loan than a bond that is made in a private operation.

Green credit cards

Green credit card users are rewarded with points that can be converted into cash or donated to environmental funds when they buy environmentally friendly products, use public transport, make paperless payments, and consume less electricity, water, and gas. The green credit card also offers discounts on electric car charging services and the purchase of recycled car parts. In addition, it feeds the market for low-carbon

products and services, which promotes eco-innovation and moves to a low-carbon economy. The Green Credit Card is the world's first nationwide initiative that uses a credit card platform to offer various financial rewards for environmentally friendly behaviour.

Green CDs

With Green Bank CD, the customer can earn a guaranteed interest rate during the period chosen by the customer. Banks offer a wide range of certificates from seven days to five years.

E-banking

Online banking allows you to make financial transactions over the Internet. Online banking is also known as internet banking or internet banking. The online bank offers customers almost all the services normally available through a local branch, including deposits, transfers and bill payments online.

Mobile banking

Mobile banking refers to the use of a mobile device such as a smartphone or tablet to open and manage bank accounts and conduct various financial transactions. Mobile banking apps provide a convenient and secure way to manage your finances on the go without visiting a bank branch or ATM.

Advantages of green banking

Basically, ethical banking avoids so much paperwork and relies on online/electronic transaction processing so you can get green credit cards and green mortgages, less paper means less trees cut down.

- To raise the awareness of traders about enabling eco-friendly trade
- Reduced time.
- Green banks adopt and implement environmental standards in lending, a truly forward-looking idea that would enable ecological business practices that would benefit our future generations.
- Green banking is used in the maintenance of natural resources
- Tax incentives It leads to better economic control
- It increases customer goodwill potential
- People are more and more computer savvy, so getting started with green banking is easy.
- Most customers use ATM card, phone banking, internet banking. So, it is time to start all the green banking initiatives.
- Mobile and internet banking is increasing day by day, so it is time to spread green banking practices.
- Time consumption one.

LITERATURE REVIEW

The green banking initiative is a natural extension of corporate social responsibility (CSR) that promotes sustainability. The bank monitors borrowing and looks for ways to benefit from sustainability. A bank can require its customers to follow sustainable development guidelines to meet their corporate financial requirements (Pek et al., 2019).

Green banking means that banking is socially responsible and environmentally friendly. Green finance significantly promotes green industry and economy, which is an integral part of the global environmental conservation initiative of stakeholders. Green finance involves financing or enabling projects that benefit the environment and industry and green products through grants, debt and equity mechanisms (Harun Ur Rashid and Uddin, 2018)

Singhal, Singhal and Arya (June 2014) explore how a bank can become greener in their article Green Banking: An Overview. According to the study, the banking sector and financial institutions play an important role in the growth of the Earth. Green banking saves both energy and the environment. Today, many banks offer green products such as ATMs, green credit cards, green CDs, electronic money transfers, solar and wind, etc. but it's not ready yet. We need to do more to save the environment and green banking is one of the best ways to start. The green banking initiative is a natural extension of corporate social responsibility (CSR) that promotes sustainability. The banking sector has an important role to play in improving the current situation. The bank monitors the lending business and looks for opportunities for the benefits of sustainable development. The bank can demand compliance from its customers.

CONCLUSION

Conclusion: Various countries are currently faced with the degradation of energy resources, natural resources, and environmental pollution. As the party providing financing, banks must participate in reducing environmental damage. Green banking is a better way for people to get more awareness about global warming, every entrepreneur must contribute a lot to /environment and make this earth a good place to live. The concept of "Green Banking" will be benefit to the Banking sector, industries and the economy.

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ETHICAL IMPERATIVES IN DIGITAL EVOLUTION: A FRAMEWORK FOR RESPONSIBLE TRANSFORMATION

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ABSTRACT

The way we work, live, and engage with the outside world has completely changed as a result of the rapid advancement of digital technology. The digital revolution has brought about a significant upheaval for businesses in particular. Efficiency and competitiveness are now synonymous with the use of digital technologies and tactics. This rise will likely be further accelerated by the incorporation of cutting-edge technologies like artificial intelligence, augmented reality, and the Internet of Things, which will present both new opportunities and difficulties. Understanding ethical requirements in digital development, identifying the need for responsible transformation in this area, and evaluating the influence of ethical frameworks are the goals of this research. Using secondary data, the study discovered that ethical imperatives are essential to guaranteeing that the evolution of digital technology benefits society, upholds individual rights, and tackles the larger ethical issues raised by technological advancement. In order to address the ethical implications of technological advancement in a world that is evolving quickly, technologists, ethicists, policymakers, and the general public are engaged in an ongoing discourse that is reflected in the iterative nature of ethical concerns.

KEYWORDS

Ethical imperatives, Tech Transformation, Digital Evolution, Ethical framework

INTRODUCTION

Depending on the context, the phrase "digital evolution" can indicate several things, but generally speaking, it refers to the continuous process of development and change in the digital space. Technological developments over the past few decades have thrust the digital landscape into a dynamic space marked by ongoing innovation and change. This evolution has been fuelled by the introduction of mobile devices, the expansion of high-speed internet, and the acceleration of computing power. Companies in a variety of sectors are adjusting to new paradigms and using cloud computing, automation, and data analytics to make data-driven choices, optimize operations, and obtain a competitive advantage in the digital economy. The ongoing advancement of digital

technologies is one of the main forces behind the expansion of the digital world. The expansion of digital evolution is not limited to business settings. The increasing use of social media, online collaboration tools, and digital communication platforms is causing a digital transformation in societal norms and habits. The unceasing motion that characterizes the digital ecosystem's adaptability and resilience in the face of constantly changing opportunities and demands is reflected in the voyage of digital evolution.

OBJECTIVES OF THE STUDY

- To understand ethical imperatives in Digital Evolution.
- To identified the need for responsible transformation in Digital evolution
- To assessing the impact of ethical framework in digital evolution

RESEARCH METHODOLOGY

This methodology utilized integrates qualitative and quantitative approaches to collect data, create a conceptual framework, and provide suggestions regarding ethical issues related to technology growth. Examining academic publications, books, and industry reports provide the basis for identifying important ethical imperatives and difficulties in the context of digital evolution. This study is descriptive in nature and uses secondary sources. This study offers practical insights into how ethical choices affect technical outcomes as well as a real-world environment.

ETHICAL IMPERATIVES IN DIGITAL EVOLUTION

A set of moral requirements accompanying the digital revolution are essential for directing the creation, application, and utilization of digital technology. These requirements are necessary to guarantee that the development of digital technology has a beneficial and morally consistent effect on people, communities, and the environment.

- **Privacy Protection:** Uphold people's right to privacy. Protecting user data must be a top priority for businesses and organizations, and they must also make sure that data collecting and processing operations are transparent and require user consent.
- **Cybersecurity:** Give digital system and network security a priority. A strong commitment to cybersecurity measures is necessary for ethical digital progress in order to guard against hostile acts that could harm people or organizations, as well as illegal access and data breaches.
- **Accountability and Transparency:** Create accountability for the results of digital technology creation and use, and promote transparency in these areas. It is the responsibility of developers and organizations to consider the ethical implications of their work and to accept responsibility for any unfavorable outcomes that may result.

- **Fairness and Equity:** Make sure that the use of digital technologies is done in a fair and equitable manner. Addressing biases in algorithms, data sets, and decision-making procedures is crucial to preventing prejudice and advancing equity, inclusion, and equal chances for everyone.
- **Environmental Sustainability:** Take into account and reduce how digital technologies affect the environment. To lessen the impact on the environment, ethical digital development entails implementing sustainable practices including energy-efficient design and appropriate disposal of electronic trash.
- **Empowering the User:** Prioritize user empowerment and informed consent when it comes to users' interactions with digital technology. In the digital sphere, autonomy and respect for individual agency are enhanced when users have access to clear information and control options.
- **Inclusivity and Accessibility:** Make sure that everyone, regardless of ability or socioeconomic background, can use digital technology. It entails taking into account the requirements of people with disabilities and preventing the development of digital divides that can exclude particular populations.
- **Global Collaboration and Governance:** Create frameworks for global governance of digital technologies and promote international collaboration. For the responsible development and application of digital technologies to be guided by shared ethical standards and standards, cooperation across nations, organizations, and stakeholders is necessary.

Recent Evolution of Ethical Frameworks in Technological Development

Internet and Globalization

- 1990s to early 2000s
- Widespread adoption of the internet and globalization
- New ethical challenges such as digital privacy, cybercrime, and the digital divide
- Recognition of the need for global ethical frameworks as technology transcends national borders

Focus on Privacy and Data Protection

- 2000s to 2010
- Increased collection and utilization of personal data
- Introduction of regulatory frameworks like GDPR to enhance individual control over personal information

AI and Algorithmic Accountability

- 2010s to 2020
- The rise of artificial intelligence (AI) and machine learning
- Ethical challenges related to bias, transparency, and accountability in AI development

- Evolution of ethical frameworks to address responsible AI development, emphasizing fairness and ability

Sustainable and Ethical Tech
- 2020 to till date
- Growing emphasis on sustainability and ethical considerations in technology development
- Increased awareness of the environmental impact of technology
- Efforts to create eco-friendly and socially responsible innovations

IMPACT OF UNETHICAL TECHNOLOGICAL ADVANCEMENTS

Technological innovations that are unethical can have profound and far-reaching effects on people, societies, and the environment in a variety of contexts.

- **Privacy Violations:** Through illicit data collecting, spying, and data breaches, unethical technology can result in widespread privacy violations.
- **Security Risks:** Technology-related ethical failings can raise vulnerabilities, which can then result in identity theft, cyberattacks, and other security mistakes.
- **Discrimination and Bias:** When it comes to artificial intelligence and algorithmic decision-making, unethical use of technology has the potential to both reinforce and amplify biases and discrimination.
- **Social Inequality:** Unethical technological developments have the potential to exacerbate already-existing social gaps by generating differences in economic prospects, digital literacy, and access to technology.
- **Job displacement:** If there are insufficient measures for retraining and reskilling the workforce, some technological improvements may result in job displacement.
- **Propaganda and Manipulation:** Improper use of technology can aid in the dissemination of false information, propaganda, and opinion-shaping.
- **Environmental Degradation:** Some technical developments, including electronic waste and excessive energy use, maybe a factor in environmental degradation.
- **Ethical Dilemmas in Research and Development:** Immoral methods used in the development of new technologies might give rise to moral and ethical quandaries, so casting doubt on the appropriate use of these developments.
- **Loss of Human Connection:** A decline in genuine human connection and social interactions may be attributed to certain technological breakthroughs.
- **Legal and Regulatory Challenges:** Immoral technological developments may put the current legal and regulatory systems under strain, necessitating constant modification to handle emerging ethical issues.

ETHICAL GAPS IN CURRENT TECH DEVELOPMENT PRACTICES

Privacy Concerns
- Widespread data collection practices without adequate safeguards.
- Invasive surveillance technologies compromise individuals' privacy.

Algorithmic Bias and Discrimination
- Biases in algorithms leading to discriminatory outcomes.
- Reinforcement of social inequalities through biased decision-making.

Lack of Transparency
- Lack of transparency in how algorithms operate and make decisions.
- Proprietary and opaque decision-making processes.

Inadequate Cybersecurity Practices
- Insufficient measures lead to data breaches and compromises.
- Weaknesses in encryption and security protocols.

Digital Inclusion and Accessibility
- Unequal access to technology perpetuates digital divides.
- Limited accessibility for individuals with disabilities.

Environmental Impact
- Electronic waste and high energy consumption in technology production and usage.
- Insufficient consideration of environmental sustainability.

Ethical Dilemmas in AI and Automation:
- Lack of guidelines for the ethical development and deployment of AI.
- Concerns about job displacement and accountability in automation.

Corporate Social Responsibility (CSR):
- Prioritization of profit over broader societal responsibilities.
- Insufficient efforts to address social challenges associated with technologies.

Misinformation and Online Manipulation:
- Spread of misinformation on digital platforms.
- Manipulation of online content impacting public discourse.

Ethical Considerations in Emerging Technologies:
- Lack of ethical guidelines for cutting-edge technologies.
- Unforeseen ethical consequences in emerging fields like biotechnology and quantum computing.

IMPACT OF ETHICAL TECH EVOLUTION IN SOCIAL, ENVIRONMENTAL AND ECONOMIC CONDITIONS:

Social Impacts
- **Equality and Inclusion:** Ethical technological advancements can help close the digital gap by giving marginalized people access to technology and opportunities.
- **Privacy and Security:** By improving cybersecurity and privacy safeguards, ethical IT practices increase user trust and reduce the likelihood of identity theft and data

breaches.

- **Algorithmic Fairness:** Algorithmic and AI ethics promote more equitable decision-making, lowering prejudice and discrimination in fields including criminal justice, lending, and employment.
- **Empowerment of the Community:** Ethical technological advancement may promote local development by enabling communities to employ technology for civic participation, healthcare, and education.
- **Public Awareness and Education:** Placing a strong emphasis on ethical technology helps raise public awareness and educate people about digital literacy, responsible technology use, and the possible social effects of emerging technologies.

Environmental Impacts

- **Sustainability activities:** As electronic waste declines and energy-efficient technologies and data centers are developed, ethical tech evolution supports ecologically sustainable activities.
- **Green Innovation:** The creation of eco-friendly technology and renewable energy solutions for data centers are examples of how ethical tech practices spur innovation in this field.
- **Decreased Environmental Footprint:** By taking environmental impact into account during the design and manufacturing of technology, overall environmental footprints are decreased, which helps to create a more sustainable planet.

Economic Impacts

- **Job Creation:** As technology becomes more ethical, jobs in fields like cybersecurity, data privacy, and sustainable technology development may be created.
- **Market Growth:** As customers place a higher value on ethical and responsible business practices, companies who adopt these methods may find themselves drawing in a wider clientele.
- **Innovation and Competitiveness:** By addressing societal demands and promoting beneficial social and environmental outcomes, ethical tech practices promote innovation and increase the competitiveness of organizations.
- **Long-Term Viability:** Companies that put ethics first are more likely to be successful in the long run because they gain the trust of stakeholders and customers and lower their risk of reputational harm.

CONCLUSION

The research paper "Ethical Imperatives in Digital Evolution: A Framework for Responsible Transformation" underscores the critical importance of ethical considerations in navigating the ever-evolving landscape of digital technologies. In order to guarantee that the advancement of digital technology is consistent with moral standards, individuals, institutions, and legislators can use the framework presented in this study as a reference. In addition to embracing innovation, the framework seeks to cultivate a digital ecosystem that is deeply committed to the welfare of people, society, and the environment by placing a strong emphasis on privacy protection, openness, fairness, and sustainability. In the end, the framework that has been put forth here serves as a call to action for all parties involved in the digital sphere to take a collective step toward responsible transformation, led by an uncompromising dedication to ethics in the dynamic field of digital evolution.

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A STUDY ON NEURO MARKETING: AN EMERGING TOOL OF MARKET RESEARCH

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ABSTRACT

A new instrument for marketing research has emerged recently: neuro marketing. This technique applies brain research to management settings and is becoming more and more well-liked in both the academic and real-world domains. Neuro marketing, which piqued the interest of marketers in the beginning of 2002, effectively shortens and streamlines the process of probing brains for the benefit of the advertisers. In this paper, the conceptual function of neuro marketing as a useful tool for marketers in the new era of market research for today's sophisticated consumer is examined. Our study's goals center on the position and development of neuro marketing as well as the procedures used in the current environment, such as eye tracking, neuroimaging, EEG, and FMRI. Nowadays marketing research has been oriented towards four components of consumers as: physical body, mind, heart and spirit with the help of practices of Neuro marketing.

KEYWORDS

Neuro marketing, Brain research, Neuroimaging, Eye Tracking, EEG, FMRI.

INTRODUCTION

Neuro marketing is a strategy that uses the knowledge of neuroscience and cognitive science to accurately identify customer needs, desires, and preferences. It studies consumers' responses to marketing stimuli and assesses non-conscious reactions to specific advertising campaigns, packaging, design, etc. The approach helps develop effective marketing campaigns and strategies that resonate with the target audience.

Many scientists highlight the controversial nature of neuromarketing. Some people assume that several types of ads might be deceptive and dishonest. They also add that these methods influence people's brains and encourage customers to take the desired action. On the contrary, neuromarketing advocates claim that their techniques help understand customers' needs and desires and serve them better.

Neuro marketing companies operate ethically toward consumers the same way regular advertising agencies do. They don't intend to promote illegal and deceptive products and create ads that control consumers' purchasing decisions. Neuro marketers say that this approach allows customers to understand the patterns of their choices. Besides, it enables people to find out whether companies manipulate their buying decisions or influence them.

In short, neuro marketing is the fusion of medical knowledge, technology, and marketing. It is the intersection of brain science and marketing. A relatively new area of marketing called "neuro marketing" looks at how customers react to advertisements. The use of neuroscience in marketing is known as neuro marketing. Neuro marketing is the process of directly measuring a subject's reaction to particular items, packaging, advertisements, or other marketing aspects using brain imaging, scanning, or other brain activity measurement equipment. In certain instances, the brain reactions observed through these methods might not be consciously perceived by the participant; hence, this information could be more informative than self-reporting on questionnaires, in focus groups, etc.

CONCEPTS OF NEURO MARKETING

In 1990, psychologists at Harvard University created this idea. Ale Smidts created the term "neuro marketing" in 2002.This is a new area of neuroscience where researchers measure how consumers respond to specific brands, slogans, and ads using medical technology. In 2004, the inaugural Neuro marketing conference took place at Houston's Baylor College of Medicine. "Meme" is the cornerstone of neuro marketing. A meme is a type of data that is kept in the brain. These devices have a significant impact on people, as they can influence judgments made in 2.6 seconds. When a meme is well-chosen, we remember the humorous or musical piece and are inclined to share it. Marketers have an impact on memes because they stick in our memories.

As a result, neuro marketing is a fascinating and developing discipline that has a lot of promise for use in advertising, brand management, and marketing. It came into being as a result of combining ideas from the fields of neurochemistry, psychology, human neurophysiology, and neural science. This has significantly expanded the use of neuro marketing. In a congested and cluttered market, the principles of neuro marketing offer a genuine competitive advantage. Consumers speak different languages in different nations and cultures, but the human brain speaks a global language. Therefore, neuro marketing has had a significant impact on brands, packaging, advertising, and products.

OBJECTIVES OF THE STUDY

More specifically the study makes an earnest attempt by having the following as its objectives:

- To study the stance of Neuro marketing in the current scenario.
- To identify the various techniques used in Neuro marketing.

REVIEWS OF LITERATURE

According to Martínez, author of 'The Consumer Mind' (2012), consumers' minds can be differentiated into four categories; between what they think, what they say, what they do, and what they feel (Martínez 2012, p. 5). Martínez emphasizes that a critical point of traditional marketing research is that "(…) consumers contradict themselves, saying what they want, but doing what they feel" (Ibid.). Thus, Martínez argues that neuro marketing will help marketers acquire more objective information from and about consumers than through the use of traditional marketing tools such as surveys and interviews. Martínez proposes that the most efficient way to apply neuroscience in relation to marketing is through a combination of qualitative, quantitative, and neuroscience research, as they hereby will complement and support each other, yielding the richest information possible (Op.cit., p. 6).

It is the attempt to pinpoint how and where our brain reacts to marketing and advertising stimuli and the attempt to measure the impact of such stimuli. From a general perspective, neuroscientific methods are used to study consumer behaviour, the decision-making processes, emotions in purchase decisions, and marketing phenomena through analyses of the underlying neurobiology (Javor et al. 2013, p. 2).

In neuro marketing, systems neuroscience, which is the study of how different brain areas or complex brain systems interact, is the main focus (Braeutigam 2005, p. 350). A critical distinction is made between consumer neuroscience, referring to academic research at the intersection of neuroscience and consumer psychology, and neuro marketing, referring to a commercial interest in neuro-physiological tools (Javor et al. 2013, p. 3). There are several ways to measure physiological responses to advertising. Neuro marketing is an emerging field that bridges the consumer purchase decision with neuroscience (Christophe, 2011). Neuro marketing is advancing rapid believability and acceptance among advertising professionals. As everything depends on consumers " willingness and competency to describe how they feel when they are exposed to an advertising campaign, conventional methods for testing and predicting the effectiveness of huge investments generally have a minimal effect. Cutting-edge methods for directly probing minds without requiring demanding cognitive or conscious participation are offered by neuro marketing.

Michael J.R. Butler (2008) determines the emerging field of neuro marketing as a knowledge that has malleability. Different marketing researchers perceive the development and application of neuro marketing knowledge in dissimilar manners. Having different perceptions of knowledge is not a new issue, but finding new interconnections between those perceptions is beneficial to knowledge creation and diffusion. The research–practice gap in neuro marketing was briefly discussed and then resolved through the contribution of that commentary, the proposal of a novel Neuro marketing Research Model. The Model interconnects basic research reporting, applied

research reporting, media reporting and power processes.

RESEARCH METHODOLOGY

The results of the study show that exploratory research is necessary to comprehend how marketers and consumers conceptualize neuro marketing. In addition, exploratory research aims to establish the framework for further investigations or assess whether the observations can be explained by and evaluated in the context of the body of current literature. As a result, secondary data, already published literature reviews, fact sheets from journals, and periodicals are used in qualitative research.

NEURO MARKETING EMERGENCE

Importance Of Neuro Marketing

- Identify customers' non-conscious responses to different ads, designs, methods;
- Develop new unique strategies;
- Resonate with the audience's needs and desires;
- Improve advertising campaigns and strategies;
- Explore the feelings and emotions particular ads, logos, phrases can trigger in customers;
- Improve customer experience;
- Satisfy customers;
- Increase sales;
- Gain competitive advantage

NEURO MARKETING WORKING MODEL

- Neuro marketing uses functional magnetic resonance imaging and electroencephalogram tools to scan people's brains and evaluate physiological and neural signals to specific ads, packaging, design, etc. Brains' responses are crucial for companies since they provide business owners with a clear picture of customers' needs and wants.
- Marketers show ads, packaging, or product design to customers and track their reactions and brain activity. After they get responses and measure the changes, companies can decide what steps they need to take next.
- Brain scanning allows brands to track every brain activity such as eye movement, the change of pupils, face expression, heart rate and emotions and empower brands with customer insights. Based on the given results, companies can decide how to improve their ads and content, product packaging and design, website design, and branding to hook the audience's attention and resonate with customers' needs.

NEURO MARKETING TECHNIQUES

To successfully implement neuro marketing, brands need special tools and neuro marketing specialists. They will empower you to use the following neuro marketing techniques.

Eye-Tracking (Gaze)

The technique focuses on gaze and where customers direct it. With its help, you can figure out colors, fonts, ads, and designs that succeed to grab their attention. Besides, eye-tracking can also cue the objects that evoke confusion among these people. If you are interested in brand recognition, you can find out the customers' recognition speed. This approach will tell you whether you have a high level of recognition or need to work on it to make people recall your company faster. Once you choose eye-tracking, it allows you to improve website design, packaging, and ads at a low cost. Although the technique is easy to manage, it won't help you evaluate customers' emotions. So use it with biometrics to get a more detailed analysis of your target audience.

Pupillometry

This method draws conclusions based on the state of the subjects' pupils. It checks whether the pupils are dilated to assess the level of customer engagement. With its results, you can figure out the steps to revise ads, site design, and product packaging. The approach is relatively cheap and easy to execute.

Facial Coding

This method focuses on the facial expressions of subjects to identify emotional responses. It enables you to figure out the emotions people feel: happiness, fear, anxiety, surprise, satisfaction, etc. For a relatively cheap price, you'll receive information that will help you improve your ad content and resonate with the audience.

Biometrics

This technique identifies the level of engagement and the type of response (positive or negative) based on skin respiration, conductance, and heart rate. Biometrics allows you to make your ad content in accordance with people's desires. Together with eye-tracking, it can significantly improve the ads and content you choose for them.

Electroencephalogram

It enables you to reveal customers' engagement and recall with the help of electrical signals that come from neurons inside the brain. This relatively expensive technique enables you to evaluate changes in short periods and improve the quality of ads and branding.

Functional Magnetic Resonance Imaging (FMRI)

This most expensive approach provides detailed emotional responses, recall, and customer engagement. To perform the method, you need a lab. fMRI identifies blood flow in the brain during high neural activity. As a result, you receive information that helps improve branding and set prices.

IMPLEMENTATION OF NEURO MARKETING

Study Patterns Of Eye-Tracking: Although you might not have paid much attention to eye movements and changes in them, they can provide insights into your business. Eye-tracking can identify whether customers like your advertising, product packaging, and design. The technique can also determine the elements of your ads online and in-store that drive more attention. By studying the gaze of customers, your team can define the things that help stand out and hook the audience. Gather a group of research participants to figure out whether customers like your company's colors, font, and visuals. Look carefully at customers to find out whether they got engaged with your ads in a store. Once you figure it out, you'll know what to do with your ads, packaging, and branding next.

Create A Positive Personality: It's a well-known fact that a smile drives attention, and images of happiness release endorphins. As a result, people become more interactive and open to society. Being friendly, open-minded, and cheerful enables you to be closer to the audience. It will establish trust and transparency. If you place an image of a smiling person on your ads or social media posts, it will shape a positive image of your brand. People will be more likely to purchase with your company.

Simplify The Rules To Enter: When you ask prospects to insert their credit card details to get a free trial, you are more likely to scare them away. They will look for a service that doesn't require this information. Users who sign up for a free trial without submitting card details are more likely to convert into customers. So consider this fact and try to reduce the barriers to entry. You can simplify the sign-up process, create intuitive web forms, and enhance the buyer journey.

Implement Psychological Tricks: Marketers adapt numerous tricks to capture customers and influence their buying decisions. All companies use specific price points to convince shoppers that they save a lot. For example, you'll often encounter prices like $99.99 instead of $100. Some companies can remove the dollar sign. Neuromarketers highlight other "tricks" that might be useful for the brand's revenue. If you place goods with light colors on the top shelves and goods with dark colors on the bottom shelves, your sales are more likely to increase.

Use Sensory Marketing: By appealing to customers' senses, you can reach them and build a positive image of a brand. You'll win attention and build trust. Nice smells and pleasant lighting can create an exceptional atmosphere and ensure an outstanding experience for customers. It'll have a positive effect on sales. Scents can create great memories and excitement people will associate with your brand later.

CONCLUSION

Overall, neuro marketing is still a nascent industry. Many of the companies working in the space are a step behind the curve, which makes it hard for industry leaders to establish legitimacy. As the field progresses and technology evolves, neuro marketers will continue to demonstrate their ability to impact marketing efforts in unprecedented ways and generate a higher ROI than any other form of market research. Until the rest of the world catches up, it's up to marketers to determine which neuro marketing companies are worth the investment.

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GREEN INNOVATION: DRIVING SUSTAINABILITY AND TRANSFORMING THE FUTURE FOR INDUSTRY 5.0

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ABSTRACT

Green innovation is the major component in the field of industry transformation towards sustainability in the future. In the face of mounting environmental challenges, green innovation has emerged as a critical force for sustainable development. By harnessing technological advancements and fostering creative solutions, green innovation aims to decouple economic growth from environmental degradation, ensuring a healthier planet for generations to come. This paper aims to fulfil the UNO 17 SDGs on the Industry 5.0 revolution and into the transformative power of green innovation, exploring its multifaceted benefits and outlining strategies for its effective implementation.

INTRODUCTION

In 2015, countries adopted the Sustainable Development Goals (SDGs). They embarked on a journey to achieve the 2030 Agenda to promote prosperity and address inequalities while protecting the environment. The 17 SDGs offer the most practical and effective pathway to tackle the causes of poverty, violent conflict, human rights abuses, climate change, and environmental degradation.

- No Poverty
- Zero Hunger
- Good Health and Well-being
- Quality Education
- Gender Equality
- Clean Water and Sanitation
- Affordable and Clean Energy
- Decent Work and Economic Growth
- Industry, Innovation and Infrastructure,
- Reduced Inequalities
- Sustainable Cities and Communities
- Responsible Consumption and Production
- Climate Action
- Life below Water
- Peace, Justice, and Strong Institutions
- Partnerships for the Goals

The world stands at a pivotal juncture, grappling with the escalating consequences of climate change, resource depletion, and biodiversity loss. These environmental crises demand a paradigm shift, a transition towards a sustainable future where human progress aligns with ecological harmony. Green innovation serves as a beacon of hope, offering a pathway to address these challenges and pave the way for a greener, more resilient world. This study focuses on implementing green innovation and fulfilling the 6, and 13,14,15,16 SDGs on Green innovation.

RELATED LITERATURE

Roeshartono Roespinoedji and et.al (2019) investigated the role of green organizational culture as the antecedent of both green product and process innovation. In addition, the current examination also analyzed the unique contribution of both product and process innovation in prompting organizational competitiveness and environmental performance in Malaysian companies. In doing so, we apply the Partial Least Square equation modeling approach. The results of the examination confirm that green product innovation; green process innovation and competitive advantage have positive and significant influences on green organizational culture. Moreover, the results of PLS-SEM likewise confirm that competitive advantage is positive and significantly influenced by green product innovation and green process innovation. The outcomes further affirm that competitive advantage has a positive and significant impact on environmental performance in Malaysian manufacturing firms.

Sanjay Kumar Singh and et.al (2021) found that this study examines direct and indirect effects among stakeholder pressure, green dynamic capabilities, green innovation, and performance of emerging market small and medium-sized enterprises (SMEs). Using survey questionnaires, multisource data from 248 SMEs in the manufacturing sector were collected and the partial least squares (PLS) path modelling approach (PLS-PM) was used to examine the hypotheses of the study. The study showed that stakeholder pressure influenced green dynamic capability, green dynamic capability influenced green innovation, and green innovation influenced firm performance. Furthermore, results also suggested that green dynamic capability mediated the influence of stakeholder pressure on green innovation and green innovation mediated the impact of green dynamic capability on firm performance. The findings of the study suggested critical implications for both theory and practice.

Yingying Sun, Kexin Bi, and Shi Yin (2020) found that solving the contradiction between economic growth and ecological environmental protection is a practical problem that should be solved urgently at present. First, the green innovation risks were divided into global green R&D risk, global green manufacturing risk, global green marketing risk, and global green service risk from the perspective of the process. Then, this study established a management criteria system for green innovation risk identification in the manufacturing industry under the global value chain (GVC). Furthermore, three methods were applied to identify the green innovation risk of the manufacturing industry under the GVC. Finally, this paper put forward the countermeasures to the green innovation risk of the manufacturing industry under the GVC. The empirical research results of this paper were as follows: From the perspective of the green innovation process, four risks were classified in this study, namely, global green R&D risk, global green manufacturing risk, global green marketing risk, and global green service risk. Among the four stages of green innovation risk, green

marketing risk was the highest, followed by green service risk, and green R&D risk and green manufacturing risk were the least.

DEFINITION OF GREEN INNOVATION

Green innovation comprises all types of innovations that contribute to the creation of key products, services, or processes to reduce the harm, impact, and deterioration of the environment at the same time optimize the use of natural resources. Such type of innovation develops a critical role these days because it channels an appropriate use of natural resources to improve human well-being. Moreover, the creation and incorporation of changes in products and production processes could contribute to sustainable development. The concept of green innovation is grounded as a development of other synonyms or related constructs (i.e., environmental innovation, eco-innovation, eco-efficiency), which have been frequently used indistinctly in the literature.

Green innovation encompasses the development and implementation of new products, processes and services that minimize environmental impact and enhance resource efficiency. It embraces a holistic approach, considering the entire lifecycle of products, from raw material extraction to end-of-life disposal. Green innovation transcends mere technological advancements; it encompasses a mindset shift, a commitment to sustainable practices and a collaborative effort among diverse stakeholders.

BENEFITS OF GREEN INNOVATION

The benefits of green innovation extend far beyond environmental protection. It fosters economic growth by spurring new industries, creating green jobs and enhancing energy efficiency. Green innovation also contributes to social well-being by improving air and water quality, promoting public health, and strengthening communities. Additionally, it bolsters national competitiveness by positioning countries as leaders in sustainable solutions. The following ten benefits towards implementation of green innovation in the industry sector.

- Reduces Energy Consumption
- Reduces Waste Thanks To Recycling
- Improves Product Design And Performance
- Reduces Business Expenses
- Facilitates Eco-Friendly Agriculture
- Reduces Water Consumption
- Reduces Air Pollution In The Cities
- Reduces Overall Carbon Footprint
- New Employment Opportunities
- Tax Incentive

STRATEGIES FOR IMPLEMENTING GREEN INNOVATION

Harnessing the power of green innovation requires a multifaceted approach. Governments play a crucial role in establishing supportive policies such as carbon pricing mechanisms, research and development incentives, and green procurement guidelines. Businesses must embrace sustainability as a core business strategy, integrating environmental considerations into their operations and product

development. The private sector can also contribute by investing in green technologies and fostering collaborations with academia and research institutions.

CASE STUDIES OF GREEN INNOVATION

Numerous examples illustrate the transformative impact of green innovation. Renewable energy technologies, such as solar and wind power, are revolutionizing the energy sector, reducing reliance on fossil fuels and mitigating climate change emissions. Sustainable agriculture practices such as organic farming and precision agriculture, are enhancing food production while conserving soil and water resources. Green buildings are minimizing energy consumption and waste generation, contributing to healthier cities and a reduced environmental footprint. The following top 10 Implications for green innovation in the field of Industry 5.0

- Harnessing Solar Energy Like Never Before
- Wind Power: The Future of Renewable Energy
- Hydroelectric Innovations: Making Waves in Sustainability
- Biofuels: Green Energy from Unexpected Sources
- Innovative Water Conservation Technologies
- Advancements in E-Waste Recycling Techniques
- Eco-Friendly Materials Revolutionizing Industries
- Eco-Friendly Materials Revolutionizing Industries
- Electric Vehicles: Driving Towards Clean Energy
- Vertical Farming: Agriculture's Upward Bound

CONCLUSION

Green innovation serves as a guiding light, presenting a route to a sustainable future where economic well-being harmonizes with environmental guardianship. Embracing green innovation allows us to alleviate the negative repercussions of climate change, preserve invaluable resources, and forge a healthier planet for future generations. It transcends being merely an alternative; it stands as a necessity, a shared duty to guarantee a flourishing planet for both our present and our posterity. In the 21st century, our country implemented several green innovation technologies in the industry sector and served the public sector in many ways, like EV vehicles, solar energy plants, wind energy plants, bio-fuels, hydropower plants, etc. In this case, India will fulfil UNO 17 sustainable development goals, including green innovation goals in the industry sector, within 2030.

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