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Table of Contents

LABOUR LAWS IN INDIA: THEN AND NOW

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"I believe in the dignity of labour, whether with the head or hand; that the world owes no man a living but that it owes every man an opportunity to make a living"

John D. Rockefeller

Abstract

The growth of a country is dependent both on the agrarian economy and industrial developments. For the industries, workman or the work force is one of the most essential elements. Industrial revolution has seen the increase in profits and at the same time the increase in the exploitation of the workforce. To solve this issue, there were various legislation in India. The Scope of this paper is introducing the labour laws in India. The paper will also see the historical development of the labour laws, the need for labour laws and so on. Due to limitation, the paper would cover only certain important legislations and its historical evolution.
made by international organisations to the promotion, enhancement, and enforcement of human rights.

Keywords*: Labour Laws, Workforce, Regulations, Human Rights, Legislation.*

1. Introduction

One of the most essential requirements in any industry or company or manufacturing unit is the labour force. Without labour, there would be no production and other allied works. Though it is true that capital remains one of the top essentials for setting up any industrial unit, but at the same time without labour, the capital would be of no use. The vice versa of this is also true, without capital, labour would not get any work.

When we talk about the labour laws, these can be briefly defined as the laws, regulations which gives rights, duties, liabilities of an employer and employee. These fix the responsibilities in the case of any mishappening, and provides a legal framework to approach in case any violation is done. Having separate and definite labour laws also work as a guiding light to both the employer and the employee to understand and limit their

ABOUT THE BOOK

The book is intended to capture contemporary discussions to build synergy between the two very different disciplines of Law and Psychology, The book Includes contributions from lawyers, psychologists, sociologists and criminologists, academicians, researchers, and industry experts in the field. The book bridges the inherent gap between the practice of law and the profession of psychology at an international level. The book will be essential reading not only for academics and professionals in psychology, the law, and related disciplines wishing to understand the broadening base of psychology within the legal process but also for students trying to form an understanding of the emerging science and the associated career opportunities for this exciting field.

ABOUT THE EDITORS

Dr. Komal, Associate Professor (Law), Gurugram University Gurugram

A versatile and passionate academic professional with over 16 years of teaching and industry experience with Industry experience to her credit. Dr. Komal is PhD in Corporate Law, she is also the author of a comprehensive text-book, "Law related to Mergers and Acquisitions" (Thomson and Reuters), and edited book named 'Contours of Real Estate Laws' besides being a dedicated teacher and mentor in the discipline. Her expertise in Commercial laws has been tapped by the Indira Gandhi National Open University (IGNOU) to create discipline-specific for the benefit of the broader community of learners in the country. Dr. Komal with her research and writing acumen has combined the theoretical and practical aspects of law to mould a teaching pedagogy in law school and published MOOCs on various platforms. She has presented papers in national & international conferences. Published research papers in reputed journals, book chapters

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CONTENTS

CHAPTER 1

Analysing The Rights Of Person with Mental Illness

Dr. Kirti Dahiya

"Your mental health is everything, prioritize it. Make the time like your life depends on it because it does." *Mel Robbins*

ABSTRACT

According to the Mental Health Act, 2017, mental illness means, *"substantial disorder of thinking, mood, perception, orientation or memory that grossly impairs judgment, behaviour, capacity to recognise reality or ability to meet the ordinary demands of life, mental conditions associated with the abuse of alcohol and drugs, but does not include mental retardation which is a condition of arrested or incomplete development of mind of a person, specially characterised by subnormality of intelligence."*

There can be varied reasons for a person to suffer from mental illness which includes abusive relationship, family and societal pressure and so on. The purpose of this chapter is to analyse the meaning and definition of the term mental illness, to find out some of the causes for the same. The Chapter further analyses the various rights available to persons suffering from mental illness under the Constitution of India and the Mental Healthcare Act, 2017.

INTRODUCTION

According to the Mental Health Act, 2017, mental illness means, a "substantial disorder of thinking, mood, perception, orientation or memory that grossly impairs judgment, behavior, capacity to

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DR. HERAMB NAYAK
DR. SUMITA KUKREJA
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SEEMA

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Exploring Relationship of High-performance Work System with Knowledge Workers' Work engagement through Indirect and Indirect Effects

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Abstract

This research work was undertaken to examine how the implementation of a high-performance work system (HPWS) affected the level of work engagement in Indian knowledge workers by observing the both direct and indirect effects. Research was carried out involving 202 knowledge workers from India. The study employed an online survey to gather information from the participants, and the data was obtained through a structured questionnaire. According to the study's findings, Indian knowledge workers recognized and valued the advantages of an HPWS (High Performance Work System) that embraced employees' participation in important decisions, receive ongoing training and development, access pertinent information and knowledge, and have access to a well-structured performance evaluation system. Furthermore, the study demonstrated that Indian knowledge workers also acknowledged their level of engagement in their work, indicating a willingness to take on challenges, voluntarily assist colleagues and supervisors, and fully engage with their tasks. In general, HPWS reported for 35 per cent of the variability in job engagement and exhibited a positive connection with work assignment. The study's findings also showed that HPWS reported for 31 per cent of the alteration in psychological contract fulfillment, 22 per cent of the variance in workers' perceived organizational support in terms of resources, and 33 per cent of the variance in organizational identity among Indian knowledge workers. Notably, constructs like 'psychological contract fulfillment,' 'organizational identity' and 'perception of job resources' influenced the Indian knowledge workers' 'work engagement.' Also, findings showed that in the context of Indian knowledge workers, factors such as the 'psychological contract fulfillment,' 'perception of job resources,' and 'organizational identity' played a role as partial mediators between High-Performance Work Systems (HPWS) and knowledge workers' 'work engagement.' Moreover, 'job satisfaction' acted as a perfect intermediary or mediator between 'fulfillment of psychological contract' and 'work engagement'.

Keywords: High-Performance Work Systems, knowledge workers, work engagement, organizational identity.

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1. Introduction

Several multinational companies have recently established themselves in India, leading to increased competitive pressure on all market participants (Al-Kwifi et al., 2020). This situation has also highlighted the significance of knowledge workers. The term "knowledge workers" was given in 1959 by Peter Drucker, referring to extremely skilled individuals who apply their theoretical as well as analytical expertise to create new products (Sims, 2006). As the labour market grows more specialized, there's a growing demand for knowledge workers who have specialized knowledge and creative skills (Surawski, 2019). Knowledge workers play a crucial role in promoting and developing companies and creating sustainable competitive advantages (Igielski, 2017). The success of an organization depends on the engagement and performance of knowledge workers. J.P. Morgan's study highlights that organizations have improved their approaches to recruit, select, train, compensate, evaluate, and motivate their human resources (International Labour Organisation., 2019). Organizations are now viewing their human resources as valuable members and implementing the systems to improve their productivity, performance, and effectiveness. HPWS, or 'high-performance work systems', pertain to coordinated HR practices that aspire to improve employee effectiveness (Özçelik et al., 2016). Various definitions for HPWS exist, with describing it as a system combining hiring selectively, training extensively, empowerment, reduced status differences, performance-based pay, and sharing information with workers to maximize performance (Rayton & Yalabik, 2014). HPWS as labour management approaches that enhance skills, promote participative work, and motivate employees to improve organizational performance. Overall, HPWS is a set of practices that aim to enhance employee motivation, skills, and engagement (Harley, 2002).

In the knowledge economy, using HPWS has been agreed upon by both managers and employees to enhance job performance, but disagreements remain regarding the intangible cognitive aspects of the job, which can lead to reduced work engagement (Latham, 2021). Although some HPWS measures effectively enhance performance, the influence of HPWS on job engagement is not fully understood (Bieńkowska & Ignacek-Kuźnicka, 2019). Work engagement is a favorable work-related mental condition portrayed by passion, strength, and attachment (Bakker, Leiter & Breevaart, 2011; Bledow et al., 2011). Both definitions highlight the importance of absorption, vigour, and dedication in work engagement. HPWS may impact the engagement of knowledge workers through various mechanisms, but incorrect practices can demoralize and negatively impact performance (Mládková et al., 2015). However, the effect of HPWS on Indian knowledge workers has not been adequately explored (Varma et al., 2005). It is thus important to delve into the impact of HPWS on job engagement of knowledge workers in India. According to a study undertaken by Techcircle (2023) in Indian context, it was found that Indian knowledge workers like programmers, architects and scientists face exhaustion and high turnover, especially amidst younger workers in smaller organizations. So, in order to withhold employees, the managers are resorting to implementing HPWS, which offers competitive and motivating salary packages, training, authorization, and empowerment (Bhargava, 2020). Nevertheless, studies detailing the HPWS impact on knowledge workers engagement in India are limited and no to little agreement is there about the mediation mechanisms (Varma et al., 2005). Keeping these gaps in mind, this study investigates how HPWS impacts the 'work engagement' of knowledge workers in India.

2. Literature Review

Sufficient number of research have probed the impact of 'High-performance work systems' (HPWS) on employees' work commitments. The impact of HPWS on work engagement can be understood with the help of 'social exchange theory'. Social exchange theory assumes that social behavior is the outcome of an exchange process. The primary intent of exchange process is to increase profits while denigrating the associated costs (Cook et al., 2013). The theory believes that individuals ordinarily weigh the strengths and weaknesses of social behaviors and associations before determining whether to partake in such behaviours or not. Their decision is influenced by determining which factor holds greater importance, whether it is the outweighing of benefits over risks or the reverse. If the advantages surpass the risks, people tend to get involved in the behavior or relationship. Conversely, if the risks surpass the advantages, people tend to evade the behavior or end the association.

HPWS is known to positively impacting the employee engagement in Indian manufacturing sector (Huang et al., 2018). Other studies also confirm positive impact of HPWS on employee engagement in various industries (Peprah, 2020; Zhu et al., 2022). This indicates that when HPWS is increased, employees tend to be more engaged in their work and the organization. Contemporary research recommends that HPWS exerts a positive effect on 'work engagement', but it is believed to be indirect. In a study it was found that HPWS was inversely related to psychological contract breaches

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(Braekkan, 2012). As investment in HPWS increased, employees' perception of psychological contract violations decreased (Abdullah, 2017). Another study by Li and Yu (2017) focused on the mediating role of psychological contracts in the relationship between HPWS and Organizational Citizenship Behavior (OCB). Their investigation uncovered that HPWS was associated positively with relational and balanced psychological contracts, but negatively related to transactional psychological contracts. This led to the formation of the study's first hypothesis expressing:

H1: HPWS is positively related to the psychological contract fulfilment of Indian knowledge workers.

Job resource demand theory suggests that job demands and resources have a mediating role in employee engagement. It suggests that in situations where both job demands and resources are elevated, employees experience increased engagement with their work. Although few studies examined the effect of HPWS' on perceived job resources; HPWS is hypothesized to have a positive influence on job resources due to its ability to enhance employees' ability to carry out their tasks effectively. Comprehensive training, which is a part of HPWS, equips employees with the necessary knowledge and skills to perform their tasks competently. As a result, employees can use the available resources effectively, leading to a sense of adequate job resources (Fu et al., 2019). Another reason is the provision of resources by the organization. According to HPWS definitions, employee involvement is an important component. However, since there is limited research in this area, future studies should discover the effect of HPWS on the perception of resources within the job. So, the next hypothesis suggests:

H2: High Performance Work System is positively associated with perceived job resources by Indian knowledge workers.

'Organizational identity' refers to how companies resemble individuals, whereas social identity theory states that High Performance Work System creates an organizational identity that Human Resources identify with and perceive as congruent with their own identities, leading to greater work engagement and commitment to the organization. However, empirical research on the connection between HPWS and organizational identity is limited. (Mahdi et al., 2015) found a positive correlation between HPWS and organizational identity, indicating that when HPWS is improved, organizational identity also increases. However, besides the research is a scarcity of studies that explore the HPWS' influence on organizational identity. Thus, this is an area that requires further investigation in future research (Mahdi et al., 2015).. This led us to hypothesize:

H3: HPWS is positively associated with Indian knowledge workers' organizational Identity.

According to a study, there exists no direct link between work engagement and breaking the psychological contract (Rayton & Yalabik, 2014). However, it was discovered that breaking the psychological contract lowers job satisfaction, which in turn decreases work engagement (ibid). This indicates that fulfilling the psychological contract has a positive relationship with work engagement, mediated by job satisfaction (Rayton & Yalabik, 2014). Another study by Malik and Khalid (2016) explored how breaking the psychological contract affects the intentions behind a turnover and engagement at work. Their findings indicated a negative association between the two. Studies have support this finding, while some studies suggest that the relationship is moderated by job satisfaction (Al-dalahmeh, Khalaf and Obeidat, 2018; Wirawan, Jufri and Saman, 2020; Wang et al. 2020). This resulted in formation of hypotheses H4 and H5 expressing:

H4: Psychological contract satisfaction motivates Indian KWs (Knowledge Workers) to work engagement.

H5: Job Satisfaction mediates the effect of psychological contract satisfaction on Indian knowledge workers' engagement.

Numerous studies have delved into the relationship amidst work engagement and job resources and indicated towards a positive relationship; however, 'perception of job resources' tends to be a les explored field. In 2015, Alzyoud, Mohd Isa and Othman also found an affirmative correlation between work engagement and job resources in another study (Alzyoud et al., 2015). According to Van den Broeck (2017), since possessing job resources tends to lead to workers perceiving these resources positively, it might be contended that a favorable 'perception of job resources' is somewhow associated with better work engagement (Van Den Broeck et al., 2017). Drawing from these results, it is inferred that job resources bolster engagement at work, implying that a favorable perception of job resources is likely to amplify the engagement in work as

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well. However, such studies are extremely limited in Indian context; but based on available literature, it can be assumed that:

H6: Perceived Job Resources increase job engagement of knowledge workers in India.

Very few studies have indicated that organizational identity might have positive effects on work engagement; but it is possible to hypothesize the relationship between the two factors based on the definition of organizational identity. Organizational identity pertains to the set of articulations that the members of an organization consider essential, distinguishable, and enduring (Field & Buitendach, 2011). The increased engagement can be attributed to employees feeling proud of their organization and wanting to be associated with it. As a result, they may work harder to uphold these optimistic features (De Waal & Pienaar, 2013). However, the lack of research on this topic suggests that this can only be hypothesized, highlighting the necessity for additional investigation in this domain.

H7: Organizational identity motivates knowledge workers in India for work engagement.

Some gaps in the available academic literature are obvious. There is clearly a lesser research on the correlation between perception and enagegment towards work; despite the expected positive effects on the latter; that managers struggle to achieve with knowledge workers. Another gap concerns the link between HPWS and perception of job resources, which researchers have largely overlooked. Likewise, very less research eextablishing the relationship between organizational identity and work commitment. Moreover, extremely less researches have been conducted in Indian context and mediating effects have also been observed on different organizational outcomes. Hence, this study was designed to understand the both immediate and mediated effects of HPWS on job engagement.

3. Research Methodology

The present study empirically investigated how HPWS impacts work engagement among Indian knowledge workers, considering variables such as psychological contract fulfillment, perception of job resources, and organizational identity. Following quantitative research principles, the study collected primary data through a survey and analyzed it using inferential statistics to identify patterns and relationships. This study hypothesized a positive association between these variables and aimed to determine the generalizability of the collected data. For data collection, close-ended questions were used through standardized questionnaires to reach a large sample size cost-effectively and facilitate data analysis using statistical methods. The questionnaire contained 29 statements that covered all the key variables of the study. Respondents rated each statement on a 5-points Likert scale. In this study, purposive sampling was employed due to its convenience and cost-effectiveness. The study collected data from 210 respondents, which was considered sufficient for this investigation. SPSS was utilized to analyze the data. To facilitate easy understanding of the collected data, descriptive statistics were utilized to visualize the data's central tendency and dispersion. Tables were used to represent the data. To confirm the internal consistency and avoid measurement error, it was essential to estimate the reliability of the scale. A valid and reliable measure ensured the reproducibility of the research. In order to ascetain the reliability and validity of the research instrument, Cronbach Alpha was employed. The study put forth a hypothesis suggesting a positive connection between multiple variables, and Pearson's Correlation Coefficient has been used to measure this relationship by understanding the degree and direction of this relation. As, this investigation sought to comprehend the effect of HPWS on work engagement of knowledge workers in India; regression statistic was used.

4.1 Findings of the study

The information gathered from 210 Indian professionals was examined and has been displayed under various headings.

4.1. 1 Demographical details of the respondents

Table 1 provides details on the gender, age, years of experience within the company, and industry type of the respondents from whom data was gathered. Table 1 reveals that 47.6 per cent of the sample were male, while 52.4 per cent were female. Among the age groups, 41.4 per cent were between 26-35 years old, followed by 24.8 per cent in the 36-45 years and 20.5 per cent in the above 45 years age group. Only 13 per cent of the respondents were between the age group of 18-25 years.

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Table 1

Table 1: Demographics of the respondents

Particular	Variable	Frequency	Percentage
Gender	Male	100	47.6
	Female	110	52.4
Age	18-25 years	28	13.4
	26-35 years	87	41.4
	36-45 years	52	24.8
	More than 45 years	43	20.5
Number of years in the company	Less than 5 years	99	47.14
	5-7 years	78	37.14
	8-10 years	19	9.04
	10 years above	14	6.67
Profession	Programmer/ Data scientist	50	23.8
	AI/ML engineer	42	20
	Architect	36	17.14
	Consultant	59	28.1
	Others (lawyers, scientist, academician)	23	10.95

Nearly half of the participants, around 47.14 per cent, have been linked to their current organization for less than 5 years, while 37.14 per cent stated their affiliation with their present company to be lasting between 5-7 years. Only 9 per cent of the respondents declared their association with their existing company for the last 8-10 years. 28 per cent respondents were consultants whereas 24 per cent of the sample was represented by the programmers and data scientists.

4.1.2 Cronbach's α Test for reliability

In order to guarantee the consistency and dependability of the measurement scale, this study used Cronbach's Alpha. A score of 0.7 is considered acceptable to guarantee the that measurement scale is reliable. In the given Table 2, Cronbach's Alpha values spanned between 0.720 to 0.944, indicating that the measurement scale used to evaluate the impact of high-performance work systems on engagement at work was reliable.

4.1.3 Descriptive Statistics

Descriptive statistics are presented in Table 2. It can be seen from the table that the score for each item was above the average value of 3, indicating a positive assessment. The mean values for the statements ranged between 3.59 and 4.50, and the standard deviation values ranged from 0.402 to 0.762. Additionally, Table 2 displays the mean values for each construct, which ranged from 3.70 to 4.52. Work engagement was assigned the highest value, while job satisfaction received the lowest score.

Table 2: Descriptive and reliability statistics

Construct	Items	Item Mean	Std. Deviation	Construct Mean	Cronbach Alpha
High-performance work system (HPWS)	HPWS1	3.85	.642	4.09	.944
	HPWS2	4.18	.625		
	HPWS3	4.17	.612		
	HPWS4	4.26	.687		
	HPWS5	4.03	.728		

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	HPWS6	4.05	.762		
	HPWS7	4.12	.666		
Work engagement (WE)	WE1	4.33	.571	4.47	.901
	WE2	4.55	.480		
	WE3	4.53	.418		
	WE4	4.56	.608		
	WE5	4.49	.590		
	WE6	4.41	.570		
Psychological contract fulfilment (PCF)	PCF1	4.09	.609	4.17	.789
	PCG2	4.15	.588		
	PCF3	4.18	.402		
	PCF4	4.24	.528		
Perception of job resources (POJR)	POJR1	3.77	.505	3.94	.823
	POJR2	3.88	.620		
	POJR3	3.94	.613		
	POJR4	4.18	.568		
Organizational identity (OI)	OI1	3.73	.575	3.85	.720
	OI2	3.79	.505		
	OI3	3.82	.489		
	OI4	4.06	.669		
Job satisfaction (JS)	JS1	3.59	.512	3.72	.767
	JS2	3.66	.672		
	JS3	3.77	.425		
	JS4	3.84	.518		

4.1.4 Analysis of the Correlation Coefficient

This study tested an affirmative association between various variables through bivariate correlation taking the statistical significance level at 5 per cent. All variables had a significant positive correlation, with coefficients spanning 0.429 to 0.774 (refer table 3). HPWS showed a significant favourable correlation with psychological contract fulfillment (PCF), perception of job resources (POJR), and organizational identity. The results confirmed a moderate association between HPWS and PCF, POJR, and organizational identity, with correlation coefficients ranging from 0.550 to 0.650.

Table 3: Correlation analysis

Correlations							
		HPWS	WE	PCF	POJR	OI	JS
HPWS	Pearson Correlation	1					
	Sig. (2-tailed)						
	N	210					
WE	Pearson Correlation	.582**	1				
	Sig. (2-tailed)	.000					
	N	210	210				
PCF	Pearson Correlation	.650**	.774**	1			
	Sig. (2-tailed)	.000	.000				
	N	210	210	210			

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POJR	Pearson Correlation	.550**	.774**	.527**	1		
	Sig. (2-tailed)	.000	.000	.000			
	N	210	210	210	210		
OI	Pearson Correlation	.588**	.714**	.636**	.660**	1	
	Sig. (2-tailed)	.000	.000	.000	.000		
	N	210	210	210	210	210	
JS	Pearson Correlation	.552**	.792**	.551**	.586**	.429**	1
	Sig. (2-tailed)	.000	.000	.000	.000	.000	
	N	210	210	210	210	210	210
**. Correlation is significant at the 0.01 level (2-tailed).							

Table 3 exhibits a positive relationship of 'psychological contract fulfillment' with employees' 'work engagement', with a significant correlation coefficient statistic of 0.774 (sig. <0.05). 'Work engagement' too, was significantly associated with 'perceived job resources' with significant correlation coefficient statistic of 0.774 (sig. <0.05) and with 'organizational identity' with a significant correlation coefficient value of 0.714 (sig. <0.05). These findings affirmed that 'work engagement' had a strong favourable relationship with 'psychological contract fulfillment', 'perceived job resources', and 'organizational identity'.

4.1.5 Hypotheses testing

The primary reason of conducting this investigation was to explore how 'high-performance work systems' impact or influence 'work engagement' of Indian knowledge workers. It was anticipated that 'high-performance work systems' would have a favorable impact on 'psychological contract fulfillment' and 'organizational identity', and these components would consequently affect the employees' 'work engagement'. This study utilized regression analysis to test these suppositions and the outcome of the same have been displayed in Table 4.

Table 4: Regression summary

Hypothesized relationship	R2	Beta	t-value	Significance	Decision
HPWS--PCF	.313	.530	9.368	.000	Accept
HPWS--POJR	.222	.440	7.117	.000	Accept
HPWS--OI	.334	.572	9.859	.000	Accept
PCF--WE	.584	.761	16.701	.000	Accept
PCF—JS--WE	.712	.126	1.152	.100	Accept
JS--WE		.709	8.730	.000	
POJR--WE	.542	.712	15.642	.000	Accept
OI--WE	.545	.739	15.746	.000	Accept

The table 4 shows that HPWS (high-performance work system) accounted for 31 per cent of the change in 'psychological contract fulfillment' of Indian knowledge workers. ANOVA was utilized to test the applicability of the regression statistic; that yielded with a significant F statistic value (88.830, sig.<0.05). HPWS was reported with a beta value of .530 and a significant t value (9.318, sig.<0.05), showing a strong relationship with 'psychological contract fulfillment'. These findings affirmed the hypothesis H1, which envisaged a positive link between HPWS and 'psychological contract fulfillment' of Indian knowledge workers.

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Table 4 exhibits that HPWS accounts for 22% of the differences in perceptions of job resources of knowledge workers in India. Corresponding ANOVA statistics also indicated a significant F value i.e., 51.657 (Sig. < 0.05). HPWS was also seen associated with a beta value of 0.440; that was accompanied by a significant t-value (7.117, sig. < 0.05), denoting that HPWS was significantly linked with perception of job resources. These results supported the hypothesis H2 suggesting a positive relationship between HPWS and Indian knowledge workers' perceptions of job resources.

Table 4 shows that HPWS accounted for 33 per cent of the variation in organizational identity among Indian knowledge workers. ANOVA statistics were significant (97.546, sig.<0.05), with a beta value of .574 and a significant t-value of 9.859 (sig.<0.05), indicating HPWS as a significant predictor of organizational identity. These findings support hypothesis H3. Furthermore, psychological contract fulfillment explained 58 per cent of the variation in work engagement, with a significant t-value of 292.250 (sig.<0.05). Psychological contract fulfillment had a beta value of .761 and a significant t-value .of 16.701 (sig.<0.05), indicating that it was a crucial indicator of work engagement, supporting hypothesis H4.

The study proposed job satisfaction as a medium to brdge the gap between psychological contract fulfillment and Indian knowledge workers' engagement. When both these were considered together, the beta value decreased to .129 with an insignificant t-value of 1.152 (sig.>0.05), while job satisfaction remained a significant predictor of work engagement, with a beta value of .712 and a significant t-value of 8.730 (sig.<0.05). The findings suggest that job satisfaction completely mediates the relationship between these two variables, supporting hypothesis H5. (Table 4)
The perception of job resources explained 54 per cent of the variation in work engagement for Indian knowledge workers (Table 4). The regression analysis had a significant ANOVA statistic with a value of 238.529 (sig.<0.05). The perception of job resources had a beta value of .712 and a significant t-value of 15.642 (sig.<0.05), suggesting its significant role in predicting work engagement. These findings support hypothesis H6.

Organizational identity accounted for 55 per cent of the variation in work engagement among Indian knowledge workers, with a significant beta value of .739 and a significant t-value of 15.746 (sig.<0.05). These results support hypothesis H7, which suggests a positive association between organizational identity and work engagement among Indian knowledge workers, as shown in Table 4.

HPWS explained 35 per cent of the variation in work engagement and had a significant beta value of .599 and a t-value of 1.563 (sig.<0.05), supporting hypothesis H2. HPWS also positively influenced relational expectations fulfillment, perceived job resources, and organizational identity, which in turn impacted work engagement. The findings of this study revealed that work engagement was influenced by job satisfaction, which worked as a mediator in the relationship between fulfillment of the psychological contract and job engagement. Sobel test was used to check the mediating mechanisms between High performance work system and job engagement.

4.1.6 Validating the mediating mechanisms

Table 5 shows the results of the Sobel test, which examined the mediating character of PCF, POJR, and organizational identity between HPWS and engagement towards work. HPWS was a significant predictor of work engagement (b = .420, p < 0.05), and when the mediators were added to the regression analysis, HPWS remained a significant predictor but with reduced predictive power (see C' values column). All variables were found to be partial moderators

Table 5: Sobel Test

Hypothesis with mediator CS	a with std. error	b with std. error	C (with sig.)	C' (with sig.)	Sobel test statistic	Type of mediation	Result of Sobel Test
HPWS---PCF---WE	.530, .044	.761,.043	.420 (.040)	.178 (.030)	9.0112	Partial	Significant
HPWS---POJR--WE	.440, .049	.712, .034	.420 (.040)	.231 (.000)	8.253	Partial	Significant

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HPWS---OI---WE	.572, .036	.739, .071	.420 (.040)	.178 (.000)	8.706	Partial	Significant
PCF---JS---WE	.715. .027	.709, .038	.761 (.000)	.126 (.100)	15.252	Complete	Significant

The Table results show job contentment as a variable which mediates between PCF and job engagement. The results reveal that satisfaction regarding a job completely mediates the relationship between PCF and work engagement, with a non-significant value of b= .126 ($p > 0.05$). These results were consistent with those reported in Table 4. Sobel test confirmed the statistical significance of the mediating effects for each variable ($p < 0.05$).

5. Discussion of the findings and implications

The current enquired sought to examine the impact of HPWS on Indian knowledge workers' job engagement. Data was collected from 210 workers with varying demographics and work experience. Results revealed that most respondents perceived adequate incentives and believed that their companies incentivized them to perform better. These results resemble with earlier research's results of Yalabik et al. (2008), Carvalho and Chambel (2014) and Jyoti and Rani (2017), which highlighted the significance of discriminating hiring, skill development, empowering work environment, merit-based compensation, comprehensive perks, competent appraisal schemes, and workers' encouragement in high-performance work systems. The outcomes of this study suggest that Indian companies embrace all the characteristics of HPWS as well (Carvalho & Chambel, 2016; Jyoti & Rani, 2017; Yalabik et al., 2008).

Respondents were motivated to achieve their goals and accept challenges, as seen in previous researched by Bakker et al. (2011) and Bledow et al. Job Engagement was defined as a fulfilling job-related experience characterized by absorption, vigor, and dedication. The current study's findings supported this, validating that high-performance work systems (HPWS) significantly enhance work engagement and account for 36 per cent of the variance. Previous research by Huang et al. confirmed the positive association of HPWS with job engagement. Husin, Mansor and Kelana (2021).and Li et al. (2019) also found that employee mood and job satisfaction could mediate this relationship. Thus, the present study confirmed that HPWS can impact work engagement both directly and indirectly, with various factors mediating this relationship. These findings support the social exchange theory, which suggests that both organizations and human resources can be benefitted from implementing HPWS (Kumar, 2018).

The study hypothesized that HPWS would have a favourable connection with the fulfillment of psychological contract, perceived job resources, and organizational identity. These results confirmed all the hypothesized relationships. The research found that most of the respondents of this study felt that their employers delivered the promises that were made for supporting employees and fulfilling obligations, which positively impacted psychological contract fulfillment. Regression analysis showed that HPWS explained 31 per cent of the differentiation in psychological contract fulfillment among Indian knowledge workers. The findings can be explained by the theory of social exchange, which suggests that psychological contract fulfillment is enhanced by HPWS, eventually leading to increased job engagement and involvement. Turnley et al. (2003) also argue that High performance work systems fulfills the expectations of employee and increases employee productivity. Overall, the present study's results align with previous research conducted by researchers (Rogozińska-Pawełczyk, 2020), (Pawełczyk et al., 2021).

Participants in the study reported having workplace autonomy and employer support, with access to professional development and supervision. The research hypothesized a favorable relationship amid a high-performance work system and perceived job resources. Regression analysis revealed that HPWS accounted for 22 per cent of the variation in Indian knowledge workers' perception of job resources. The job demand theory also supports these results, as HPWS can improve job resources, enabling employees to handle increased job demands effectively. In conclusion, the research's conclusions support previous findings from the past conducted for the relationship between HPWS and perception of job resources (Andersén & Andersén, 2019; Fu et al., 2019; Granziera et al., 2021).

Results showed that most participants identified strongly with their company and believed its values aligned with their own. The study hypothesized that a high-performance work system would positively impact organizational identity, and the results confirmed this, with HPWS explaining 33 per cent of the variation. These findings align with Mahdi et al.'s (2014) study and support the social identity theory's notion that HPWS fosters employee performance by creating a feeling

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of attachment to the organization. The social identity theory also suggests that HPWS systems are designed to improve employee performance by fostering a sense of belonging and identification with the work group and the organization.

The goal of the research was to analyze the mechanisms through which HPWS the work engagement. The study confirmed that PCF, POJR, and organizational identity acted as partial mediators between HPWS and work engagement. So, it can be said that HPWS has both immediate and mediated effects on work engagement in Indian context. It was found that High performance work systems had the highest influence on organizational identity, then by the fulfilment of psychological contract, and the lowest impact on perceived job resources. While past researches have examined the effect of HPWS on various variables, they did not highlight their relative contributions. Therefore, this study makes a unique contribution to the existing literature by identifying the relative impact of HPWS on these variables.

Findings revealed that psychological contract fulfillment explained 58 per cent of variance in work engagement. Respondents were satisfied with their jobs and companies, and their job matched their desired type. The correlation between psychological contract fulfillment and work engagement was completely mediated by satisfaction in their job. Past research has consistently demonstrated a detrimental effect of psychological contract breach on work engagement (Rayton & Yalabik, 2014), which is supported by these findings. However, the present study's results do not align with those of Rayton and Yalabik (2014), who discovered that only the relationship of work engagement with psychological contract breach was reconciled by job satisfaction. and denied the direct effect of PCF on WE. The different results could be understood by appreciating the treat of psychological contract wherein Rayton and Yalabik (2014) studied the latter from negative perspective i.e., breach; whereas this study discussed the positive aspect of psychological contract i.e., fulfillment (Rayton & Yalabik, 2014).

54 per cent of the variation in the Indian knowledge workers' job engagement was explained by the perception of job resources. Job resources were utilized to measure the perceived job resources in the previous literature. The results align with the theory of job demand (Kim, 2015; Bakker and Demerouti, 2017), which suggests when there is a high level of job demands and resources, job engagement improves. HPWS provide organizational personnel with the necessary resources, enhancing their work engagement. 55 per cent of the variation in work engagement was determined by the organizational identity. The results matched with previous studies wherein employees appreciating the organization's values and characteristics working harder, resulted in better productivity and increased engagement (De Waal and Pienaar, 2013). The results can be understood through the lens of social identity theory, which suggests that social behavior may be affected by affected by an individual's group membership, character, and motivations. Therefore, the present study largely supports previous research.

The findings also showed that psychological contract fulfilment, organizational identity, and impression of job resources had the least impact on work engagement. Job satisfaction, however, served as the only mediator between psychological contract fulfilment and job engagement. Although earlier research acknowledged the mediation effect of job satisfaction, it did not examine the relative weighting of each element on work engagement. This qualification signifies the distinctive contribution that this study makes to the body of research.

The study has important implications. Firstly, it attempts to clarify how HPWS affects work engagement among Indian knowledge workers by considering the role of four different variables. The study also confirms the mediating function of PCF, POJR and organization identity between HPWS and work engagement; and job satisfaction between psychological contract fulfilment and work engagement, which brings much-needed clarity to the inconsistent findings of previous studies. Moreover, the research reveals that the impact of fulfilment of psychological contract on job engagement is not direct, and job contentment mediates this association completely. This information greatly contributes to the current literature. This research findings have vital implications for human resources in the knowledge arena due to which HR managers should take these findings seriously. Organizations must pay attention to employee needs and keep their pledges and commitments. In order to maintain employee engagement, managers are encouraged to provide enough training and opportunities for professional development. Also, they must take steps to ensure that employees strongly identify with the company's underlying principles.

6. Conclusion

The motive of the study conducted was to understand how a high-performance work system affects work engagement in Indian knowledge workers. Results showed that Indian knowledge workers were provided with opportunities to engage in

crucial decision-making processes and receive regular training and development chances. They also successfully maintained the balance between their work and personal life and received incentives for better performance, germane data and sharing information, and had a performance evaluation framework that was well developed. In summary, the study found that a high-performance work system had a favorable relationship with work engagement. Fulfillment of Psychological contract, perceived job resources, and organizational identity were the salient mechanisms through which HPWS affected work engagement. Indian knowledge workers had a strong sense of attachment with their organizations and recognized unequivocally with them. The study shows that HPWS had the greatest influence on organizational identity and psychological contract performance. We could also ascertain that psychological contract fulfillment, perception of job resources, and organizational identity were positively related with work engagement. Further, job satisfaction fully intervened the relationship between psychological contract fulfillment and work engagement. This research found that maximum variation in Indian knowledge workers' work engagement was determined by psychological contract fulfillment, followed by organizational identity.

7. Limitations and future research directions

Quantitative methods were employed in the study to investigate the effect of High-performance work systems on job engagement. However, these quantitative methods are limited in their ability to provide a comprehensive understanding of the real emotions, beliefs, and values. They also suffer from artificial experimental conditions. Hence, researchers in future may consider implementing a mixed methodology to gain a better understanding of the impact of HPWS on work engagement. Sampling method was another disadvantage. The present study used judgmental sampling, which allowed the investigators to gather data from Indian employees knowledgeable about high-performance work systems. Although this method is cost-effective and timely, though it suffers from investigator bias, yielding a less representative sampling, and it also affects the generalization of the findings. So, future investigators are recommended to employ probability sampling. Another limitation of the study is the sample size. Although the sample size of 210 respondents was statistically effective, small samples greater variability, which may reduce the results' trustworthiness. Therefore, potential researchers are advised to collect data from larger sample and compare the inconsistency in findings, if any.

The study focused on the impact of HPWS on work engagement among Indian knowledge workers. However, there are other employee outcomes that have been reported by previous researchers such as motivation, organizational citizenship behavior, productivity, retention, and loyalty. Future examinations should take into account these variables while researching the impact of high-performance systems. In addition, while the current study considers employee engagement as a dependent variable and job satisfaction as an intermediate variable between PCF and job engagement, future exploration should do filter the character of job engagement either as a dependent or an intermediate variable through separate studies. It is also suggested that the mediating role of job satisfaction between HPWS and job engagement should be considered in future research.

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10 Impact of Artificial Intelligence in Promoting Teaching and Learning Transformations in Education System

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Chapter Abstract:

It is a well-established fact that every organization is established with a certain purpose and goals. Virtually all business organizations regularly obtain measurements dealing with end results but what is reflected on the balance sheet does not necessarily show the true worth of organizations and do not ensure their survival. Thus, the question arises: what exactly makes the organizations sustainable and successful in an ever changing environment? There are several examples of companies like Faber-Castell (1761), Bank of Ireland (1783), Chivas (1802), DuPont (1802) and many more which have been able to sustain and survive over the years and still have a successful existence in the present era. Thus, it is important for the organization to pay equal attention to its three bottom lines, i.e., people, profit and planet for its sustainability, which not only meet the needs of the present generation but should have a futuristic approach as well. At the present time, there is a new normal working dynamic adopted by maximum organizations

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coping with the pandemic situations to sustain the business environment. Technology is playing a major role in this new working dynamic where machine learning and artificial intelligence (AI) is facilitating human functioning at work in an effective manner. The aim of the book is to contribute to the understanding and development of sustainable human resource management processes and practices having recent technologies in alignment. It covers the interconnection among three bottom line sustainable approaches for the growth and development of the organization. Topics discussed in this book include: • Disruptive technologies and HR sustainability • Convergence of artificial intelligence, HR and organizational growth • Triple bottom line sustainability for HRM • Business oriented talent analytics • Role of leadership in sustainable HRM practices.

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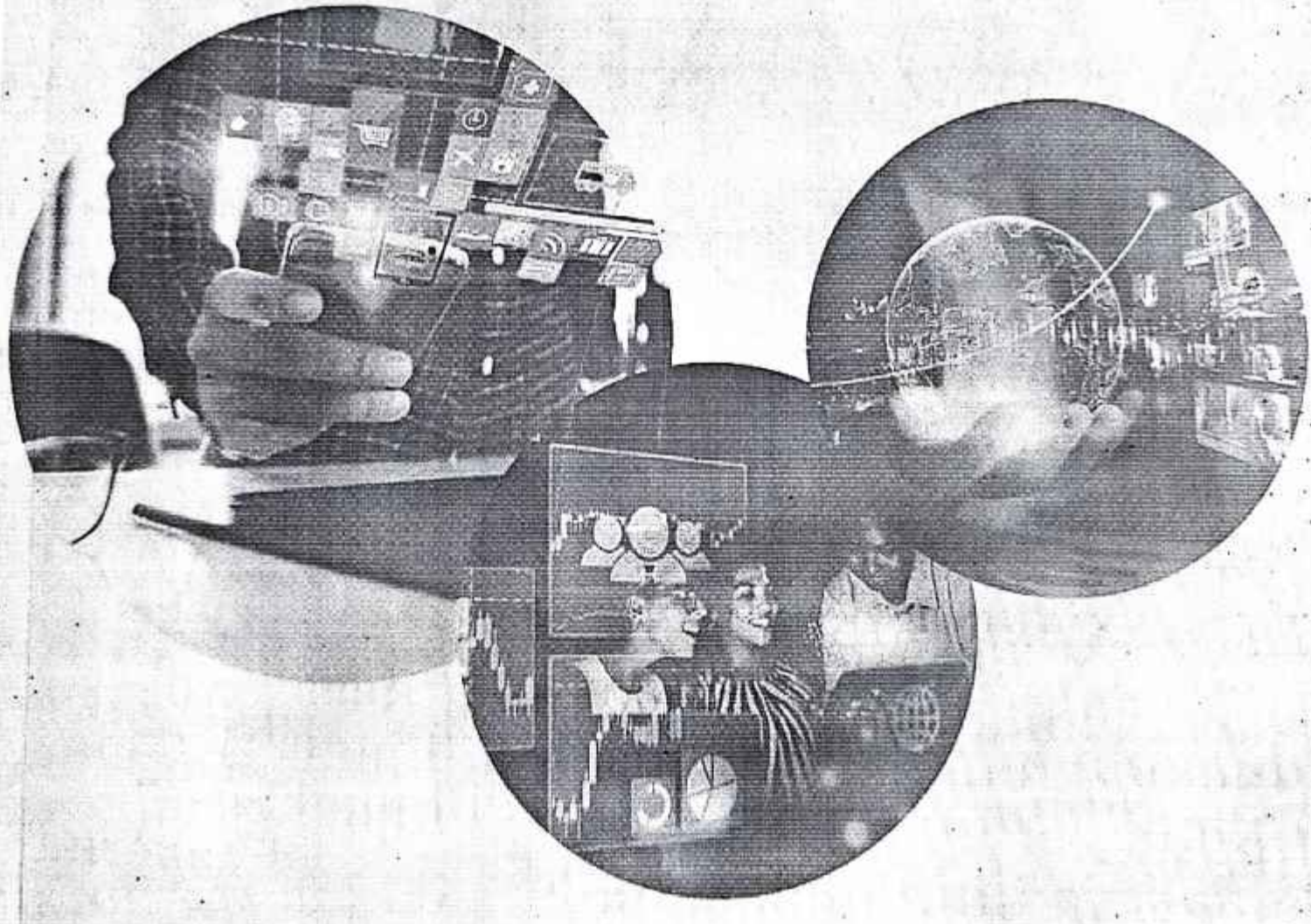

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Artificial Intelligence: How it is Changing the Marketing Scenario?

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Ms. Chanchal Phore[1] ✉
Dr. Pallavi Rajain[2]

Abstract

Artificial Intelligence has existed for several years but its involvement in marketing is very recent. With the advent of the digital era, there have been major shifts in the way of working in different fields including marketing. The application of AI in marketing is a change that needs research and analysis to understand its importance. Therefore, this study was undertaken to analyse previous research to find the functional areas of AI in marketing. Further, the research provided uses of AI in marketing. Through a review of 50 recently published papers, some of common functional areas found included integrated digital marketing, content marketing, experiential marketing, marketing operations, market research, precision marketing and interactive marketing. The use of AI in marketing is still in its nascent stage but holds huge potential in the future.

Keywords: *Artificial Intelligence, Marketing, Functional Areas, Uses*
JEL Classification: *M31.*

INTRODUCTION

According to the American Marketing Association (AMA, 2017), "Marketing is the activity, set of institutions, and processes for creating, communicating, delivering, and exchanging offerings that have value for customers, clients, partners, and society at large.

AI can be broadly defined as "intelligence exhibited by machines" (Siau, 2017).

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Parichay Maharaja Surajmal Institute Journal of Applied Research

Digitaltalization At Workplace Post Covid-19

Dr. Pallavi Rajain

Abstract: Fast-forward digitalization has begun thanks to COVID-19. The trend of working remotely has been growing for a while, but requiring employees to "work from home" quickly altered businesses in a way that normally takes years. It's referred to as "forced digitization." Today, a lot of professionals, particularly knowledge workers, work from home. A significant investment in remote planning lowers risk and gets the company ready for the future. By investing in digital technology like cloud-based software and automated procedures, small businesses can get ready to continue working remotely. Although many organisations still find it difficult to convert to 100% long-term work, those who have already made investments in digital transformation have found the transition to be much simpler. Interaction can be a little more difficult when working long hours, but it can be made easier with the correct tools and methods. Therefore, the present study was conducted to find which key factors led to digital transformation. Secondly, to find how digital transformation has changed the way of working. Even, if one might not be accustomed with video conferences in today's world, visual meetings with 20 people conversing are less effective. In addition to many other things, IT enabled video conferencing, online shopping, private delivery, telemedicine, e-learning, e-commerce, online marketing, and video streaming. Traditional operational procedures have seen a substantial change in processes. The application of contemporary information technology is one aspect of the broader spectrum of digital transformation.

Keywords: Digitalization, Digital transformation, Workplace, Covid-19, Work-from-home

1. INTRODUCTION

1.1 DIGITAL TRANSFORMATION

Digital technology offers new ways of collaborating and bringing distributed teams closer. Overall, they are found to increase the efficiency of the organization. Encouraged by these expectations, experts have learned the basics of mobility, collaboration, compliance and digital technology technostress in the workplace. In this research the author identifies the way to digital workplaces with the transformation of digital technologies. However, moving to a digital workplace also comes with expectations and cultural change.

Schwarzmüller (2018) found that in the digital age, organizations face leadership and cultural challenges. As a recent component, organizations want to transform their culture into a culture that promotes digital innovation. They incorporate digital technologies to provide employees with a variety of collaborative action skills. As the aspect of the study that finds different ways digital workplace construction are found to be the way of determining the digital transformation to different locations. Dery (2017) found that traditional companies are changing their work environment to support their digital business strategies. Colbert emphasizes the importance of a digital workplace and digital workforce for the future of organizations and Köffer (2015) recommends that organizations play a role in transforming their work environment. These studies report the findings of organizations that are incorporating digital technology with the workplaces to get digitalized more. In fact, they have to make a strong technical guide for this to setup a good level of digital workplace.

In recognizing importance of workplace transformation in the aspect of the digital transformation, people do not have strong explanations for how organizations are initiating changes in workplace practices that make it easier for them to achieve their digital transformation goals. In addition, research has been done to find out the different digital technologies which help to develop a digital workplace. This technological imperative to define Digital Workplace Transformation seems to overshadow the institutionalization that goes hand in hand with Digital Workplace Transformation, where organizations must also abandon established workplace practices.

The manufacturing industry is increasing the digital aspects to make use of the proper resources for building the different information models with them, stock handling, holograms, scans, software handling, data interpretation for the long term goal achievement of the organisation. find the solutions for the residents of the nearby locality of that area with different facilities for them.

In Construction, for example, Old 2D Paper Designs are used in the past scenarios of the construction Based Design (Digitisation). These are also aspects which are allowing Project Purchase by Sharing Cad Projects of Different Businesses.

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Article

Psychological Effects of the COVID-19 Pandemic in Haryana (India)

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Sage

Rupa Rathee[1], Pallavi Rajain[2] and Rakhi Singh[1]

Abstract

With the spread of coronavirus disease 2019, countries all over the world took drastic measures to curb its spread. These measures had different kinds of effects on people based on their knowledge and attitude towards this pandemic. The people faced several kinds of difficulties in their day-to-day lives. All these aspects formed the basis of this article. The data were collected through convenience sampling from a sample of 110 respondents in Haryana (India). As the data were collected in July, the country was already in its second phase of unlocking after several months of lockdown. The data were analysed using SPSS version 25. It was found that due to various awareness programs by the government, the majority of respondents had knowledge about the severe acute respiratory syndrome coronavirus-2 virus and its effects. The people had an attitude of fighting the spread of the virus by taking the necessary precautions. There were slight psychological effects as the country had already started unlocking. Lastly, the difficulties faced during the pandemic were discussed which had disrupted the lives of the people.

Keywords

Knowledge, attitude, psychological effects, difficulty, COVID-19

Introduction

Corona virus is a species of virus which instigates diseases in animals or humans. Quite a few coronaviruses cause respiratory infections in humans varying from common cold and influenza to more grave ailments such as Middle-East respiratory syndrome (MERS) and severe acute respiratory syndrome (SARS). The newly revealed coronavirus called severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2) causes coronavirus disease 2019 (COVID-19).

This new strain of virus and disease caused by it was unknown before the outbreak in December 2019 in China. As of 30 August 2020, more than 25 million cases have been recorded worldwide, resulting in 843,586 deaths. More than 16.45 million have recuperated till date (*The Hindu*, 2020).

Symptoms

The most common symptoms of COVID-19 are pyrexia, fatigue and cough. A few patients might develop unusual symptoms like myalgia, rhinitis, sore throat or diarrhoea (see Table 1). Mild symptoms are seen in most of the case but some might develop multi-organ dysfunction syndrome (MODS), sepsis, acute respiratory distress syndrome (ARDS) and thrombus. Just like viral and bacterial infections, there is a period of incubation between initial infection and the time of onset of symptoms. This incubation period is typically around 5 days but may range from 2 to 14 days. Some people become symptomatic, whereas some individuals remain asymptomatic despite getting infected. About 80% of the people recover from the disease without needing special treatment. Around 15% of the people become severely ill and develop respiratory distress needing intensive care. Old-age people suffering from severe medical conditions like cardiovascular and pulmonary diseases or diabetes are at extreme possibility of progressing to grave complications from COVID-19. A fraction of patients do not develop any symptoms at all throughout the infection; these are called asymptomatic cases but are still potent carrier for disease transmission.

Complications

Complications related to COVID-19 include lung infection, ARDS, MODS, sepsis, death and cardiovascular

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Impact of Talent Management on Organization Performance and Practice: A Study of Talent Management in IT sector in context of NCR region

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Abstract
Talent management is a business strategy that organizations accept will empower them to hold their top talented employees and work on to improve the organization performance. It is the course of employing the right ability, setting them up to take up top situations in future, evaluating and dealing with their presentation and furthermore forestalling them to leave the association. The performance of every organization depends on the performance of their employees. If the employees have unique competencies which the competitors cannot replicate, the organization automatically gains a competitive edge over its competitors. So, for managing this unique human capital, the organizations are focusing on creating effective systems and processes for talent management. The organizations are also striving hard to retain their top/key talent because if they leave, the complete repository of knowledge is also gone out of the hands of the organization. The purpose of the study was to find out the impact of talent management on

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Understanding the Adoption of Mobile Wallets Amongst Rural Indian Women

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Abstract

Acknowledging the great paucity of studies concerning the mobile wallet adoption by the rural women in Indian context; this study intended to explore the mobile wallet (M-Wallet) adoption among Indian rural women along with understanding the factors affecting adoption, challenges and possibility of mobile wallet as a tool of women empowerment. This study adopted the embedded mix method design in which both qualitative and quantitative information were obtained concurrently, however the qualitative information was incorporated throughout the quantitative information. Using Census (2011) as frame of reference, data was collected from rural women of Delhi. Purposive and snowball sampling techniques were used for data collection. Data for qualitative phase was collected from 10 females; whereas for quantitative phase data was collected from 208 females. Qualitative data was analysed using thematic analysis whereas quantitative data was analysed with the help of SPSS employing one independent sample t-test and factor analysis. The study concluded that Paytm Google Pay and PhonePe were the most used mobile wallets amongst Indian rural women. Most common usage of mobile wallet by the Indian rural women included recharges and bill payments. Three factors namely the "perceived ease of use" "perceived usefulness" and "social norms" were identified as the facilitators or drivers. "Self-efficacy" was found essential for effectively using the mobile wallets; however rural Indian women considered themselves less confident possessing limited knowledge about the mobile wallets. "Perceived risk" was identified as a restraining factor impeding usage of mobile wallets. Lack of confidence, socio-cultural barriers, lack of financial resources and lack of awareness were highlighted as the major challenges faced by rural Indian women while using mobile wallets. Mobile wallets have the possibility to act as a tool of women empowerment by facilitating banking needs of the unbanked, fostering cooperation, self-dependence and promoting self-employment and business amongst the rural Indian women.

Keywords: Mobile Wallets, Indian Rural Women, Adoption and Challenges of M-Wallets

Introduction

India is betting big on being digital and has made significant strides towards the same through significant initiatives like Digital Kranti renamed as Digital India and demonetization. Today, India boasts of more than 1.2 billion internet subscribers and now stands at number 2, second only to China, according to the latest Statista report (Statista, 2023). Majority of the people in India access internet through mobiles; especially in the year 2023, around 1.05 billion people accessed internet through their mobile device; thereby mobile devices playing a significant role in India's digital progress (Basuroy, 2023). Availability of cheap and feature laden smartphone and new telecom spectrum licenses have spurred the growth of mobile device based internet accessibility. One of the most popular trends emerging really fast in past few years is the Cashless truncations. Virtual or cashless transactions are getting increasingly popular in every sphere and mobile wallets are acting as the most important mediums facilitating the virtual transactions. Mobile wallets are a sub-type of digital wallets with latter being a type of software used for making online transactions

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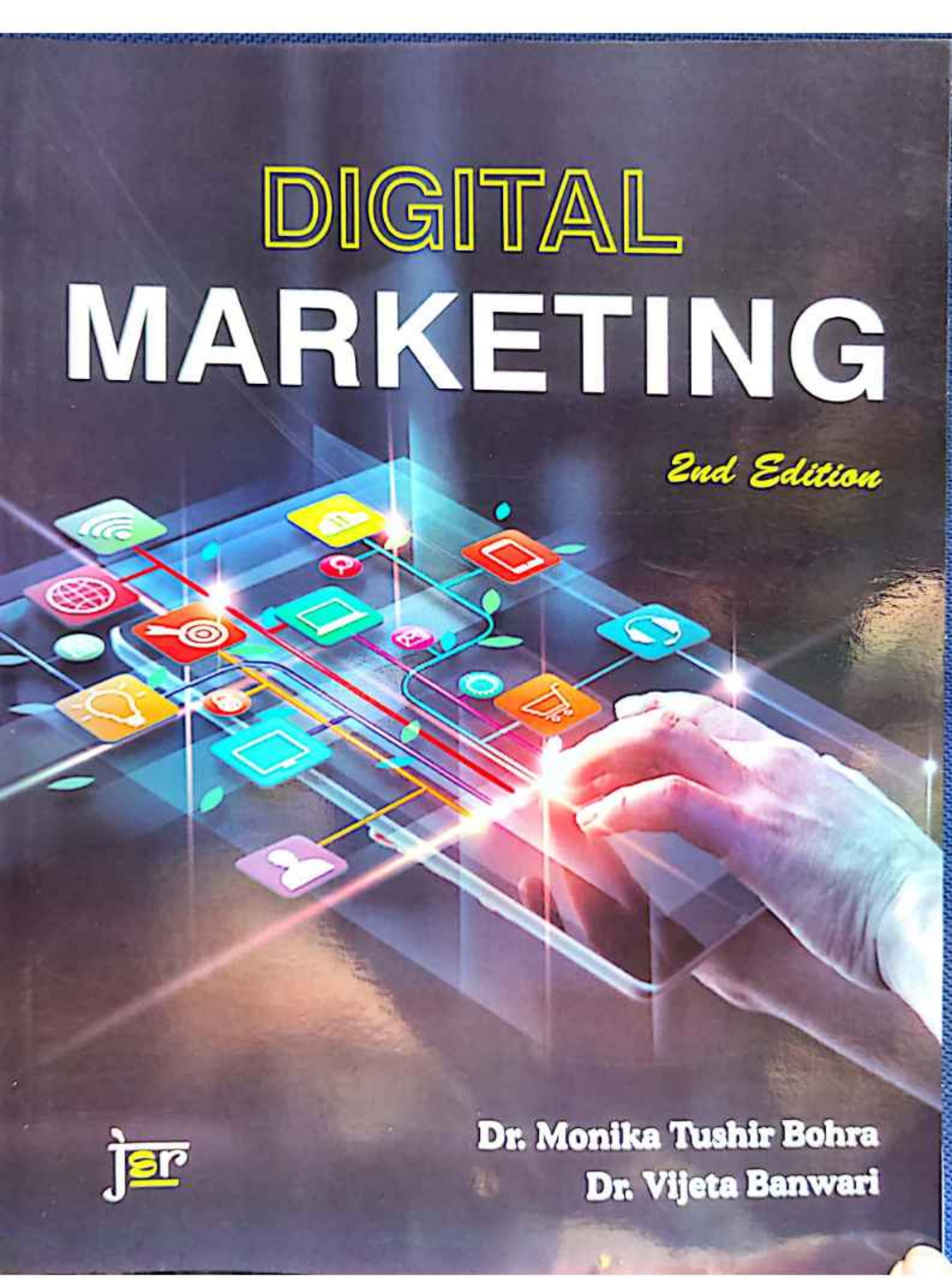

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Impact of Artificial Intelligence on Employee Satisfaction

Dr.Shaiza Dutt , Dhruv Jain

ABSTRACT

Employee satisfaction and engagement can lead to multiple positive impacts in an organization, as the AI is becoming more and more popular in today's world, it is the only one of the viable option for the companies to deploy Artificial intelligence-based services in their organization. AI based chatbots, ticketing issues, conversational AI, etc. can help in increasing the productivity level and job happiness for the employees by many folds.

This research paper aims to find the impact of artificial intelligence on employee satisfaction majorly in 2 sectors IT and Banking & Finance. Research is based on descriptive as well as Explorative and gathers the data through survey from over 236 employees from both the sectors and then the collected data has been used for further analysis correlation between the variables included for the analysis and the regression test along with the reliability test.

Keywords- Artificial intelligence, employee satisfaction, IT, Banking & Finance sector, Job happiness and chatbots

INTRODUCTION

The term "Artificial Intelligence" was first coined by John McCarthy in 1956 and started the development of 1st AI programming language, LISP, in 1960s. And since then we have seen many evolutionary changes in AI and its applications in various fields and sectors like in Banking & Finance, IT, Healthcare, Insurance, etc. So, What Actually is Artificial Intelligence (AI)? Artificial intelligence is a potentially world-changing technology, AI is the development of computer systems that are able to perform tasks that would require human intelligence (artificial intelligence and its effect on employee work assignment and job satisfaction, 2022). On an operational level for businesses, AI can be referred to as set of technologies that are based primarily on machine learning and deep learning, used for data analytics, predictions and forecasting, etc. And because of its diversified applications in various fields and sectors, this study's main concern is related to the employee satisfaction and engagement in IT and Banking & Finance.

In today's competitive business landscape, employee satisfaction is paramount for success. Employee satisfaction leads to enhanced employee retention (Artificial Intelligence with Improved Employee Satisfaction, 2025), employee development and training and quick resolution of employee issues. AI is already transforming the nature of work (The impact of AI on the workplace, 2023). In the 60 years of its existence, it has celebrated dramatic successes and equally dramatic failures. While AI promises to streamline processes, boost productivity, and improve decision-making, its impact on employee satisfaction and engagement remains a topic of intense debate. This exploration delves into the complex relationship between AI and the human element of work.

One of the major contributor in employee satisfaction and engagement has been the introduction of AI based chatbots and effective ticketing systems for the employees at workplace. Chatbots integrated into the company's communication systems will also help to improve management of employee productivity and results. Many businesses have started developing various virtual and conversational AI chatbot services which are specific to employees for their growth prospects, handling their issues, providing at a time employee data, etc. An important role is played by the human resource management of any business to use artificial intelligence up to its full extent

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diligently towards a common agenda: To protect consumers against dangerous products in Europe.

In the last decade, IoT and Blockchain Technologies have revolutionized the way food traceability is developing and performing. The industry experts believe this may be the best combination available. The food items transportation from point A to B can be tracked by IoT which tracks malfunctions and technical issues.

On the other hand, Blockchain assists entities to look at the data recorded at all stages of the food supply chain. And the beauty of the combination is that the consumer can track the food item from its origin to his plate.

With IoT and Blockchain, another technology is added relatively to enhance their role in safety and compliance of food products i.e. Artificial Intelligence (A.I). In terms of food safety and assurance of quality, A.I. is dominating. These technological advancements used by the top Giants of the industry are proving that the food industry is moving towards automation.

2. RECOGNITION OF NEW TREND AMONG CONSUMERS DURING PANDEMIC

One major change that has been observed by major e-commerce food businesses in this pandemic is transformed consumer behavior towards their diet. The data which normally helps food e-commerce companies to identify the demand across varied demography according to the varied seasons has changed immensely during the pandemic. When fresh data was analyzed they found that Pandemic created a demand from consumers to order plant-based more diet than meat.

That might be the effect of Covid-19. Every day some new news was only making the decision tough to rely on meat products for major consumers across the globe. Even countries where lockdown was not implemented initially started to see this same trend been coming into the picture slowly and thus stayed for long. And the moment meat-based products picked up the pace the new Covid-19 spread in few countries and again that reluctance became obvious.

Consumer suddenly after staying in a home for few months prioritizes their health. There was a sudden spike in knowing the food products they ordered. From origin to nutritional value they want to know the maximum about it. This is another challenge in the new age. Responsibility towards developing and sustaining their brand image by safeguarding the food traceability mechanism with advanced computer-based solutions in this digital age. It should be considered a positive sign for our regional and domestic markets as it will drive healthy competition among food industry players.

3. PANDEMIC-NEW SAFETY PROTOCOLS FOR FOOD INDUSTRY

Even standing today in the January of 2021 Covid-19 is still a threat to the food industry. To quote an example major food manufacturing units from cold-chain segments employee detected Covid-19 positive. Due to this various countries stopped or put ban until the situation comes to normal for the import of cold-chain products. In another incident, France in December 2020 placed 48 hour hold for British citizens to enter the country. Also, all the trucks/freight was asked to halt for the same time.

All this is happening not because food products got infected but it's the fear of the unknown which causing all this. Due to this, governments across the world have implemented stricter new safety protocols for the food industry. This is applied from farms, slaughterhouses, plant factories, etc to the delivery people responsible for delivery to the consumer.

These guidelines have to be followed by every individual from the food and supply industry. They have to follow social distancing, have to wear masks all the time, and wash hands as and when necessary along with other norms. Regular surface sanitization and daily temperature checks have to be recorded. Surveillance for food safety and regulations increased due to similar situations as mentioned above increased in the year 2020.

Countries are keeping a very close check using digital solutions in terms of imports of food products. A.I., IoT, and Blockchain technologies have been turning jobs quite easier in recalls for regulatory agencies and companies as and when necessary during these critical times. That's why the food industry's demand for advanced digital solutions has grown multifold during these past years.

Let's look at the importance of some the crucial digital methods for Food Traceability in this Pandemic.

4. RADIO FREQUENCY IDENTIFICATION (RFID)

Here radio waves identify objects automatically which don't even need a line of sight to do this. RFID tags are used which has a microchip that stores data, an antenna that receives and transmits the data. Both components are encompassed in a substrate. It helps manufacturers, distributors, and retailers schedule product delivery efficiently as RFID provides real-time information.

RFID tech was used by Wal-Mart stores Inc. and also it was the first major company to implement this tech in supply chain management. In the following year (2006) BT Foodnet network which is an arm of the UK's British Telecommunications group launched RFID Network for its food industry. It developed an ecosystem that helped manufacturers and retailers 24*7 to access synchronized product data of all stock items which are essential to the supply chain. This helped lower the cost of recalls. [2] RFID system contains 3 main components:

4.1 **Computer System**: First step CS performs is receiving information from the reader. The second step is to store and interpret data.

4.2 **Reader**: The third step transmits and receives audio frequencies. The fourth step involves the broadcasting

Parichay Maharaja Surajmal Institute Journal of Applied Research

Increasing Significance of Market Research and Competitive Analysis

Dr. Vijay Dahiya [1],Nishita Kapoor [2]

Abstract: *Background:* In today's rapidly changing business environment, organizations face intense competition and a constant need to understand and meet customer demands. To thrive and stay ahead in this dynamic landscape, businesses must rely on data-driven decision-making and strategic planning. Market research and competitive analysis play a crucial role in this context. This study serves as an introduction to the increasing significance of market research and competitive analysis in today's business landscape, highlighting the importance of these practices and their role in driving organizational success.

Keywords: rapidly changing business environment, intense competition, dynamic landscape, data-driven decision-making, strategic planning, market research, competitive analysis, business landscape, organizational success

1. INTRODUCTION

Market research and competitive analysis are essential components of strategic decision-making in today's business landscape. As markets become more competitive and customer demands evolve, organizations need to stay informed about market trends, customer preferences, and competitor strategies. Marketing research plays a crucial role in competitive analysis by enabling us to gain a comprehensive understanding of consumer attitudes towards brands and products, including those of our competitors, and their impact on the market[1]. By actively engaging with both users and non-users, we acquire valuable insights into their preferences and motivations, allowing us to identify the reasons behind their choices. Competitor analysis serves as a strategic management tool that evaluates the strengths and weaknesses of both existing and potential competitors[2]. Prior to commencing a business venture, it is advisable to conduct a thorough examination of the market and competitors to ensure the viability of your ideas. The first step in this process is conducting market research for your small business. In order to achieve success, it is crucial to identify an adequate customer base. Performing a market and competitive analysis helps in identifying potential customers and competitors[3].

This research paper explores the increasing significance of market research and competitive analysis in guiding business decisions and enhancing competitiveness.

2. LITERATURE REVIEW

There have been numerous studies on market research and competitive analysis conducted by researchers and scholars in a variety of fields, including marketing, business, and economics. These studies have focused on various aspects of market research and competitive analysis, including the methods and techniques used, their impact on business decision-making and success, and their role in informing marketing and strategic planning. When contemplating a strategic entry into a new market, firms often examine their competitors as a reference point before deciding whether to establish a foothold. (A foothold refers to deliberately establishing a small position within a market where the firm doesn't currently compete.)[4]. One notable researcher in the field of market research is Philip Kotler, a well-known marketing scholar. Kotler has written extensively about the importance of market research in informing business decisions and developing marketing strategies. In his book "Marketing Management," Kotler discusses the various methods and techniques of market research, including surveys, focus groups, and online data analysis, and their application in different business contexts. Kotler also emphasizes the importance of defining clear research objectives and accurately analyzing and interpreting data in order to make informed decisions[5]. Other researchers and scholars who have written about market research include David Aaker, who has published numerous articles and books on the topic, including "Marketing Research" and "Managing Brand Equity."[6]. Aaker has focused on the role of market research in brand management and the development of effective marketing strategies[7]. Morris B. Holbrook, a professor of marketing at Columbia Business School, has also conducted research on market research and its role in consumer decision-making, specifically in the context of experiential consumption[8]. There appears to be a heightened level of interest in the concept of embracing a market-oriented approach when launching a new product[9].

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ORIGINAL ARTICLE

The influence of AR & VR-induced reality congruence on customer engagement in e-commerce websites: a mediation analysis

Pooja[1,2] · Pranay Verma[1] · Jasbir Singh[1]

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Abstract
This study investigates how augmented reality (AR) and virtual reality (VR) can improve service quality to achieve customer engagement by inducing reality congruence. The study explores the relevance of the stimulus-organism-response (SOR) model and the cognitive-conative-affective framework. A conceptual model is proposed, and hypotheses are developed to test the model. We gathered data from 400 e-commerce users and utilized partial least squares structural equation modelling (PLS-SEM) to examine the data. It included incorporating second-order constructs to capture the underlying dimensions of customer engagement. The empirical findings indicate that reality congruence enhances service quality and facilitates customer engagement through traits. The study demonstrates that reality congruence strengthens trust and commitment, leading to customer engagement. Based on these findings, reality congruence (AR &VR) is crucial for e-commerce service providers to foster customer engagement. The practical implications of this study suggest that e-commerce service providers and integrative technology designers must actively engage customers in a digitally connected and intensely competitive era.

Keywords Customer engagement · Service quality · Reality congruence · S-O-R model · Cognitive-conative-affective model

1 Introduction

Academic forecasts suggest a notable expansion in both revenue and market scale for the augmented reality (AR) and virtual reality (VR) sectors in the forthcoming years. Analysts foresee considerable revenue increments driven by the increasing adoption of these technologies across diverse industries and applications (Statista 2023). Currently, e-commerce represents 5.2% of the total market for AR and VR worldwide (Statista 2023). Additionally, reports from TechSci Research emphasize the importance of AR and VR in the global e-commerce landscape (Techsciresearch report 2023). Western markets are increasingly adopting these technologies, and retailers are investing significantly in this technology. Similarly, retailers in India are also experiencing a rising adoption rate, currently at 23% (Statista, 2023).

As online shopping options proliferate, capturing and maintaining customer interest has become increasingly challenging. To remain competitive, companies must leverage innovative technologies that enhance the shopping experience and build stronger consumers connections. AR and VR technologies allow businesses to create unique, immersive experiences, leading to higher sales and increased customer satisfaction. These technologies enable companies to influence key factors driving consumer behavior and better manage customer journey touchpoints (Archibald et al. 2020). Studies have shown that AR and VR enabled services technologies allow businesses to create unique, immersive experiences, leading to higher sales and increased customer satisfaction (Kautish and Khare 2022; Kranzbühler et al. 2018). Over a billion smartphones and tablets are currently available, making it easy to have a virtual experience. By

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Through IT and Managerial Skills

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A Conjoint Analysis Approach To E-Service Attributes Of Online Shopping Websites To Generate An Optimised Unique Selling Proposition

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Abstract

This research seeks to determine how certain service attributes of e-commerce might be integrated by partitioning those attributes into distinct components. Prior studies solely focused on the cognitive elements of utilizing the service features of an online store. This is the first study of its sort to quantify the utility of each service attribute. A focus group method is employed to examine the crucial e-service qualities and classify them into desired levels. This is a prototype combination of e-service attributes using orthogonal design with SPSS software, this gives a heuristic combination of e-service qualities. Conjoint Analysis, a practical method for identifying the underlying set of features that the user values most, is used for further analysis. Businesses that are able to combine the variety of available e-service features will enhance website usability and, as a result, offer a more satisfying client experience, giving them a competitive advantage. The latest research provides valuable input in designing and altering existing websites. The choice-based conjoint analysis is used to create the optimum value proposition for the service characteristics of online stores. Our findings demonstrate that the respondents considered Payment

DIGITAL EMPOWERMENT IN THE INFORMATION AGE

The Book

In the rapidly evolving information age, this book delves into the multifaceted domain of digital empowerment, examining its intricate dynamics and accompanying challenges. Through insightful analysis, it highlights the imperative need for digital empowerment and its pivotal role in shaping the future. The book unpacks the concept of digital inclusion and addresses the barriers to universal access. It stresses the urgency of bridging the digital divide and advocates for inclusive policies. The contents of the book also focus on Digital India, a transformative government initiative, and its impact on governance and citizen engagement. Further, it delves into communication and collaboration in cyberspace, emphasizing the transformative power of digital platforms, including online learning.

Security and privacy in the digital realm are thoroughly examined, alongside initiatives to strengthen cybersecurity infrastructure. Blockchain technology is discussed for its potential in securing transactions, and ethical considerations in digital communication are underscored. Moreover, the contents of the book aim at strengthening the practical knowledge as well through the inclusion of related practical applications in different fields. Therefore, the book serves as a comprehensive guide to the transformative potential of digital empowerment, advocating for a balanced relationship between technology and humanity.

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Foundations and trends in option pricing models: a 45 years global examination based on bibliometric analysis

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Abstract

Purpose – The purpose of this study is to analyse and compile the literature on various option pricing models (OPM) or methodologies. The report highlights the gaps in the existing literature review and builds recommendations for potential scholars interested in the subject area.

Design/methodology/approach – In this study, the researchers used a systematic literature review procedure to collect data from Scopus. Bibliometric and structured network analyses were used to examine the bibliometric properties of 864 research documents.

Findings – As per the findings of the study, publication in the field has been increasing at a rate of 6% on average. This study also includes a list of the most influential and productive researchers, frequently used keywords and primary publications in this subject area. In particular, Thematic map and Sankey's diagram for conceptual structure and for intellectual structure co-citation analysis and bibliographic coupling were used.

Research limitations/implications – Based on the conclusion presented in this paper, there are several potential implications for research, practice and society.

Practical implications – This study provides useful insights for future research in the area of OPM in financial derivatives. Researchers can focus on impactful authors, significant work and productive countries and identify potential collaborators. The study also highlights the commonly used OPMs and emerging themes like machine learning and deep neural network models, which can inform practitioners about new developments in the field and guide the development of new models to address existing limitations.

Social implications – The accurate pricing of financial derivatives has significant implications for society, as it can impact the stability of financial markets and the wider economy. The findings of this study, which identify the most commonly used OPMs and emerging themes, can help improve the accuracy of pricing and risk management in the financial derivatives sector, which can ultimately benefit society as a whole.

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Originality/value – It is possibly the initial effort to consolidate the literature on calibration on option price by evaluating and analysing alternative OPM applied by researchers to guide future research in the right direction.

Keywords Option pricing models, Option pricing methods, OPM, BSM, Bibliometric analysis, Co-citation, Bibliographic coupling

Paper type Research paper

1. Introduction

Option pricing is a leading-edge area of current financial theory and practice. Since Black, Scholes and Merton introduced their trailblazing work on option pricing, trading in derivatives and activity in global financial markets have exploded. The stock option market has risen drastically over the years due to increasing returns and reduced risk. The Black–Scholes (BS) model, the most prominent and prestigious model of option pricing, was introduced in 1973 and quickly became the industry standard (Lee *et al.*, 2013). The model is grounded in a series of core assumptions that serve as the foundation for its option pricing framework. It assumes that stock market movements follow a random walk, both volatility and risk-free rates are constant and known, no dividends are paid on the underlying stock, stock prices evolve smoothly according to geometric Brownian motion, there are no risk-free arbitrage opportunities, European-style options are considered, the market is efficient and no taxes or transaction costs impact the pricing equation. These assumptions collectively shape the model's capacity to predict and evaluate option values in a simplified, yet coherent, financial environment.

Over the past two decades, there has been an outbreak of new models in option pricing, each relaxing some of the restrictive assumptions of the Black–Scholes–Merton (BSM) model. There are numerous option pricing models (OPM) that address each of these assumptions. For example, the underlying price can follow a discrete-time or continuous-time procedure. It can be a diffusion or non-diffusion process, a Markov or non-Markov process, a non-Poisson or Poisson jump process, a mixture of diffusion and jump components with or without random jumps and with or without stochastic volatility (SV), among other continuous-time processes. Many different models have evolved to address the limitations of the classical BSM model.

With the passage of time, an increasing number of consumers are showing interest in opening their demat/brokerage accounts and engaging in e-trading, which creates a new need for more accurate pricing models for options. More precise and profitable investments may become available as values rise. Improved option pricing may also make the volatility and dynamics of the market more resilient to manipulations.

This study provides an overview of the topic of option pricing, recognizing the necessity of integrating the current literature review on OPM, highlighting research gaps and outlining upcoming research goals in this field. As a result, a comprehensive examination is required to gain a complete understanding of the types of option pricing systems used around the world.

To achieve the objective, two important questions are inscribed.

RQ1. Broad description and publication trends analysis related to the different methods/models used for option pricing.

RQ2. Broadly outline the current knowledge structure [(2a) conceptual and intellectual framework(2b)] in the area of OPM research worldwide.

To address the first research question (*RQ1*), we have identified and discussed a general framework of research databases, including trends in yearly publication, the most

influential researchers with their impact factor, affiliations and most cited individual works. We have also identified the most useful publication outlets, such as articles, journals and other relevant documents. To answer the *RQ2*, we have developed a thematic map, Sankey diagram and bibliographic network system of the top 100 primary documents, with detailed explanations.

This work attempts to contribute to the literature on financial derivatives in the context of OPM research in two important ways by addressing the issues mentioned above. Firstly, recognizing the significance of important ideas requires knowledge of publication trends, the most prolific authors, highly influential works and publishers. Secondly, the bibliographic network study would indicate the history of research and recommend prospective possibilities in this field for the future.

The structure of the paper is as follows: Section 1 introduces the problem statement, Section 2 describes the associated efforts of various authors, Section 3 discusses the study topics and methodology, Section 4 presents the descriptive findings and thematic discussion and Section 5 concludes with future implications.

2. Literature review

This study provides an overview of option pricing research, recognizing the need to integrate current option pricing literature, identify research gaps and outline future research goals in this field.

Classical model BSM applicability: BS OPM was used to compute the prices for call options traded on the CBOE using daily price quotes for every option traded on the CBOE starting from 26th April to 30th November 1973. Trading techniques based on the BS model, according to the findings, sold overpriced and bought the under-priced options (Galai and Masulis, 1976).

The BS model is the most widely used model for option pricing. The conceptualization has been exhaustively researched in recent decades, and in some situations, specific major concerns have been recognized. It is discovered by Black and Scholes (1973) that BS prediction overpriced the fair value of the option prices in excessively turbulent markets. Errors in the BS model increase in both ITM and OTM scenarios (Macbeth and Merville, 1979). Furthermore, according to Gultekin *et al.* (1982), as the period to expiry advances, the discrepancy between the BS model and the factual value of an option grows. Black and Scholes's (1973) model became the most extensively used model for the formulation of option pricing with minor revisions. Despite a few assumptions, this model provides a reasonable methodology for option pricing and is commonly used in the financial market (Bodie *et al.*, 2013).

The BS OPM is widely studied and has been the subject of much research. John Hull's book "Options, Futures, and Other Derivatives" (Hull, 2015) is a comprehensive resource for information on the model and the various modifications that have been proposed by researchers, such as constant volatility and efficient markets. These assumptions limit the accuracy of the model in real-world situations, and more advanced models have been developed to account for these limitations. Nevertheless, the BSM model remains a valuable tool for option pricing and continues to be widely used in finance (Mehrdoust *et al.*, 2017; Singh *et al.*, 2020; Dash *et al.*, 2021).

The BSM model is a widely used mathematical model for pricing options in finance. It is particularly applicable in real options, which refer to the options that are embedded in real assets such as investment opportunities in a company or the flexibility to expand or abandon a project. Despite the fact that option pricing is critical for risk management and investing, precisely pricing options is difficult due to the increasingly complex variations in

the process of asset pricing. The expanding popularity of the option concept may be seen in its applicability to derive the value of lease contracts and real estate deals (Grenadier, 1995). In addition to asset assessment, option theory is extensively carried on in the area of risk management (Williams, 1991; Buetow and Albert, 1998).

Black and Scholes (1973) were the first authors to bring forward a model which is established on financial options and can be used extensively based on the assumption of continuity of decision-making. It is further extended to the real valuation of options. Brennan and Schwartz (1985) and Mcgrath (1997) also claimed that the BS model can apply to circumvent the net present value (NPV) limitation in a technological-driven or newly established investment enterprises. Merton (1974) makes the critical examination of the equity position of companies, which is considered as a call option on assets having an exercise price equal to the liabilities. According to Mun (2012), the most essential variables in using the BS model to estimate the value of an investment firm is volatility, which may be estimated using numerous methods such as historical volatility, Monte Carlo simulation volatility, market substitution and so on.

Hillegeist *et al.* (2004) state that a corporation is in danger of going bankrupt if its assets are smaller than its liabilities. In the BS model, the possibility of liquidation is defined as the probability of the price of assets in the real market lower than the face value of debts.

In the four decades since Merton's (1974) model was published, several extensions and different models have been developed and published, but the original model is still widely used by academics and practitioners to evaluate credit risk (Afik *et al.*, 2016). Many parameters of the Merton model, as well as a couple of its modifications are applied and find that the asset's projected return and volatility have the greatest impact on default prediction goodness (Dang *et al.*, 2017). The Monte Carlo technique is used to generate hedging parameters and plain vanilla.

European option prices using a reasonably generic jump-diffusion OPM that integrates multi-factor Gaussian interest short rates with stochastic variance. Gauss–Hermite expansion is applied to European options. For this real-world and simulated option prices, new option price is calibrated, and it is concluded that the resultant volatility spillover curve gives the nearest estimation over a different variety of strike prices (Necula *et al.*, 2019).

OPM other than BSM model: the status of option trading has changed significantly over the past four decades in the light of the vast amounts of available data given the technological innovations and applications (Zumbach, 2012) which leads to the emergence of multiple types of risks and substantial empirical research on alternative OPM (Bates, 2000). Resultantly, new approaches of viewing option pricing continue to emerge (Cox *et al.*, 1985; Heston, 1993; Stein and Stein, 1991). The BS model was a ground-breaking development in the field of option pricing, but over time, it became clear that certain assumptions made in the original model were too restrictive. Researchers have since expanded upon the BS model by incorporating new insights and techniques, such as considering interest rates and volatility as stochastic variables, leading to more accurate representations of real-world market conditions. These modifications have improved the accuracy of OPM and helped to further advance the field of financial mathematics. Some researchers, Scott (1997), Wiggins (1987), Hull and White (1987), Stein and Stein (1991) and Heston (1993), made significant contributions to the field of financial mathematics by generalizing and expanding upon the BS model. While Amin and Jarrow (1992) modified the BS model incorporating stochastic interest rate into OPM, accomplished through the use of advanced mathematical techniques such as stochastic calculus and binomial distribution.

Eminent researchers like Bates (1991, 1996), Kou (2002), Wang (2009) and Bakshi *et al.* (1997) made significant contributions to the field of option pricing by proposing jump-

diffusion models. These models consider the presence of sudden jumps or spikes in asset prices, which are not captured by traditional models like BS. Bates (1996) included the process of jump-diffusion in the model of SV, while Scott (1997) makes efforts for option pricing by applying jump-diffusion model, incorporating interest rates and SV. Rendleman (1979) and Cox *et al.* (1979) used binomial distribution to create the BS model. Out-of-the-money put options are regularly priced incorrectly by stochastic and time-varying volatility models when the term is short. By integrating a jump component to realized volatility OPM, fitting characteristics under the physical measure is improved (Alitab *et al.*, 2019).

In addition to the BS and jump-diffusion models, a wide range of other OPM have been proposed and validated using real-world data, such as constant elasticity of variance (CEV) models (Cox and Ross, 1976; Beckers, 1980; Davydov and Linetsky, 2001; Lee *et al.*, 2004; Chen *et al.*, 2009), Markovian models (Rubinstein, 1985), generalized autoregressive conditional heteroskedasticity (GARCH) models (Duan, 1995; Heston and Nandi, 2000; Wu, 2006) and models based on Lévy processes (Geman, 2002; Carr and Wu, 2004), all aim to provide a more accurate representation of real-world market conditions and improve the accuracy of option pricing results. Each of these models has its own unique strengths and limitations, and the choice of which model to use often depends on the specific needs and requirements of the trader.

In a perfect market, the BS model should be used as the first choice. On the other hand, a neural network model can be used for American option pricing, for which the traditional BS model cannot be used. Furthermore, the neural network model can be used for volatile markets which violate the BS assumption of constant volatility.

By allowing for a flexible change of measure, the filtered historical simulation (FHS) method provides a new framework for option pricing. However, a problem with the FHS option pricing method is that it relies on Monte Carlo simulation, which is very time-consuming. Empirical results show that the FHS option pricing method outperforms the BS model of Dumas *et al.* (1998), the HN-GARCH model of Heston and Nandi (2000) and the GARCH model with inverse Gaussian innovations of Christoffersen *et al.* (2006).

The GARCH model of option pricing given by Duan (1995) and Huang *et al.* (2019) creates the utmost option prices, followed by other models such as log-normal Ornstein–Uhlenbeck and BS model. BS model and a binomial tree coupled to an original SV model were examined using Chicago Board Options Exchange market options pricing. The proposed dynamic SV model outperforms in comparison to the standard BS formula in terms of option pricing (Zapart, 2002). A realized GARCH framework is created for pricing of European options and applied to S&P 500 index options, which outperforms in terms of pricing mistakes (Huang *et al.*, 2017). A different OPM is named threshold GARCH with generalized error distribution. According to the findings, the comparative analysis produces improved estimate results and least pricing errors (Jiang and Hua, 2019).

Four models of option pricing performance results in order of highest to lowest, i.e. two state lognormal model, BS, two-state constant elasticity variance model and two-state jump-diffusion model in both call and put options, with put options outperforming call options (Su and Wen Wong, 2019).

The work of Wu (2004, 2005, 2007) and Lee *et al.* (2005) has provided valuable contributions to the field of option pricing by incorporating fuzzy logic into the traditional BS model. This has led to a more flexible and robust approach to option pricing that can handle uncertainty and vagueness, providing a more comprehensive and accurate way to incorporate uncertainty into the option pricing process. The findings in the study by Arin and Ozbayoglu (2022) are interesting and suggest that the hybrid deep learning-based options pricing model they developed can produce more accurate prices compared to the

widely used BS model. The fact that the improvement was significant, with a 94.5% improvement in terms of mean squared error, indicates that the hybrid model may be a more reliable and effective method for option pricing.

3. Research methodology

The motivation for this work is to re-examine the most frequently used models in option pricing to attain the results for our two dominant research problems stated above. To achieve this, we have applied a quantitative review of the literature to analyse the indicators used through a bibliometric approach to identify specific publications (Bamel *et al.*, 2020; Bamel *et al.*, 2022). Examination of bibliometrics is an unconstrained means to critically review the remarkable publications, as these analyses check for biasness in authors' work in relation to exclusion and inclusion of publicizing in a particular area (Zupic and Čater, 2015).

3.1 Process of data retrieval

Data were retrieved from the Scopus database on 19 January 2022, using a bibliometric approach to identify relevant publications. The Scopus database was chosen because it provides global and regional coverage of published documents (Waltman, 2016). A systematic literature review and widely used data retrieval protocol (Jones *et al.*, 2011) were applied to retrieve the data.

The following search string was used to retrieve documents on the topic, field, article, title, keywords and abstracts: TITLE-ABS-KEY ("Option Pricing Models" OR "Option Pricing Methods"). This search yielded 1,572 documents. Inclusion and exclusion criteria were applied to ensure the significance of the publications (Tranfield *et al.*, 2003). The inclusion criteria were publications in the subject areas of economics, econometrics, finance, business management, accounting, social sciences and multi-disciplinary fields. Exclusion criteria were publications in subject areas such as mathematics, chemistry, computer science, engineering, physics and astronomy, energy, immunology and microbiology, biological science, biochemistry and neuroscience. This resulted in 896 documents. The articles, conference papers, conference reviews and book chapters were included, while letters, notes, short surveys, editorials, etc., were excluded. This resulted in 887 documents. Publications written in the English language were included, while those written in Chinese, Spanish, French, German, etc., were excluded. This resulted in 868 documents. After manually screening the abstracts, 864 papers were included.

PRISMA model (Figure 1) is used to depict the inclusion and exclusion criteria.

4. Findings and discussion

Section 4 addresses research question 1 (*RQ1*) by analysing the broad description and publication trends of various OPM (refer sub-Section 4.1.1), exploring yearly publication patterns (refer sub-Section 4.1.2), identifying prolific scholars in financial derivatives and OPM research (refer sub-Section 4.1.3) and top 50 models are manually selected in a chronological order, as described in sub-Section 4.1.4.

It also contributes to answering *RQ2* through a thematic map (refer sub-Section 4.2.1), a Sankey diagram (refer sub-Section 4.2.2) and an examination of bibliographic coupling among primary documents (refer sub-Section 4.2.3).

4.1.1 Broad description and publication trends analysis of different option pricing models. This section provides an overview of the fundamental trends and describes OPM in the context of financial derivatives. Our data set consists of 868 papers published between 1976

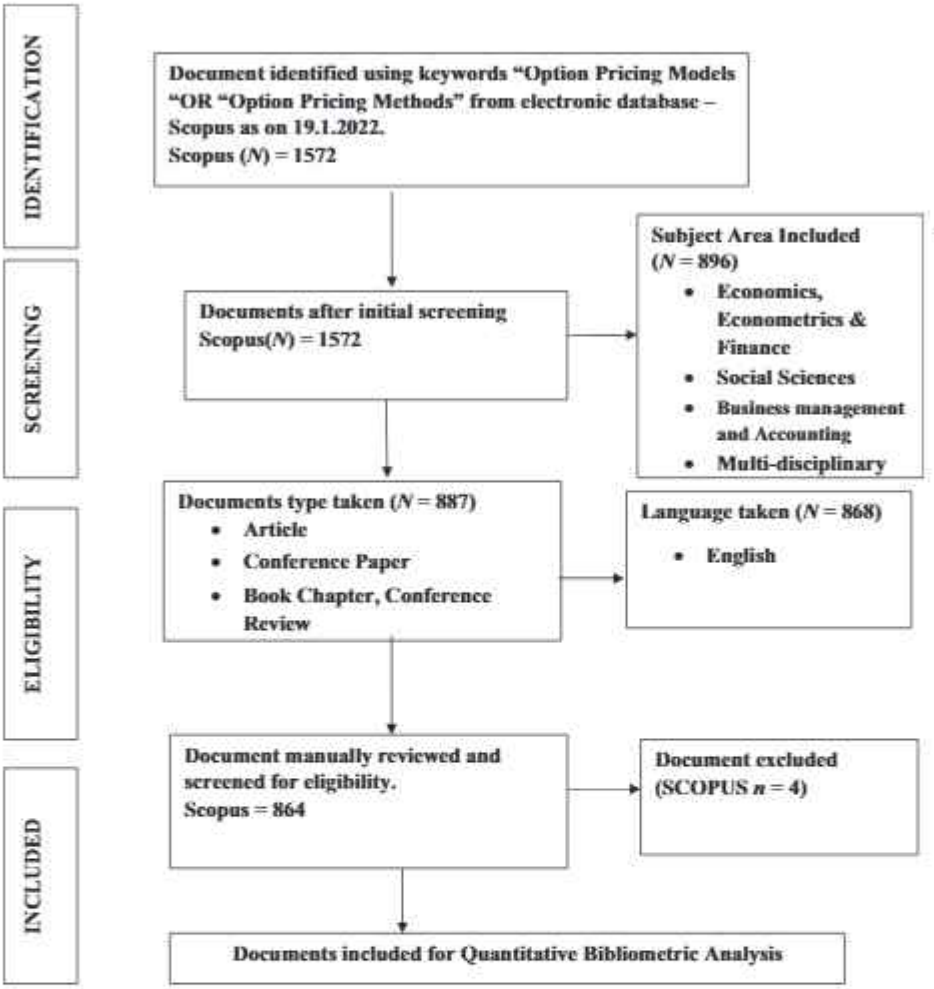


Figure 1.
Bibliometric analysis of option pricing models for the period 1976–19th Jan'2022

Source: Inspired from Moher *et al.* (2009)

and 19 January 2022, including 743 research articles, 37 book chapters, 28 reviews and 13 books. With a mean of 26.13 of citations, these documents have been published in 321 sources (journals, books, etc.). In total, 1,490 authors contributed to these 868 documents. The co-authors per document ratio is 2.15, and the author collaboration index is 2.02 (refer Table 1).

4.1.2 Trend analysis of yearly publication. Figure 2 displays the yearly publication trend. The first publication on this subject was released in 1976. Over the next decade, there was a gradual increase in the number of publications on this topic. However, after 1998, there was a sharp surge in the number of publications, and since then, it has consistently remained above the trend line every year.

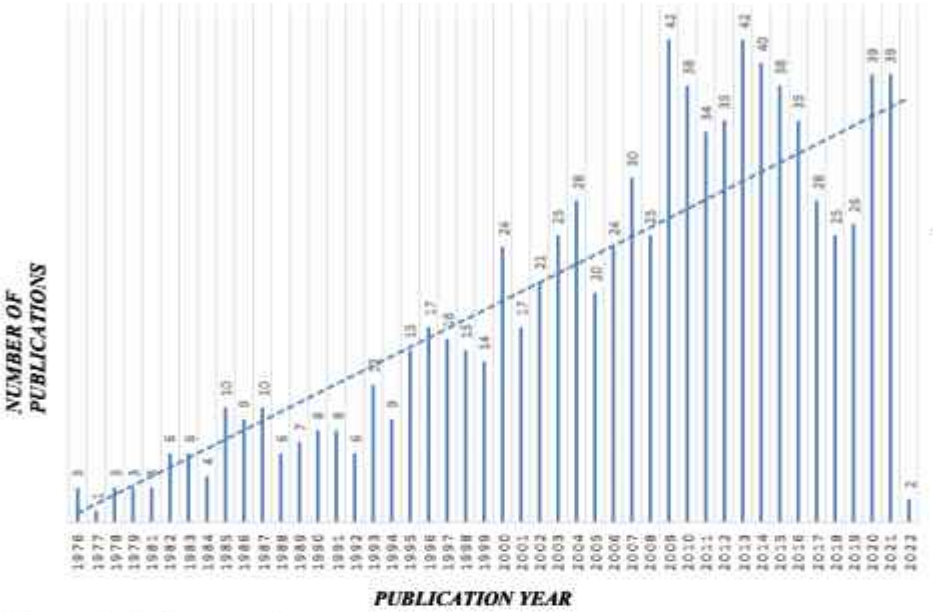
Description	Results
Timespan	1976:2022
Sources (journals, books, etc)	321
Documents	868
Average years from publication	15
Average citations per documents	26.13
Average citations per year per doc	1.316
References	24,716
Document types	
Article	743
Book	13
Book chapter	37
Conference paper	46
Conference review	1
Review	28
Document contents	
Keywords plus (ID)	994
Authors' keywords (DE)	1,742
Authors	
Authors	1,490
Author appearances	1,864
Authors of single-authored documents	207
Authors of multi-authored documents	1,283
Authors collaboration	
Single-authored documents	232
Authors per document	1.72
Co-authors per documents	2.15
Collaboration index	2.02

Source: Authors' own creation (Scopus database accessed on 19/01/2022)

Table 1. Relevant information data set

4.1.3 Most prolific scholars in option pricing models research in financial derivatives context. The aim of the study is to identify the most influential scholars in the financial derivatives context of OPM research based on their productivity and impact. Table 2 presents citation indexes for 20 of the most productive authors, including total citations, h-index, g-index and m-index. The authors are ranked based on the number of publications and, if there is a tie, the number of citations. The table also provides information on the research themes explored by each author. According to the ranking, Camara A, Renault E, Zhang JE, Kim S and Lee CF from the University of Oklahoma State University (USA), University of Warwick (UK), University of Hong Kong (Hong Kong), Hankuk University of Foreign Studies (South Korea) and Rutgers Business School at Newark (USA), respectively, have published the most papers in this area.

Regarding the most influential authors, Rubinstein M from the University of California, Berkeley (USA) has received the highest total citations for all of their publications (1,143 citations). It is also noteworthy that more than 50% of the most productive authors are still actively engaged in this field, based on their publication timelines. Another interesting finding is that authors affiliated with institutions from the USA, the UK, Hong Kong and South Korea are prominent in this list.



Source: Authors' own creation

Figure 2.
Trends of annual production of research articles in option pricing models

To comprehend pioneering work in a specific field of study, it is required to identify the most prolific writers and significant work. A thorough examination of Table 3 depicts the list of the top most 20 journals that accepted research work on OPM using the following:

- *Keywords:* Option pricing, Economics, OPM, BS model, GARCH model, Real options, Implied volatility, Mathematical models and SV (The table presented in this study was generated using the VOSviewer software and is based on a Sankey diagram. The diagram was created using 930 words selected from the Keyword Plus option in the document title, and a weighted inclusion index was calculated based on the frequency of these words in the documents.)
- *Most productive journals: Journal of Futures Markets, Quantitative Finance, Journal of Banking and Finance and Journal of Derivatives.*
- *Most productive countries:* The USA, the UK, China, Taiwan and Canada.
- It is worth noting that a few developing countries, such as India and China, appear on the list of the most productive countries.

4.1.4 Top 50 models are screened out manually to answer the RQ1 and depicting in timeline mode starting from 1973 to 19.1.2022 (refer Table 4). The BSM classical model has been used extensively over the past four decades and remains very popular for option pricing. This model is widely used because it provides theoretical values that are close to the actual values of options. Fuzzy set theory is applied by Zadeh (1975) but was not used extensively at that time. BSM and binomial are considered the basis or classical model used for option pricing. However, the BSM model has been criticized for its restrictive and unrealistic assumptions, leading to the development of numerous other OPMs over time. The table

Table 2.
Most productive authors and their citation structure

Author	Affiliation	Theme	NP	PY	TC	h_index	g_index	m_index
C Cámara A	Oklahoma State University, USA	Two counters of jump-diffusion, DJD model	9	2005–2012	71	5	8	0.278
R Enault E	University of Warwick, UK	Comparison of ARCH-type and stochastic volatility option pricing models	7	1998–2020	482	5	6	0.2
Zhang Je	University of Hong Kong, Hong Kong	The implied volatility smirk and option pricing under jump-diffusion	7	2003–2020	210	6	8	0.3
Kim S	Hankuk University of Foreign Studies, South Korea	Mortgage pricing modelling	7	2004–2021	65	4	7	0.211
Lee CF	Rutgers Business School at Newark	Alternative methods to derive option pricing models	7	1991–2020	41	3	4	0.094
Madan DB	Robert H. Smith School of Business, University of Maryland	Comparison of VG and BSM model	5	2005–2017	128	3	5	0.167
Fabozzi FJ	Department of Finance, Copenhagen Business School	Option pricing with time-changed Lévy processes	5	2011–2020	111	2	5	0.167
Brorsen BW	Department of Agricultural Economics, USA	GARCH, BSM and average option pricing –an analysis	5	1995–2018	23	3	4	0.107
Rubinstein M	University of California, USA	Relation between binomial and trinomial option pricing models	4	1985–2012	1,143	4	4	0.105
B Enaroch M	School of Management, Syracuse University, USA	Managing information technology investment risk using real options analysis	4	1999–2010	787	4	4	0.167
JR	Graduate School of Business Administration, USA	Effect of different costs on OPM	4	1982–1990	347	4	4	0.098
Duan J-C	Faculty of Management, McGill University, Canada	GARCH method using a Markov chain and jump and volatility risk premiums implied by VIX	4	1992–2010	213	3	4	0.097
Wang X	University of International Business and Economics, Beijing	Pricing ESOs with averaging features under the Heston–Nandi GARCH model	4	2012–2021	76	3	4	0.273
French DW	Texas Christian University, USA	Option mispricing in investors' behaviours	4	1984–1991	56	3	4	0.077
Nawalkha SK	Department of Economics and Finance, University of Baltimore	Binomial model and contingent claims analysis of the interest rate risk	4	1995–2001	41	3	4	0.107

(*continued*)

Table 2.

Author	Affiliation	Theme	NP	PY	TC	h_index	g_index	m_index
Corsi F	University of Bologna	A realized volatility approach to option pricing with jump variance	3	2013–2019	79	3	3	0.3
Dowd K	Kent State University, USA	Comparative analysis of the calibration and performance of different options pricing models	3	2009–2013	54	2	3	0.143
Hassan MK	University of New Orleans, USA	Risk exposure of off-balance sheet banking	3	1992–1994	49	3	3	0.097
Kau JB	Dept. Ins., Leg. Studs. Real Est., University of Georgia	Measuring the impact on insurance prices of changes in the chance of a catastrophe	3	1996–2006	49	3	3	0.111
Chambers DR	Lafayette College, USA	Investors preference and option pricing models in studying volatility	3	1995–2014	38	3	3	0.107

Notes: NP = number of publications; PY = publication year; TC = total citation
Source: Authors' own creation

Table 3.
Most productive sources, countries and keywords (frequency)

S.no	Journals/book	TP	TC	Country	TP	TC	Keyword	Frequency
1	*Journal of Futures Markets*	51	535	USA	335	12,449	Option pricing	132
2	*Quantitative Finance*	34	544	China	84	385	Economics	56
3	*Journal of Banking and Finance*	29	628	UK	73	1,256	Stochastic volatility	48
4	*Journal of Derivatives*	21	362	Taiwan	69	597	Option pricing models	47
5	*The Journal of Finance*	20	3,660	Canada	46	1,202	Costs	46
6	*Review of Quantitative Finance and Accounting*	19	125	South Korea	37	255	Real options	43
7	*Journal of Financial and Quantitative Analysis*	17	679	Hong Kong	35	570	Investments	37
8	*Mathematical Finance*	15	1,272	Australia	31	249	Options	30
9	*Applied Financial Economics*	14	66	France	27	892	Implied volatility	29
10	*Review of Derivatives Research*	13	119	Germany	25	402	Black–Scholes model	25
11	*Journal of Financial Economics*	11	1,977	Italy	24	404	Commerce	22
12	*Computational Economics*	10	14	India	21	65	Option pricing model	21
13	*Financial Review*	10	56	Switzerland	18	368	Decision-making	20
14	*Real Estate Economics*	10	216	Singapore	15	434	GARCH	20
15	*Asia-pacific Financial Markets*	9	75	Spain	14	132	Black–Scholes	19
16	*Handbook of Financial Econometrics, Mathematics, Statistics and Machine Learning (in Four Volumes)*	9	1	Japan	13	122	Valuation	18
17	*International Review of Economics and Finance*	9	29	The Netherlands	12	270	Mathematical models	17
18	*Journal of Economic Dynamics and Control*	9	271	Greece	11	54	Modelling	14
19	*Journal of Econometrics*	8	794	New Zealand	9	51	Risk assessment	14
20	*Journal of Financial Research*	8	130	Portugal	9	50	Volatility	14

Source: Authors' own creation

Table 4. Timeline of 50 models used by different authors for option pricing (filtered manually)

S. no	Author	Model used	Paper/book title	Summary
1	Black and Scholes (1973)	Classical BSM model	"The pricing of option and corporate liabilities"	"The Pricing of Option and Corporate Liabilities" is a seminal paper in finance that introduces a mathematical model for pricing options and other financial contracts. It also provides a general formula for pricing other types of financial contracts (other than options), such as bonds, swaps and futures, that are based on the same underlying principles. The Black–Scholes model has since become one of the most widely used models in finance and is considered to be a cornerstone of modern finance theory
2	Zadeh (1975)	Fuzzy set theory	"The concept of a linguistic variable and its application to approximate reasoning-I"	The fuzzy set theory introduced by Zadeh has been applied in option pricing as a means of dealing with uncertainty and vagueness in the pricing problem. It can lead to improved results in situations where the information is incomplete or uncertain
3	Rendleman (1979)	Binomial distribution (to derive BSM)	"Two-state option pricing"	Binomial distribution is used to calculate the expected value of the option, taking into account the two possible states of the underlying asset. The expected value is then used as an input into the BSM formula to derive the fair price of the option. This approach provides a simple and intuitive way to price options and highlights the close relationship between the binomial distribution and the BSM formula
4	Capozza and Cornell (1979)	BSM, Merton model, Binomial model	A variance forecasting test of the option pricing model	The authors use a variety of option pricing models, including the Black–Scholes model, the Merton model and the Binomial model. They also use various measures of stock market volatility, including the standard deviation of returns and the implied volatility derived from option prices. However, the authors find that the accuracy of these forecasts varies across models and across measures of volatility
5	Sterk (1982)	Roll model vs BSM	Tests of two models for valuing call options on stocks with dividends	The paper compares the performance of Roll's option pricing model with a modified version of the Black–Scholes model. The main difference between the two models is that the Roll model allows for the possibility of dividend payments on the underlying stock, while the Black–Scholes model assumes no dividends. The results suggest that the Roll model provides a more accurate representation of the true value of options than the Black–Scholes model, especially in cases where dividends are a significant factor

(*continued*)

Table 4.

S. no	Author	Model used	Paper/book title	Summary
6	Williams (1991)	Used in lease and real estate contracts (asset valuation)	"Real estate development as an option"	It is a seminal paper that introduced the concept of treating real estate development projects as financial options. In the paper, the author argues that real estate development projects can be viewed as options that give developers the right, but not the obligation, to pursue a project under certain conditions. This approach provides a way for developers to reduce risk and increase flexibility, as they can make decisions based on real-time market conditions and adjust their plans accordingly
7	Heston (1993)	Stochastic volatility model	"A closed-form solution for options with stochastic volatility with applications to bond and currency options"	In this paper, the author presents a closed-form solution for the price of options with stochastic volatility. The model takes into account the arbitrary correlation between the volatility and spot-asset returns and also introduces stochastic interest rates
8	Duan (1995)	GARCH model	"The GARCH option pricing model"	The paper by Duan proposes a new method for pricing options using the GARCH model to estimate the volatility of stock returns. The author uses the GARCH model to estimate the volatility of stock returns and incorporates this information into an option pricing model. The results of the study show that the GARCH option pricing model provides more accurate option prices compared to traditional option pricing models that assume constant volatility
9	Grenadier (1995)	BSM used in lease and real estate contracts (asset valuation)	"Valuing lease contracts: a real-options approach"	The real-options approach proposed by Grenadier in the paper is used to value lease contracts and real estate contracts. This approach considers the uncertainty and flexibility associated with lease contracts, such as the ability to renew or terminate a lease, as real options. The value of these real options is estimated using option pricing models, such as the Black–Scholes model
10	Bates (1996)	Jump-diffusion model with stochastic volatility	"Jumps and stochastic volatility: exchange rate processes implicit in deutsche mark options"	The paper presents a jump-diffusion model for exchange rates that incorporates both stochastic volatility and jumps in the underlying process. The findings of the paper provide insights into the behaviour of exchange rate processes and the role of jumps and volatility in determining option prices
11	Scott (1997)			

(continued)

Table 4.

S. no	Author	Model used	Paper/book title	Summary
		Jump-diffusion model with stochastic volatility and interest rate	"Pricing stock options in a jump-diffusion model with stochastic volatility and interest rates: applications of Fourier inversion methods"	This paper focused on the pricing of stock options in a similar jump-diffusion model with stochastic volatility and interest rates. The paper uses Fourier inversion methods for pricing and applies the model to stock options
12	Heston and Nandi (2000)	Closed-form GARCH model	"A closed-form GARCH option valuation model"	The paper by Heston and Nandi extends the work of Duan by proposing a closed-form GARCH option pricing model. A closed-form model is a mathematical model that provides an exact solution for the price of an option. The authors use a closed-form GARCH model to price options and show that the model provides more accurate option prices compared to other option pricing models that use the GARCH model
13	Arnold (2006)	Stochastic volatility jump-diffusion model (SVJ) by using generalized method of moments (GMM)	Using GMM to flatten the option volatility smile	The model used in this paper is the stochastic volatility jump-diffusion (SVJ) option pricing model. The parameters of this model are estimated using the generalized method of moments (GMM) estimation procedure. The paper compares the performance of the SVJ model with a stochastic volatility (SV) option pricing model and evaluates the robustness of the models by considering performance beyond the estimation data
14	Duffie *et al.* (2000)	Affine jump-diffusion model	"Transform analysis and asset pricing for affine jump-diffusions"	This paper provides valuable insights into the use of transform analysis in the context of affine jump-diffusion state processes and its applications in finance, making it a crucial contribution to the field
15	Geman (2002)	"Pure Jump levy Model"	"Pure jump Lévy processes for asset price modelling"	This study aims to show that some types of Lévy processes, such as the hyperbolic motion and the CGMY, are particularly suitable for asset price modelling and option pricing. The authors also focus on two specific classes of pure jump Lévy processes, the generalized hyperbolic model and the CGMY model, and report on the goodness of fit obtained for both stock prices and option prices

(*continued*)

Table 4.

S. no	Author	Model used	Paper/book title	Summary
16	Mun (2012)	Valuation of strategic investment business using BSM	"Real Options Analysis-Tools and Techniques for Valuing Strategic Investments and Decisions"	The author discusses how the BSM model can be used to value the flexibility of waiting for better information, expanding the scale of a project or abandoning a project entirely. The author provides a comprehensive treatment of the BSM model and its applications in real options analysis, making it a valuable resource for those interested in using the model in business valuation
17	Kou (2002)	"Double exponential jump diffusion model"	"A jump diffusion model for option pricing"	Kou (2002) demonstrated that this model provides a more accurate representation of the underlying financial process compared to traditional option pricing models, such as the Black–Scholes model, which do not account for the possibility of price jumps
18	Zapart (2002)	Wavelets and artificial neural networks are used in stochastic volatility models	"Stochastic volatility options pricing with wavelets and artificial neural networks"	This study explores the use of wavelets and artificial neural networks in pricing options under stochastic volatility models. The authors propose a new pricing model that combines wavelet analysis and artificial neural network techniques to handle the complex dynamics of the volatility process. The results show that the proposed model is able to accurately price European call and put options and provides a good fit for the option prices obtained from market data
19	Carr and Wu (2004)	"Time changed levy process"	"Time-changed Lévy processes and option pricing"	To address the limitations of the BSM model, time-changed Lévy processes have been proposed as an alternative framework for option pricing. These processes incorporate the three main deviations from the Black–Scholes model by allowing for non-normal return innovations, time-varying volatilities and correlated returns and volatilities. This framework provides a more accurate representation of the underlying financial process, which can lead to more accurate option pricing
20	Wu (2004)	Fuzzy pattern of BS model-single point estimate	"Pricing European options based on the fuzzy pattern of Black–Scholes formula"	The authors of this paper likely use fuzzy set theory to model the inputs to the Black–Scholes formula as fuzzy variables rather than precise numbers and then use these fuzzy variables to determine the option price. This approach would provide a more robust estimate of the option price by taking into account the uncertainty in the inputs and would result in a wider range of possible option prices rather than a single point estimate as provided by the traditional Black–Scholes formula

(continued)

Table 4.

S. no	Author	Model used	Paper/book title	Summary
21	Muzzioli and Torricelli (2004)	Multiperiod binomial model	"A multiperiod binomial model for pricing options in a vague world"	The authors argue that traditional models, such as the Black–Scholes model, do not provide an adequate solution for options pricing in markets characterized by high uncertainty or vagueness. To address this issue, they propose a multiperiod binomial model that incorporates the concept of vagueness into the option pricing process
22	Lee *et al.* (2005)	Fuzzy binomial option pricing model	A fuzzy set approach for generalized CRR model: an empirical analysis of S&P 500 index options	The paper applies fuzzy set theory to the Cox, Ross and Rubinstein (CRR) model to set up the fuzzy binomial option pricing model (OPM). The purpose of this study is to provide investors with a more accurate method of pricing options by incorporating the uncertainty of certain parameters, such as volatility and risk-free interest rates. The authors use fuzzy volatility and fuzzy riskless interest rate to replace the corresponding crisp values in the CRR model and establish the fuzzy binomial OPM. This model allows investors to correct their portfolio strategy according to the right and left values of triangular fuzzy numbers, thereby providing a more flexible approach to pricing options
23	Chen and Palmon (2005)	Non-parametric-option pricing models	"A non-parametric option pricing model: theory and empirical evidence"	In traditional option pricing models, such as the Black–Scholes model, the underlying financial process is modelled using a set of assumptions about the distribution of future asset prices. These models are known as "parametric" models, as they rely on a specific set of parameters to describe the financial process. In contrast, non-parametric models do not make any assumptions about the distribution of future asset prices. Instead, they use historical data to estimate the distribution of future asset prices, allowing for a more flexible representation of the financial process
24	Chang (2006)	Subordinated binomial option pricing	"Subordinated binomial option pricing"	This study discusses the extension of the binomial option pricing model to incorporate the concept of subordination, which allows for a more accurate representation of price dynamics while retaining computational simplicity. The authors introduce a trinomial tree structure in which the asset price in each binomial period evolves based on two independent Bernoulli trials for trade occurrence/non-occurrence and up/down price movement

(*continued*)

Table 4.

S. no	Author	Model used	Paper/book title	Summary
25	Yoshida *et al.* (2006)	Mean value for fuzzy random variables	"A new evaluation of mean value for fuzzy numbers and its application to American put option under uncertainty"	The paper starts by introducing the concept of fuzzy numbers and a new evaluation of their mean value. The author then applies this evaluation method to pricing American put options under uncertainty using the mean value of fuzzy numbers as the underlying asset price. The results show that the new evaluation method provides a more accurate representation of the underlying asset price and results in a more accurate pricing of American put options under uncertainty compared to traditional methods
26	Wu (2006)	GARCH model – A modified lattice approach	"The GARCH option pricing model: a modification of lattice approach"	This study proposes a modification to the traditional lattice approach for option pricing that takes into account the generalized autoregressive conditional heteroskedasticity (GARCH) model for volatility. The GARCH model is a commonly used statistical model for volatility that captures the time-varying nature of volatility in financial time series data
27	Wu (2007)	Fuzzy pattern of BSM-boundary of possible prices	"Using fuzzy sets theory and Black–Scholes formula to generate pricing boundaries of European options"	In summary, the paper "Using Fuzzy Sets Theory and Black–Scholes Formula to Generate Pricing Boundaries of European Options" presents a method for pricing European options that combines the traditional Black–Scholes formula with concepts from fuzzy set theory to model uncertainty in the inputs. The approach provides a more robust estimate of the option price by generating a range of possible prices rather than a single point estimate
28	Daal and Madan (2005)	Variance-Gamma model	An empirical examination of the variance-gamma model for foreign currency options	The results of the study indicate that the VG model provides better out-of-sample pricing performance compared to the modified Black–Scholes model or the JD model. In addition, the authors use a cross-entropy analysis to show that the VG model is more consistent with the general criterion of utility maximization and optimal portfolio selection
29	Wang (2009)	Hybrid GARCH approach (neural network and GARCH)	"Using neural network to forecast stock index option price: A new hybrid GARCH approach"	A new approach for forecasting stock index option prices using a hybrid model combining a neural network and a generalized autoregressive conditional heteroscedasticity (GARCH) model. The neural network is used to capture the non-linear relationships between option prices and their underlying factors, while the GARCH model is used to model the volatility dynamics. The results

(*continued*)

S. no	Author	Model used	Paper/book title	Summary
				indicate that the hybrid model outperforms other models in terms of forecast accuracy
30	Cai and Kou (2011)	Mixed exponential jump-diffusion model	"Option pricing under a mixed-exponential jump diffusion model"	It studies the pricing of financial derivatives under a mixed-exponential jump-diffusion model, which is a combination of exponential jump-diffusion and classical diffusion models. This model is able to capture both the continuous and jump components of asset returns. The results show that the mixed-exponential jump-diffusion model provides a good fit for the market prices of options and outperforms the other models in terms of pricing accuracy
31	Ulusoy and Onbirler (2014)	GARCH-M model	"Performance evaluation of black-Scholes and Garch models on USD/TRY and EUR/TRY call options"	The results of the study indicate that the Black–Scholes model outperforms the GARCH-M model in terms of pricing accuracy. The authors also perform statistical tests to confirm their findings and conclude that the Black–Scholes model provides a closer result to the actual prices
32	Rao (2015)	"Mixed Fractional Brownian motion with Jumps model for Option"	"Option pricing for processes driven by mixed fractional Brownian motion with superimposed jumps"	The paper "Option pricing for processes driven by mixed fractional Brownian motion with superimposed jumps" presents a mathematical model for pricing options when the underlying asset is driven by mixed fractional Brownian motion with jumps. This type of process is more complex than traditional Brownian motion and can better capture the behaviour of financial markets that exhibit long-range dependence and sudden changes in price due to jumps
33	Byun *et al.* (2015)	Discrete-time option pricing model by incorporating variance-dependent pricing kernel	"The role of the variance premium in Jump-GARCH option pricing models"	The authors use a Jump-GARCH model to capture the time-varying volatility and the presence of jumps in the asset return. They incorporate the variance premium in the model and investigate its impact on option pricing. The results of the study indicate that the variance premium has a significant effect on option prices, especially for options with longer maturities
34	Jerbi (2015)	J-Model as an extension of BSM model	"A new closed-form solution as an extension of the Black–Scholes formula allowing smile curve plotting"	In this paper, the authors present a closed-form solution for pricing European options under a uni-dimensional option pricing model called the J-model. This solution is based on a new stochastic process, the J-process, which extends the Wiener process and satisfies the martingale property. The J-process is based on a new statistical law called the J-law, which is an extension of the normal law and has interesting asymmetry and tail properties. The authors

(*continued*)

Table 4.

Table 4.

S. no	Author	Model used	Paper/book title	Summary
				provide a smile curve related to this closed-form solution by inverting the Black–Scholes formula
35	Li *et al.* (2017)	Pure jump model	"Pure jump models for pricing and hedging VIX derivatives"	The model used in the paper is a novel class of parsimonious pure jump models for VIX, which is based on the additive time-change technique. The model time changes the 3/2 diffusion by a class of additive subordinators with infinite activity, yielding pure jump Markov semi-martingales with infinite activity and infinite variation
36	Dang *et al.* (2017)	Monte Carlo method, jump-diffusion and stochastic variance	"A dimension and variance reduction Monte-Carlo method for option pricing under jump-diffusion models"	The paper describes a Monte Carlo method for pricing European options under jump-diffusion models, which includes stochastic variance and multi-factor Gaussian interest short rates. The authors aim to achieve high efficiency by reducing the dimension and variance of the option pricing model
37	Chen *et al.* (2017)	SIR, stochastic volatility, double exponential JD and compare with BS	"Option Pricing under the Double Exponential Jump-Diffusion Model with Stochastic Volatility and Interest Rate"	This paper proposes an efficient option pricing model that incorporates stochastic interest rate (SIR), stochastic volatility (SV) and double exponential jump into the jump-diffusion settings. The model comprehensively considers the leptokurtosis and heteroscedasticity of the underlying asset's returns, rare events and an SIR. The authors use a characteristic function approach and an MCMC method with latent variables to estimate the parameters of the model and show that the model provides improved results compared to existing models
38	Siddiqi (2019)	Black–Scholes and stochastic variance model	"Anchoring-Adjusted Option Pricing Models"	This study discusses the use of anchoring as a heuristic in decision-making for option pricing. Anchoring involves using a starting point as a reference for making subsequent estimates. The authors of the paper argue that stock volatility can serve as an anchoring point for estimating call option volatility. The paper focuses on adjusting existing option pricing models (Black–Scholes, Heston and Bates) to account for the use of stock volatility as an anchoring point. The authors find that these adjustments can capture various anomalies in option returns and improve the accuracy of the models
39	Su and Wen Wong (2019)	Two-state lognormal model (TLN), two-state constant-elasticity-variance	"Testing the alternative two-state options pricing models: An empirical analysis on TXO"	The results presented in the text suggest that the two-state option pricing models (TLN, TCEV and TJD) performed better than the Black–Scholes model when pricing options on the Taiwan stock index. Specifically, the TLN model was the most accurate, followed

(*continued*)

Table 4.

S. no	Author	Model used	Paper/book title	Summary
		model (TCEV) and two-state jump-diffusion model (TJD) and compare with BSM model		by Black–Scholes, TCEV and TJD. The study also found that the models performed better in pricing put options compared to call options
40	Necula *et al.* (2019)	Gauss–Hermite expansion	"A general closed form option pricing formula"	The new option pricing model described in this research aims to improve upon traditional option pricing methods by using a modified Gram–Charlier series expansion, known as the Gauss–Hermite expansion. This expansion is designed to converge for fat-tailed distributions, which are commonly encountered in financial returns and often not accounted for in traditional option pricing models
41	Jiang and Hua (2019)	TGARCH-M and GED (generalized-error distribution)	"Option Pricing for TGARCH-M with GED Based on Improved EEMD"	The TGARCH-M with GED option pricing model seeks to address some of the challenges faced in traditional option pricing models by considering three important factors in the pricing framework. Firstly, it takes into account different frequency risks by using the improved EEMD. Secondly, it considers the impact of information asymmetry on option pricing. Thirdly, it addresses the non-normality of asset price processes by using the generalized error distribution. By incorporating these factors, the TGARCH-M with GED model aims to capture more volatility features and provide more accurate option pricing
42	Alitab *et al.* (2019)	Realized volatility option pricing model with jump component	"A realized volatility approach to option pricing with continuous and jump variance components"	The authors of the paper are addressing a limitation of traditional stochastic and time-varying volatility models, which fail to accurately price out-of-the-money put options at short maturities. To overcome this limitation, the authors extend realized volatility option pricing models by adding a jump component. The jump component provides a rapidly moving volatility factor and helps improve the fitting properties of the model under the physical measure (i.e. the actual behaviour of the underlying asset)

(*continued*)

Table 4.

S. no	Author	Model used	Paper/book title	Summary
43	Edeki *et al.* (2020)	He-separation of variable transformation method (HSVTM), closed-form of BSM	"Closed-form solutions of the time-fractional standard Black-Scholes model for option pricing using he-separation of variable approach"	The HSVTM is a mathematical technique that combines different methods, including he's polynomials and the homogeneous separation of variables, to solve partial differential equations in finance. The authors claim that this method is efficient and effective, and that it can be used to obtain solutions to financial models based on either Ito or Stratonovich stochastic differential equations
44	Xie *et al.* (2021)	Analytical approximation vs filtered historical simulation (FHS)	"Accelerating FHS Option Pricing Under Linear GARCH"	According to the authors, the analytical approximation technique offers several advantages over the standard FHS method. One of these is that it eliminates random sampling error, as it does not rely on simulation
45	Wattanatorn and Sombultawee (2021)	Stochastic volatility model (Heston) vs BSM	"The Stochastic Volatility Option Pricing Model: Evidence from a Highly Volatile Market"	Findings indicate that the Heston option pricing model is a better tool for pricing options in the Thai market, particularly for call options. It is able to capture the volatility smile present in the market and produce more accurate option prices compared to the standard Black–Scholes model
46	Mozumder *et al.* (2021)	Pure jump Levy, jump-diffusion, stochastic model, GARCH model (applied to BSM model)	"Option Pricing Model Biases: Bayesian and Markov Chain Monte Carlo Regression Analysis"	Systematic and unsystematic option pricing biases are investigated by using pure jump Lévy, jump-diffusion, stochastic volatility and GARCH models (applied to the Black–Scholes–Merton model)
47	Dash *et al.* (2021)	Fuzzy jump-diffusion	"A new method to solve fuzzy stochastic finance problem"	Fuzzy jump-diffusion model suggests that the paper is focused on developing a method to address uncertainty in financial markets that takes into account the possibility of sudden changes in prices, in addition to more gradual fluctuations
48	Casas and Veiga (2021)	Asymmetric stochastic volatility model	"Exploring Option Pricing and Hedging via Volatility Asymmetry"	Asymmetric stochastic volatility models refer to models that allow for volatility to be different in different market conditions, such as bullish or bearish markets. These models recognize that volatility can be asymmetrical, meaning that it can be higher or lower depending on market conditions. By incorporating asymmetric volatility into option pricing models, researchers can more accurately reflect the impact of volatility on option prices

(*continued*)

S. no	Author	Model used	Paper/book title	Summary
49	Venter and Maré (2022)	GARCH model (best OPM) when applied to VIX	"Price discovery in the volatility index option market: A univariate GARCH approach"	In this paper, the authors may have used a univariate GARCH model to analyse the volatility index options market and determine the extent to which the price of options on the volatility index contributes to price discovery in the underlying asset market. The goal of this study is to estimate the conditional volatility of the volatility index and explore the information content of options prices in predicting future volatility
50	Artn and Ozbayoglu (2022)	Deep learning-based model and compare with BSM	"Deep Learning Based Hybrid Computational Intelligence Models for Options Pricing"	The hybrid deep learning-based options pricing model they developed can produce more accurate prices compared to the widely used Black–Scholes model. The fact that the improvement was significant, with a 94.5% improvement in terms of mean squared error, indicates that the hybrid model may be a more reliable and effective method for option pricing

Source: Authors' own creation

Table 4.

shows that the SV model, GARCH model, jump-diffusion model, BSM fuzzy pattern and Monte Carlo method are widely applied in the literature, which are nothing but some of the restricted or unreal assumptions of the BSM classical model. With the exponential growth of retail investors during the COVID period, the need for new and more realistic models has emerged. Emerging models, such as BSM with machine learning, deep neural network models, computer intelligence, algorithms, fuzzy pattern of BSM, fuzzy jump-diffusion and GARCH, generate accurate findings that are closest to actual option prices.

In summary, Table 4 presents the top 50 OPMs in a timeline format, highlighting the evolution of OPM over the past four decades. The BSM model remains popular, but new models with more realistic assumptions have emerged in response to the changing needs of the market.

4.2 Conceptual and intellectual structure for RQ2

Conceptual framework of the study area aids in getting an understanding of the fundamental characteristics of organizations as well as explanations of various ideas and their underlying characteristics. Understanding the many activities of an organization is also aided by a conceptual framework, which aids in identifying the major themes in a given study (Aria and Cuccurullo, 2017).

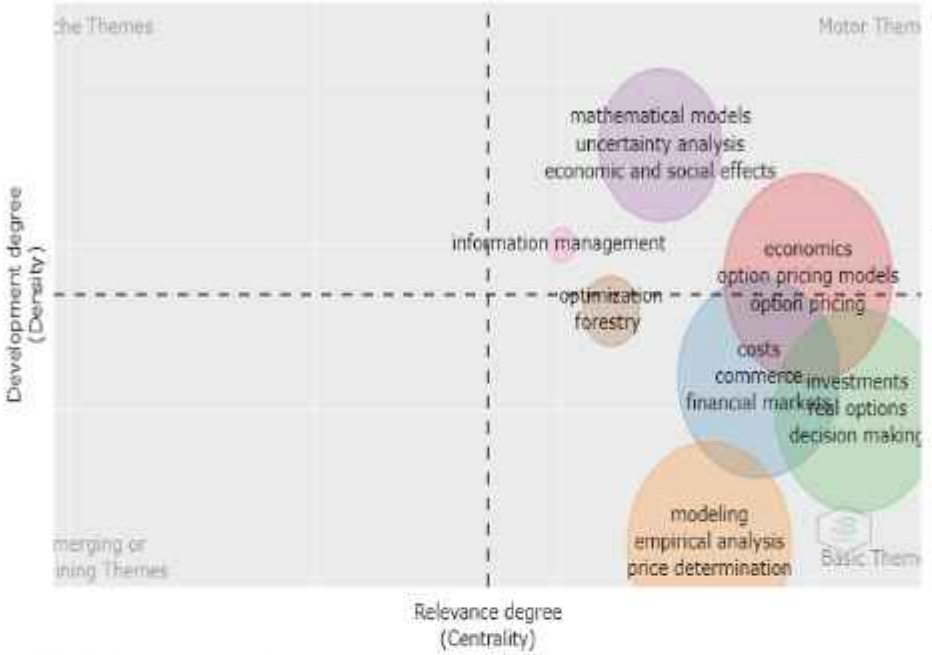
Co-word analysis of publication themes is used to generate the theme map and Sankey diagram (thematic evolution) used in the bibliometric package in the R programme in the related field of research to develop the conceptual framework of the various OPM used in various studies (Zupic and Čater, 2015; Bamel *et al.*, 2020, 2022).

4.2.1 Thematic map. Under the thematic map, themes and subthemes are plotted on a graph and divided into four groups [dropping or emerging themes, fundamental themes, highly developed and isolated themes (niche) and motor themes] to visualize the intellectual structure (refer Figure 3).

Motor theme. Mathematical models and uncertainty analysis are the motor theme (right upper quadrant) with the highest dominance and density. Keywords in this area include parameter analysis, real option pricing, economic and social impacts, Monte Carlo technique, extended double exponential jump-diffusion and more. The Sankey diagram reveals that Mathematical models and uncertainty analysis represent the motor theme with the highest dominance and density, indicating their importance in the field of OPM. However, the relatively smaller size of the cluster implies that there is still potential for further research in this area. The majority of papers in this category focus on Mathematical models and uncertainty analysis.

Fundamental/basic theme. The right-side lower quadrant, known as the basic theme, is characterized by high density and low centrality. This theme includes keywords such as BSM, SV model, Real options, NPV, Binomial, Jump-diffusion model, GARCH model and Empirical analysis. The size of the cluster indicates that this theme attracts the maximum number of publications. OPM covered under this theme includes the theoretical price of options, evaluation of alternative OPM and comparison with the classical BSM model.

Niche and emerging theme. The R software does not show any clear indication of niche or emerging themes, as it is a programming language and software tool used for statistical analysis, data visualization and data manipulation across many fields of study. However, it is important to keep in mind that the absence of niche or emerging themes within the R software may be due to limitations in the data or methods used to analyse it. To gain a comprehensive understanding of whether niche or emerging themes are present within the R software, it may be necessary to conduct further investigation and analysis. Therefore, a thorough examination of the literature (refer Table 4) suggests that fuzzy and machine



Source: Authors' own creation

Figure 3. Conceptual structure of different option pricing models extracted through R studio (Biblioshiny) by using co-word analysis of publication titles identifying four themes by taking development degree on Y-axis and relevance degree on X-axis

learning-based models are a rising subject with medium relevance and development degree. It appears that experts around the world are just beginning to pay attention to this topic, which includes models such as BSM with machine learning, deep neural network models, computer intelligence, algorithms, fuzzy pattern of BSM and fuzzy jump-diffusion. As more individuals become active in electronic trading, there is a growing need to investigate more accurate options pricing methodologies. Improved option pricing could lead to more stable market dynamics and increased resistance to market intervention.

4.2.2 Sankey diagram. Sankey diagram of OPM used by different authors in financial derivatives context. It is used to comprehend the thematic progression of the OPM research over a period of time. These nodes depicted in the Sankey diagram serve an important role in understanding the growth of a field, its direction and forecasting future trends. It helps to show the path to reflect the movements of values from one-time era to another time era (Aria *et al.*, 2020).

In Figure 4, the nodes indicate the study field, the size of the nodes symbolises the quantity of research in each topic and the pathways connecting the nodes show the growth of themes and evolutionary links among them through time (Cobo *et al.*, 2011). The Sankey diagram was designed consisting of 930 words chosen from the Keyword Plus option in the document title and a weighted inclusion index based on word occurrences.

"Keyword Plus" is a feature provided by some academic databases that identifies additional keywords related to the article that may not have been included in the article's metadata or abstract. These additional keywords can provide more information about the content of the article and help researchers find relevant articles more easily.

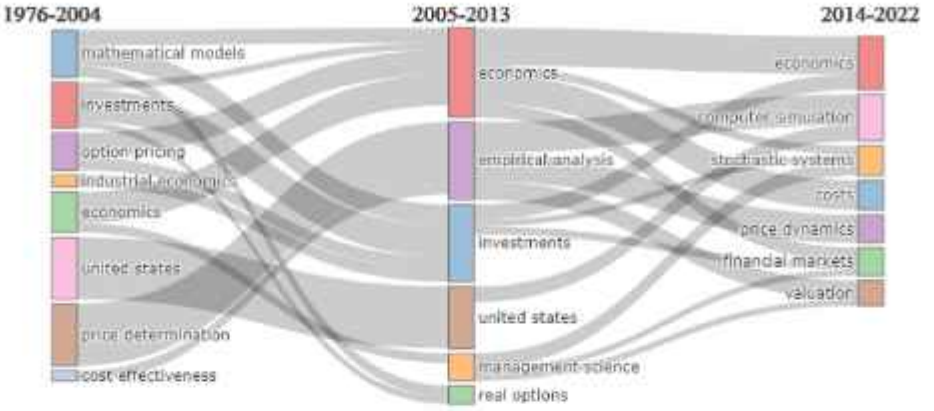


Figure 4.
Sankey diagram of OPM research in past three decades from 1976 to Jan'2022

Source: Authors' own creation

The inclusion index used in the construction of the Sankey diagram was weighted based on word occurrences. This means that the importance of each keyword was determined by how frequently it appeared in the article titles within the data set. Keywords that appeared more frequently were considered to be more important and given a higher weight in the inclusion index. By using a large set of keywords and weighting them based on their occurrence, the Sankey diagram was able to provide a comprehensive and representative overview of the evolution of research topics in the field of interest over time.

To construct a relevant map, the publishing period was analysed from 1976 to January 2022, separated into three eras (1976–2004; 2005–2013; 2014–2022), and this was based on the representative size of research.

"This figure depicts that during 1976–2004, Economics, the Black-Scholes Model, Markov Processes, Random Processes, and Stochastic Volatility were key research themes within the OPM research area. Investment, decision-making, real options, and approximation theory appeared as the foundation or basic themes, while Mathematical Models, decision theory, risk management, and cost-effectiveness were the Motor themes. Surprisingly, Mathematical Models, Investments, and Economics, which were covered under the Basic subject in the first era, were shifted to the Motor theme in the second era.

During the 2005-2013 period, real options, uncertainty analysis, decision theory, and investment decisions were the main research topics in the OPM research field, in addition to the topics covered in the first era. Management Science, stochastic models, jump diffusion, and contingent claim were the basic topics under these management science themes. Empirical analysis, regression analysis, price determination, and financial markets emerged in this era. Unexpectedly, there was no topic under the niche or peripheral theme in this phase.

During the third era (2014–Jan'2022), new research topics such as partial differential equation, financial markets, NPV, sustainable development, commodity price, Monte Carlo analysis, probability, discrete time models, and pricing kernels emerged. Real options, the Black-Scholes model, and discrete time models fell under the basic themes in era three. There were few researches on models like Monte Carlo, Fuzzy Algorithm models, Machine Learning, Deep Neural Networks, and computer intelligence in OPM literature. It is concluded that research in era three is still developing and progressing".

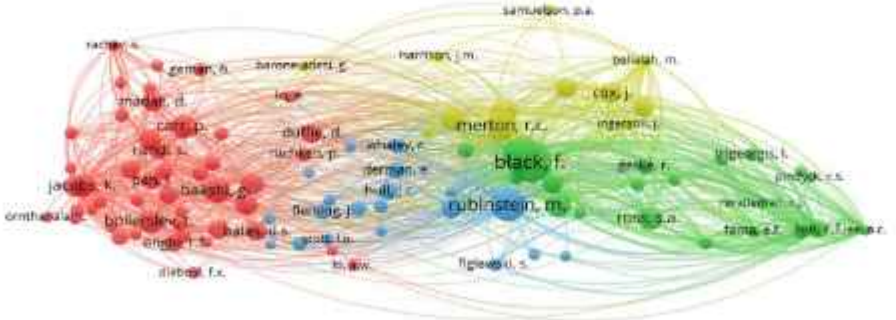
Figure 4 shows how different OPMs have been used by various authors, which has progressed over time. The diagram illustrates how a specific study topic originated and

paved the way for the emergence of another topic. For instance, investment was covered under the niche (highly developed but isolated) theme of research during the first era, but it was later converted into a motor theme (highly contributory theme). Similarly, empirical analysis and regression analysis, which fell under the motor theme during the first era, disappeared during the past two eras. Additionally, research on the GARCH model, Monte Carlo method, fuzzy algorithm, machine learning and computer intelligence in the context of OPMs is developing at an increasing rate as a basic theme, but there is a need to develop some niche research under these areas.

In conclusion, Figure 4 validates that the OPM research area within the financial market industry is constantly changing, with various research themes coming together and diverging over the past three decades.

4.2.3 Bibliographic coupling of primary documents. Bibliographic coupling is a forward-looking concept that can be used to identify new themes and directions in a subject area over a period of time by considering primary documents (Vogel, 2012). If two papers both cite the same document, they are considered bibliographically linked, and the references in bibliographically connected texts have a high degree of resemblance (Van Eck and Waltman, 2014). Bibliographic coupling states that when two or more documents cite similar documents, they are considered linked bibliographically, and the references used by these documents have a high degree of similarity as they are coupled bibliographically. This study is composed of a network of four such clusters. Based on the selection criteria of "minimum citation count of an author" and the "number of authors to be included", a total of four clusters have been formed. Each cluster includes authors who meet the specified citation and author count thresholds. The top 100 original sources with the highest link strength are interlinked, the result of which is described in the following four Clusters.

Cluster 1 is the major cluster consisting of 47 items (refer Figure 5) that cover the various OPMs used by different publications. The highest link strength is associated with the time-changed Levy process, and a comparison is made between the BSM model and the time-changed Levy process (Carr and Wu, 2004). S&P 500 options are examined,



Notes: The top 100 original sources with the highest link strength are interlinked, the result of which is described in the following four clusters

Source: Authors' own creation

Figure 5. Bibliographic coupling network

and it is found that SV and jumps are important in deriving prices and ensuring internal consistency. This study has 1,214 citations (Bakshi *et al.*, 1997). The SV/jump-diffusion model produces more realistic volatility process parameters and predicts nearest option prices (Bates, 2000; Nandi, 1998). This study discusses the correlation between volatility and returns by using the SV model. It is concluded that a non-zero correlation in the SV model gives better results in the case of mispricing in out-of-the-money options. Additionally, a pricing formula based on a fuzzy pattern of BSM is proposed by Duan and Yeh (2010) and Wu (2004, 2005, 2007).

Cluster 2 uses non-parametric tests to conclude that strike price biasness and out-of-the-money calls with shorter maturity periods are priced higher compared to calls predicted based on the BSM model (Rubinstein, 1985). The exact calibration approach shows more accurate results than the error minimization concept in terms of price and hedging performance (Jarrow and Kwok, 2015). The CEV OPM is used to derive the theoretical prices of options (Cox, 1996). The fuzzy pattern of binomial OPM is applied to S&P 500 index options, which gives a nearest value compared to the generalized Cox, Ross and Rubinstein model (Lee *et al.*, 2005). Different approaches, such as the lognormal distribution, differential and integral calculus and the BSM model, can be formed using the binomial distribution. Stochastic calculus is not required if risk is considered neutral for the formulation of the BS model (Lee *et al.*, 2016).

Cluster 3 is located at the bottom-left side in green with 20 items. Initially, it was assumed that no relationship existed between historical stock market returns and option prices. However, it was concluded that historical or past stock returns have a significant impact on index option prices (Amin *et al.*, 2004). Models such as the CEV model, jump-diffusion model, SV model, displaced diffusion model and implied binomial tree approach are compared based on their performance. All better performing models show a negative correlation between index level and volatility (Jackwerth and Rubinstein, 2012). This paper describes extensions of some non-parametric methods and implied binomial trees. The performance of all four kinds of SV pricing models is compared. The models included are the *ad hoc* BS, including implied volatility, "Heston and Nandi's [Rev. Financ. Stud. 13 (2000) 585] GARCH type model", "Madan *et al*'s [Eur. Financ. Rev. 2 (1998) 79] variance gamma model" and "Heston's [Rev. Financ. Stud. 6 (1993) 327] continuous-time stochastic volatility model". It was concluded that in terms of hedging, in-sample pricing and out-sample pricing, Heston's model outperforms all others (Kim and Kim, 2004).

Cluster 4. The GARCH model, including filtered historical innovations, is applied on S&P 500 index options to derive the theoretical price of options. This model gives better performance in comparison with other competing models for option pricing, such as *ad hoc* BS model and GARCH (Barone-Adesi *et al.*, 2008). BS model is used to examine the dual-purpose funds by using a contingent-claims analysis approach (Ingersoll, 1976).

Samuelson's work in warrants and option pricing provides a bridge between early and later OPM (Merton, 2006).

5. Conclusion, implications and future research direction

This paper conducts a comprehensive analysis of OPM within the financial derivatives domain, using bibliometric and network analysis techniques. The study spans an impressive time frame, covering almost 45 years, from 1976 to 19 January 2022 and delves into influential authors, significant works, frequently used keywords and prolific countries in this field. Our findings reveal a notable upward trajectory in publications related to OPM in the context of financial derivatives, with an annual growth rate of 6%. This growth signifies the increasing quantitative and qualitative impact of OPM research

on the financial derivatives sector. In terms of a broader overview and publication trends, our study identifies the top five productive authors as Câmara A, Renault E, Zhang JE, Kim S and Lee CF. The peak year for publications in this area was 2009, with 42 publications, while 2020 and 2021 saw a tie with 39 publications each. Notably, the USA, China, the UK, Taiwan and Canada stand out as the top five countries with the highest number of publications in this research area (refer Table 5). To provide a more insightful analysis top 50 models used by different authors in the area of "Option Pricing Models used in Financial Derivatives" are screened out manually for better interpretation (refer Table 4). While classical models like BSM and binomial models serve as the foundation, they have been complemented by innovative approaches such as BSM with machine learning, deep neural network models, computer intelligence, algorithms, fuzzy pattern of BSM and fuzzy jump-diffusion and the GARCH model. These contemporary models yield results that closely align with real-world option values, overcoming the unrealistic assumptions of classical models.

Table 5: Conclusion of the Study			
Year Studied	1976-19.1.2022(45 Years)		
Area	Option Pricing Models used in Financial; Derivatives		
Approach	Bibliometric & Network Analysis using R&Vosviewer		
Broad Description & Publication Trends Conclusions for RQ.1			
Most Impactful Authors	**Most Productive Journals**	**Publications (Year with No. of Publications)**	**Most Productive Countries**
CÂMARA A	Journal of futures markets	2009(42)	United states
RENAULT E	Quantitative finance	2013(42)	China
ZHANG JE	Journal of banking and finance	2014(40)	United Kingdom
KIM S	Journal of derivatives	2020(39)	Taiwan
LEE CF	The journal of finance	2021(39)	Canada
Timeline of 50 Models used by different Authors for Option Pricing (filtered manually)			
1973-1983	**1984-1994**	**1995-2004**	**2005-2022**
BSM, Binomial, Fuzzy Set theory (but not used extensively)	SVM, BSM used in Real Option	GARCH, Option Models used in Real Option, Jump Diffusion Model, Fuzzy Pattern of BSM, Multiperiod Binomial Model	Fuzzy BSM Model, Deep Learning based Model, Machine Learning, Algorithm, GARCH, SV vs. BSM
Conceptual & Intellectual Structure Conclusions for RQ.2			
Thematic Evolution			
Motor Theme	**Basic Theme**		**Emerging Theme**
Mathematical Models, Uncertainty Analysis, Classical BSM model	Classical BSM model, NPV, GARCH		Machine Learning, Fuzzy theory, Deep Neural Network Models
Sankey Diagram			
1976-2004	**2005-2013**		**2014-Jan'2022**
Economics, BSM, SV	Real Options, Decision Theory, Investment Decisions		Fuzzy Theory, Machine Learning, Real Options, Discrete time models
Bibliography Coupling of Primary Documents			
Cluster1	**Cluster2**	**Cluster3**	**Cluster4**
BSM & Time changed Levy Process	Non parametric test	Comparison of Stochastic volatility models	GARCH with Filtered Historical Approach
Source: Authors own creation			

Table 5.
Conclusion of the study

Additionally, this study outlines the conceptual framework of OPM research within the financial derivatives context. We use the thematic evolution and Sankey diagram approach using the R programme to categorize themes into four groups: basic, niche, emerging and motor themes. This approach visually demonstrates the evolution of topics such as BSM, uncertainty analysis and SV models, highlighting their contributions to the emergence of other key themes like the fuzzy BSM model, machine learning and the GARCH model. Furthermore, we construct a bibliographic coupling network analysis to discern historical, current and potential future developments related to OPM in the financial context. In essence, our study provides a comprehensive and insightful analysis of the evolving landscape of OPM in the realm of financial derivatives, shedding light on the increasing importance and diversity of this research field.

The study's implications encompass both practical and social aspects. On a practical level, it offers valuable insights for future research in OPM in financial derivatives, helping researchers pinpoint influential authors, seminal work and productive countries while also highlighting commonly used OPMs and emerging themes such as machine learning and deep neural network models.

5.1 Future research directions

Through a rigorous analysis using bibliometric and a systematic literature review, spanning nearly 45 years, this study has identified following several significant research gaps that highlight unexplored and inadequately addressed areas within the field.

- Very few studies are conducted related to OPM in developing nations, especially in India context.
- It is evident that the classical BSM model is the foundation of option pricing, but there are few studies conducted on the comparative analysis of alternative models existing for option pricing.
- A flurry of new models evolved as a result of rejecting BSM's core assumptions. However, there is limited and ambiguous research exists that demonstrates a linkage between the assumptions and the models emerged by breaching BSM assumptions for option pricing.
- More studies need to be conducted on emerging new option pricing methods such as fuzzy theory, machine learning and other advanced analyses due to technical and usage of market.

This research has pinpointed several significant research gaps (referred above) within the field. Notably, there is a scarcity of research on OPM in developing nations, particularly in the Indian context. Furthermore, while the BSM model serves as the foundation for option pricing, there is a notable lack of comparative analyses of alternative models. Additionally, the study reveals a dearth of research that clearly links the rejection of BSM's core assumptions to the emergence of new models for option pricing. Finally, there is a pressing need for more research on emerging option pricing methods, such as those using fuzzy theory, machine learning and advanced analytics, driven by technical advancements and market demands. These research gaps provide valuable insights for future investigations and scholarly contributions.

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Foundations and trends in option pricing models: a 45 years global examination based on bibliometric analysis

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Abstract

Purpose – The purpose of this study is to analyse and compile the literature on various option pricing models (OPM) or methodologies. The report highlights the gaps in the existing literature review and builds recommendations for potential scholars interested in the subject area.

Design/methodology/approach – In this study, the researchers used a systematic literature review procedure to collect data from Scopus. Bibliometric and structured network analyses were used to examine the bibliometric properties of 864 research documents.

Findings – As per the findings of the study, publication in the field has been increasing at a rate of 6% on average. This study also includes a list of the most influential and productive researchers, frequently used keywords and primary publications in this subject area. In particular, Thematic map and Sankey's diagram for conceptual structure and for intellectual structure co-citation analysis and bibliographic coupling were used.

Research limitations/implications – Based on the conclusion presented in this paper, there are several potential implications for research, practice and society.

Practical implications – This study provides useful insights for future research in the area of OPM in financial derivatives. Researchers can focus on impactful authors, significant work and productive countries and identify potential collaborators. The study also highlights the commonly used OPMs and emerging themes like machine learning and deep neural network models, which can inform practitioners about new developments in the field and guide the development of new models to address existing limitations.

Social implications – The accurate pricing of financial derivatives has significant implications for society, as it can impact the stability of financial markets and the wider economy. The findings of this study, which identify the most commonly used OPMs and emerging themes, can help improve the accuracy of pricing and risk management in the financial derivatives sector, which can ultimately benefit society as a whole.

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Originality/value – It is possibly the initial effort to consolidate the literature on calibration on option price by evaluating and analysing alternative OPM applied by researchers to guide future research in the right direction.

Keywords Option pricing models, Option pricing methods, OPM, BSM, Bibliometric analysis, Co-citation, Bibliographic coupling

Paper type Research paper

1. Introduction

Option pricing is a leading-edge area of current financial theory and practice. Since Black, Scholes and Merton introduced their trailblazing work on option pricing, trading in derivatives and activity in global financial markets have exploded. The stock option market has risen drastically over the years due to increasing returns and reduced risk. The Black–Scholes (BS) model, the most prominent and prestigious model of option pricing, was introduced in 1973 and quickly became the industry standard (Lee *et al.*, 2013). The model is grounded in a series of core assumptions that serve as the foundation for its option pricing framework. It assumes that stock market movements follow a random walk, both volatility and risk-free rates are constant and known, no dividends are paid on the underlying stock, stock prices evolve smoothly according to geometric Brownian motion, there are no risk-free arbitrage opportunities, European-style options are considered, the market is efficient and no taxes or transaction costs impact the pricing equation. These assumptions collectively shape the model's capacity to predict and evaluate option values in a simplified, yet coherent, financial environment.

Over the past two decades, there has been an outbreak of new models in option pricing, each relaxing some of the restrictive assumptions of the Black–Scholes–Merton (BSM) model. There are numerous option pricing models (OPM) that address each of these assumptions. For example, the underlying price can follow a discrete-time or continuous-time procedure. It can be a diffusion or non-diffusion process, a Markov or non-Markov process, a non-Poisson or Poisson jump process, a mixture of diffusion and jump components with or without random jumps and with or without stochastic volatility (SV), among other continuous-time processes. Many different models have evolved to address the limitations of the classical BSM model.

With the passage of time, an increasing number of consumers are showing interest in opening their demat/brokerage accounts and engaging in e-trading, which creates a new need for more accurate pricing models for options. More precise and profitable investments may become available as values rise. Improved option pricing may also make the volatility and dynamics of the market more resilient to manipulations.

This study provides an overview of the topic of option pricing, recognizing the necessity of integrating the current literature review on OPM, highlighting research gaps and outlining upcoming research goals in this field. As a result, a comprehensive examination is required to gain a complete understanding of the types of option pricing systems used around the world.

To achieve the objective, two important questions are inscribed.

RQ1. Broad description and publication trends analysis related to the different methods/models used for option pricing.

RQ2. Broadly outline the current knowledge structure [(2a) conceptual and intellectual framework(2b)] in the area of OPM research worldwide.

To address the first research question (*RQ1*), we have identified and discussed a general framework of research databases, including trends in yearly publication, the most

influential researchers with their impact factor, affiliations and most cited individual works. We have also identified the most useful publication outlets, such as articles, journals and other relevant documents. To answer the *RQ2*, we have developed a thematic map, Sankey diagram and bibliographic network system of the top 100 primary documents, with detailed explanations.

This work attempts to contribute to the literature on financial derivatives in the context of OPM research in two important ways by addressing the issues mentioned above. Firstly, recognizing the significance of important ideas requires knowledge of publication trends, the most prolific authors, highly influential works and publishers. Secondly, the bibliographic network study would indicate the history of research and recommend prospective possibilities in this field for the future.

The structure of the paper is as follows: Section 1 introduces the problem statement, Section 2 describes the associated efforts of various authors, Section 3 discusses the study topics and methodology, Section 4 presents the descriptive findings and thematic discussion and Section 5 concludes with future implications.

2. Literature review

This study provides an overview of option pricing research, recognizing the need to integrate current option pricing literature, identify research gaps and outline future research goals in this field.

Classical model BSM applicability: BS OPM was used to compute the prices for call options traded on the CBOE using daily price quotes for every option traded on the CBOE starting from 26th April to 30th November 1973. Trading techniques based on the BS model, according to the findings, sold overpriced and bought the under-priced options (Galai and Masulis, 1976).

The BS model is the most widely used model for option pricing. The conceptualization has been exhaustively researched in recent decades, and in some situations, specific major concerns have been recognized. It is discovered by Black and Scholes (1973) that BS prediction overpriced the fair value of the option prices in excessively turbulent markets. Errors in the BS model increase in both ITM and OTM scenarios (Macbeth and Merville, 1979). Furthermore, according to Gultekin *et al.* (1982), as the period to expiry advances, the discrepancy between the BS model and the factual value of an option grows. Black and Scholes's (1973) model became the most extensively used model for the formulation of option pricing with minor revisions. Despite a few assumptions, this model provides a reasonable methodology for option pricing and is commonly used in the financial market (Bodie *et al.*, 2013).

The BS OPM is widely studied and has been the subject of much research. John Hull's book "Options, Futures, and Other Derivatives" (Hull, 2015) is a comprehensive resource for information on the model and the various modifications that have been proposed by researchers, such as constant volatility and efficient markets. These assumptions limit the accuracy of the model in real-world situations, and more advanced models have been developed to account for these limitations. Nevertheless, the BSM model remains a valuable tool for option pricing and continues to be widely used in finance (Mehrdoust *et al.*, 2017; Singh *et al.*, 2020; Dash *et al.*, 2021).

The BSM model is a widely used mathematical model for pricing options in finance. It is particularly applicable in real options, which refer to the options that are embedded in real assets such as investment opportunities in a company or the flexibility to expand or abandon a project. Despite the fact that option pricing is critical for risk management and investing, precisely pricing options is difficult due to the increasingly complex variations in

the process of asset pricing. The expanding popularity of the option concept may be seen in its applicability to derive the value of lease contracts and real estate deals (Grenadier, 1995). In addition to asset assessment, option theory is extensively carried on in the area of risk management (Williams, 1991; Buetow and Albert, 1998).

Black and Scholes (1973) were the first authors to bring forward a model which is established on financial options and can be used extensively based on the assumption of continuity of decision-making. It is further extended to the real valuation of options. Brennan and Schwartz (1985) and Mcgrath (1997) also claimed that the BS model can apply to circumvent the net present value (NPV) limitation in a technological-driven or newly established investment enterprises. Merton (1974) makes the critical examination of the equity position of companies, which is considered as a call option on assets having an exercise price equal to the liabilities. According to Mun (2012), the most essential variables in using the BS model to estimate the value of an investment firm is volatility, which may be estimated using numerous methods such as historical volatility, Monte Carlo simulation volatility, market substitution and so on.

Hillegeist *et al.* (2004) state that a corporation is in danger of going bankrupt if its assets are smaller than its liabilities. In the BS model, the possibility of liquidation is defined as the probability of the price of assets in the real market lower than the face value of debts.

In the four decades since Merton's (1974) model was published, several extensions and different models have been developed and published, but the original model is still widely used by academics and practitioners to evaluate credit risk (Afik *et al.*, 2016). Many parameters of the Merton model, as well as a couple of its modifications are applied and find that the asset's projected return and volatility have the greatest impact on default prediction goodness (Dang *et al.*, 2017). The Monte Carlo technique is used to generate hedging parameters and plain vanilla.

European option prices using a reasonably generic jump-diffusion OPM that integrates multi-factor Gaussian interest short rates with stochastic variance. Gauss–Hermite expansion is applied to European options. For this real-world and simulated option prices, new option price is calibrated, and it is concluded that the resultant volatility spillover curve gives the nearest estimation over a different variety of strike prices (Necula *et al.*, 2019).

OPM other than BSM model: the status of option trading has changed significantly over the past four decades in the light of the vast amounts of available data given the technological innovations and applications (Zumbach, 2012) which leads to the emergence of multiple types of risks and substantial empirical research on alternative OPM (Bates, 2000). Resultantly, new approaches of viewing option pricing continue to emerge (Cox *et al.*, 1985; Heston, 1993; Stein and Stein, 1991). The BS model was a ground-breaking development in the field of option pricing, but over time, it became clear that certain assumptions made in the original model were too restrictive. Researchers have since expanded upon the BS model by incorporating new insights and techniques, such as considering interest rates and volatility as stochastic variables, leading to more accurate representations of real-world market conditions. These modifications have improved the accuracy of OPM and helped to further advance the field of financial mathematics. Some researchers, Scott (1997), Wiggins (1987), Hull and White (1987), Stein and Stein (1991) and Heston (1993), made significant contributions to the field of financial mathematics by generalizing and expanding upon the BS model. While Amin and Jarrow (1992) modified the BS model incorporating stochastic interest rate into OPM, accomplished through the use of advanced mathematical techniques such as stochastic calculus and binomial distribution.

Eminent researchers like Bates (1991, 1996), Kou (2002), Wang (2009) and Bakshi *et al.* (1997) made significant contributions to the field of option pricing by proposing jump-

diffusion models. These models consider the presence of sudden jumps or spikes in asset prices, which are not captured by traditional models like BS. Bates (1996) included the process of jump-diffusion in the model of SV, while Scott (1997) makes efforts for option pricing by applying jump-diffusion model, incorporating interest rates and SV. Rendleman (1979) and Cox *et al.* (1979) used binomial distribution to create the BS model. Out-of-the-money put options are regularly priced incorrectly by stochastic and time-varying volatility models when the term is short. By integrating a jump component to realized volatility OPM, fitting characteristics under the physical measure is improved (Alitab *et al.*, 2019).

In addition to the BS and jump-diffusion models, a wide range of other OPM have been proposed and validated using real-world data, such as constant elasticity of variance (CEV) models (Cox and Ross, 1976; Beckers, 1980; Davydov and Linetsky, 2001; Lee *et al.*, 2004; Chen *et al.*, 2009), Markovian models (Rubinstein, 1985), generalized autoregressive conditional heteroskedasticity (GARCH) models (Duan, 1995; Heston and Nandi, 2000; Wu, 2006) and models based on Lévy processes (Geman, 2002; Carr and Wu, 2004), all aim to provide a more accurate representation of real-world market conditions and improve the accuracy of option pricing results. Each of these models has its own unique strengths and limitations, and the choice of which model to use often depends on the specific needs and requirements of the trader.

In a perfect market, the BS model should be used as the first choice. On the other hand, a neural network model can be used for American option pricing, for which the traditional BS model cannot be used. Furthermore, the neural network model can be used for volatile markets which violate the BS assumption of constant volatility.

By allowing for a flexible change of measure, the filtered historical simulation (FHS) method provides a new framework for option pricing. However, a problem with the FHS option pricing method is that it relies on Monte Carlo simulation, which is very time-consuming. Empirical results show that the FHS option pricing method outperforms the BS model of Dumas *et al.* (1998), the HN-GARCH model of Heston and Nandi (2000) and the GARCH model with inverse Gaussian innovations of Christoffersen *et al.* (2006).

The GARCH model of option pricing given by Duan (1995) and Huang *et al.* (2019) creates the utmost option prices, followed by other models such as log-normal Ornstein–Uhlenbeck and BS model. BS model and a binomial tree coupled to an original SV model were examined using Chicago Board Options Exchange market options pricing. The proposed dynamic SV model outperforms in comparison to the standard BS formula in terms of option pricing (Zapart, 2002). A realized GARCH framework is created for pricing of European options and applied to S&P 500 index options, which outperforms in terms of pricing mistakes (Huang *et al.*, 2017). A different OPM is named threshold GARCH with generalized error distribution. According to the findings, the comparative analysis produces improved estimate results and least pricing errors (Jiang and Hua, 2019).

Four models of option pricing performance results in order of highest to lowest, i.e. two state lognormal model, BS, two-state constant elasticity variance model and two-state jump-diffusion model in both call and put options, with put options outperforming call options (Su and Wen Wong, 2019).

The work of Wu (2004, 2005, 2007) and Lee *et al.* (2005) has provided valuable contributions to the field of option pricing by incorporating fuzzy logic into the traditional BS model. This has led to a more flexible and robust approach to option pricing that can handle uncertainty and vagueness, providing a more comprehensive and accurate way to incorporate uncertainty into the option pricing process. The findings in the study by Arin and Ozbayoglu (2022) are interesting and suggest that the hybrid deep learning-based options pricing model they developed can produce more accurate prices compared to the

widely used BS model. The fact that the improvement was significant, with a 94.5% improvement in terms of mean squared error, indicates that the hybrid model may be a more reliable and effective method for option pricing.

3. Research methodology

The motivation for this work is to re-examine the most frequently used models in option pricing to attain the results for our two dominant research problems stated above. To achieve this, we have applied a quantitative review of the literature to analyse the indicators used through a bibliometric approach to identify specific publications (Bamel *et al.*, 2020; Bamel *et al.*, 2022). Examination of bibliometrics is an unconstrained means to critically review the remarkable publications, as these analyses check for biasness in authors' work in relation to exclusion and inclusion of publicizing in a particular area (Zupic and Čater, 2015).

3.1 Process of data retrieval

Data were retrieved from the Scopus database on 19 January 2022, using a bibliometric approach to identify relevant publications. The Scopus database was chosen because it provides global and regional coverage of published documents (Waltman, 2016). A systematic literature review and widely used data retrieval protocol (Jones *et al.*, 2011) were applied to retrieve the data.

The following search string was used to retrieve documents on the topic, field, article, title, keywords and abstracts: TITLE-ABS-KEY ("Option Pricing Models" OR "Option Pricing Methods"). This search yielded 1,572 documents. Inclusion and exclusion criteria were applied to ensure the significance of the publications (Tranfield *et al.*, 2003). The inclusion criteria were publications in the subject areas of economics, econometrics, finance, business management, accounting, social sciences and multi-disciplinary fields. Exclusion criteria were publications in subject areas such as mathematics, chemistry, computer science, engineering, physics and astronomy, energy, immunology and microbiology, biological science, biochemistry and neuroscience. This resulted in 896 documents. The articles, conference papers, conference reviews and book chapters were included, while letters, notes, short surveys, editorials, etc., were excluded. This resulted in 887 documents. Publications written in the English language were included, while those written in Chinese, Spanish, French, German, etc., were excluded. This resulted in 868 documents. After manually screening the abstracts, 864 papers were included.

PRISMA model (Figure 1) is used to depict the inclusion and exclusion criteria.

4. Findings and discussion

Section 4 addresses research question 1 (*RQ1*) by analysing the broad description and publication trends of various OPM (refer sub-Section 4.1.1), exploring yearly publication patterns (refer sub-Section 4.1.2), identifying prolific scholars in financial derivatives and OPM research (refer sub-Section 4.1.3) and top 50 models are manually selected in a chronological order, as described in sub-Section 4.1.4.

It also contributes to answering *RQ2* through a thematic map (refer sub-Section 4.2.1), a Sankey diagram (refer sub-Section 4.2.2) and an examination of bibliographic coupling among primary documents (refer sub-Section 4.2.3).

4.1.1 Broad description and publication trends analysis of different option pricing models. This section provides an overview of the fundamental trends and describes OPM in the context of financial derivatives. Our data set consists of 868 papers published between 1976

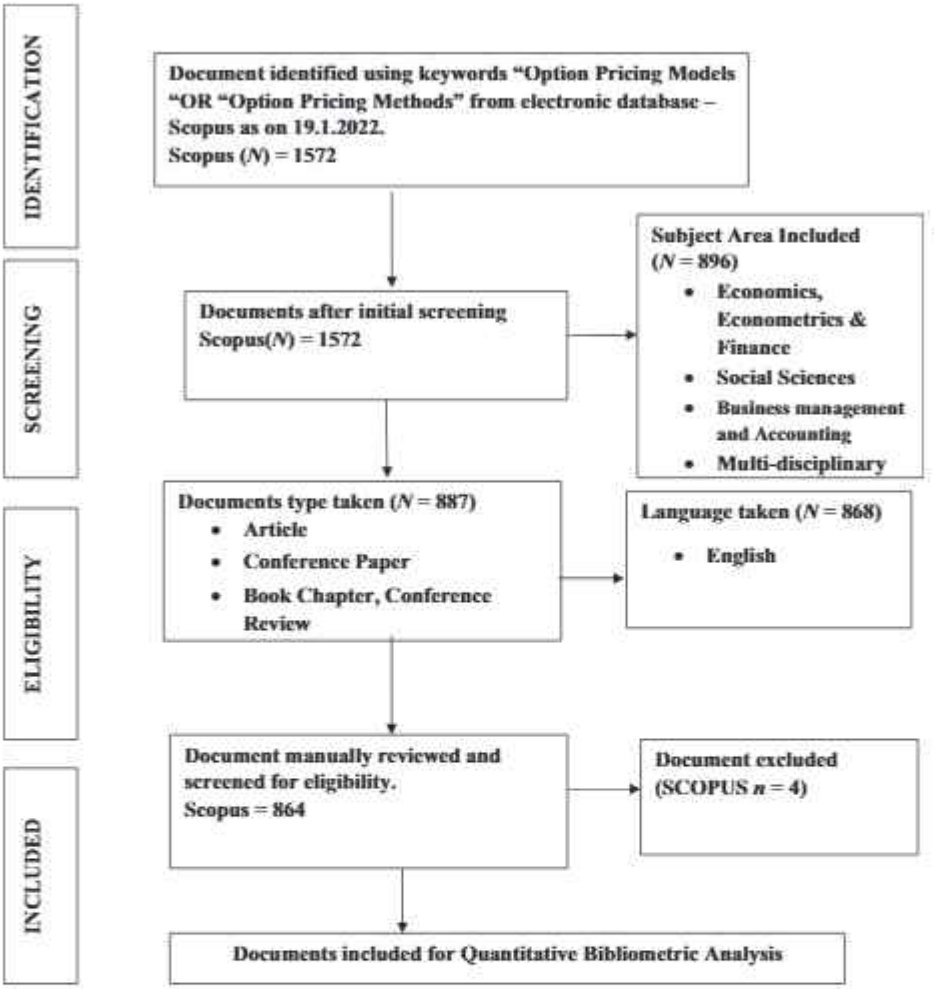


Figure 1.
Bibliometric analysis of option pricing models for the period 1976–19th Jan'2022

Source: Inspired from Moher *et al.* (2009)

and 19 January 2022, including 743 research articles, 37 book chapters, 28 reviews and 13 books. With a mean of 26.13 of citations, these documents have been published in 321 sources (journals, books, etc.). In total, 1,490 authors contributed to these 868 documents. The co-authors per document ratio is 2.15, and the author collaboration index is 2.02 (refer Table 1).

4.1.2 Trend analysis of yearly publication. Figure 2 displays the yearly publication trend. The first publication on this subject was released in 1976. Over the next decade, there was a gradual increase in the number of publications on this topic. However, after 1998, there was a sharp surge in the number of publications, and since then, it has consistently remained above the trend line every year.

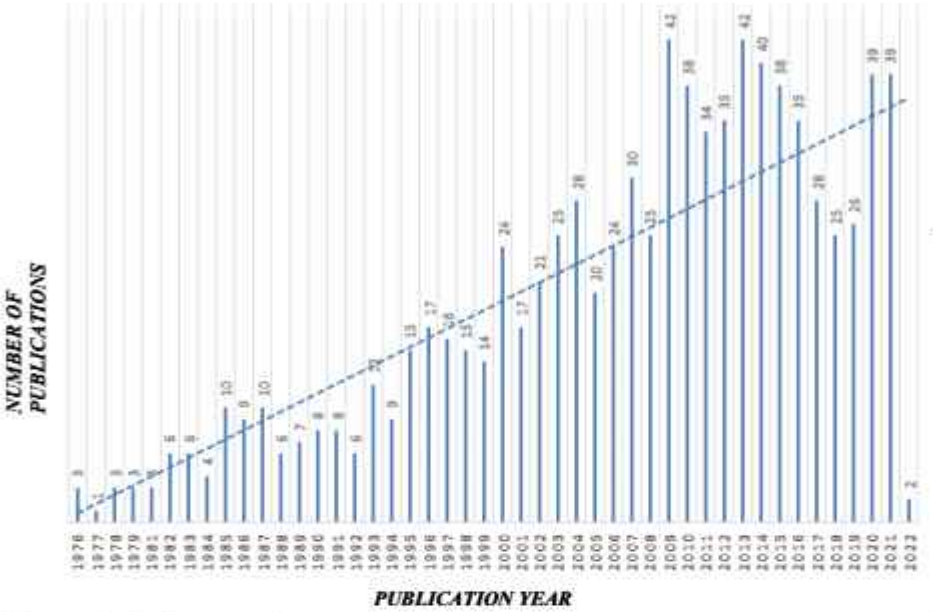
Description	Results
Timespan	1976:2022
Sources (journals, books, etc)	321
Documents	868
Average years from publication	15
Average citations per documents	26.13
Average citations per year per doc	1.316
References	24,716
Document types	
Article	743
Book	13
Book chapter	37
Conference paper	46
Conference review	1
Review	28
Document contents	
Keywords plus (ID)	994
Authors' keywords (DE)	1,742
Authors	
Authors	1,490
Author appearances	1,864
Authors of single-authored documents	207
Authors of multi-authored documents	1,283
Authors collaboration	
Single-authored documents	232
Authors per document	1.72
Co-authors per documents	2.15
Collaboration index	2.02

Source: Authors' own creation (Scopus database accessed on 19/01/2022)

Table 1. Relevant information data set

4.1.3 Most prolific scholars in option pricing models research in financial derivatives context. The aim of the study is to identify the most influential scholars in the financial derivatives context of OPM research based on their productivity and impact. Table 2 presents citation indexes for 20 of the most productive authors, including total citations, h-index, g-index and m-index. The authors are ranked based on the number of publications and, if there is a tie, the number of citations. The table also provides information on the research themes explored by each author. According to the ranking, Camara A, Renault E, Zhang JE, Kim S and Lee CF from the University of Oklahoma State University (USA), University of Warwick (UK), University of Hong Kong (Hong Kong), Hankuk University of Foreign Studies (South Korea) and Rutgers Business School at Newark (USA), respectively, have published the most papers in this area.

Regarding the most influential authors, Rubinstein M from the University of California, Berkeley (USA) has received the highest total citations for all of their publications (1,143 citations). It is also noteworthy that more than 50% of the most productive authors are still actively engaged in this field, based on their publication timelines. Another interesting finding is that authors affiliated with institutions from the USA, the UK, Hong Kong and South Korea are prominent in this list.



Source: Authors' own creation

Figure 2.
Trends of annual production of research articles in option pricing models

To comprehend pioneering work in a specific field of study, it is required to identify the most prolific writers and significant work. A thorough examination of Table 3 depicts the list of the top most 20 journals that accepted research work on OPM using the following:

- *Keywords:* Option pricing, Economics, OPM, BS model, GARCH model, Real options, Implied volatility, Mathematical models and SV (The table presented in this study was generated using the VOSviewer software and is based on a Sankey diagram. The diagram was created using 930 words selected from the Keyword Plus option in the document title, and a weighted inclusion index was calculated based on the frequency of these words in the documents.)
- *Most productive journals: Journal of Futures Markets, Quantitative Finance, Journal of Banking and Finance and Journal of Derivatives.*
- *Most productive countries:* The USA, the UK, China, Taiwan and Canada.
- It is worth noting that a few developing countries, such as India and China, appear on the list of the most productive countries.

4.1.4 Top 50 models are screened out manually to answer the RQ1 and depicting in timeline mode starting from 1973 to 19.1.2022 (refer Table 4). The BSM classical model has been used extensively over the past four decades and remains very popular for option pricing. This model is widely used because it provides theoretical values that are close to the actual values of options. Fuzzy set theory is applied by Zadeh (1975) but was not used extensively at that time. BSM and binomial are considered the basis or classical model used for option pricing. However, the BSM model has been criticized for its restrictive and unrealistic assumptions, leading to the development of numerous other OPMs over time. The table

Table 2.
Most productive authors and their citation structure

Author	Affiliation	Theme	NP	PY	TC	h_index	g_index	m_index
C Cámara A	Oklahoma State University, USA	Two counters of jump-diffusion, DJD model	9	2005–2012	71	5	8	0.278
R Enault E	University of Warwick, UK	Comparison of ARCH-type and stochastic volatility option pricing models	7	1998–2020	482	5	6	0.2
Zhang Je	University of Hong Kong, Hong Kong	The implied volatility smirk and option pricing under jump-diffusion	7	2003–2020	210	6	8	0.3
Kim S	Hankuk University of Foreign Studies, South Korea	Mortgage pricing modelling	7	2004–2021	65	4	7	0.211
Lee CF	Rutgers Business School at Newark	Alternative methods to derive option pricing models	7	1991–2020	41	3	4	0.094
Madan DB	Robert H. Smith School of Business, University of Maryland	Comparison of VG and BSM model	5	2005–2017	128	3	5	0.167
Fabozzi FJ	Department of Finance, Copenhagen Business School	Option pricing with time-changed Lévy processes	5	2011–2020	111	2	5	0.167
Brorsen BW	Department of Agricultural Economics, USA	GARCH, BSM and average option pricing –an analysis	5	1995–2018	23	3	4	0.107
Rubinstein M	University of California, USA	Relation between binomial and trinomial option pricing models	4	1985–2012	1,143	4	4	0.105
B Enaroch M	School of Management, Syracuse University, USA	Managing information technology investment risk using real options analysis	4	1999–2010	787	4	4	0.167
JR	Graduate School of Business Administration, USA	Effect of different costs on OPM	4	1982–1990	347	4	4	0.098
Duan J-C	Faculty of Management, McGill University, Canada	GARCH method using a Markov chain and jump and volatility risk premiums implied by VIX	4	1992–2010	213	3	4	0.097
Wang X	University of International Business and Economics, Beijing	Pricing ESOs with averaging features under the Heston–Nandi GARCH model	4	2012–2021	76	3	4	0.273
French DW	Texas Christian University, USA	Option mispricing in investors' behaviours	4	1984–1991	56	3	4	0.077
Nawalkha SK	Department of Economics and Finance, University of Baltimore	Binomial model and contingent claims analysis of the interest rate risk	4	1995–2001	41	3	4	0.107

(*continued*)

Table 2.

Author	Affiliation	Theme	NP	PY	TC	h_index	g_index	m_index
Corsi F	University of Bologna	A realized volatility approach to option pricing with jump variance	3	2013–2019	79	3	3	0.3
Dowd K	Kent State University, USA	Comparative analysis of the calibration and performance of different options pricing models	3	2009–2013	54	2	3	0.143
Hassan MK	University of New Orleans, USA	Risk exposure of off-balance sheet banking	3	1992–1994	49	3	3	0.097
Kau JB	Dept. Ins., Leg. Studs. Real Est., University of Georgia	Measuring the impact on insurance prices of changes in the chance of a catastrophe	3	1996–2006	49	3	3	0.111
Chambers DR	Lafayette College, USA	Investors preference and option pricing models in studying volatility	3	1995–2014	38	3	3	0.107

Notes: NP = number of publications; PY = publication year; TC = total citation
Source: Authors' own creation

Table 3.
Most productive sources, countries and keywords (frequency)

S.no	Journals/book	TP	TC	Country	TP	TC	Keyword	Frequency
1	*Journal of Futures Markets*	51	535	USA	335	12,449	Option pricing	132
2	*Quantitative Finance*	34	544	China	84	385	Economics	56
3	*Journal of Banking and Finance*	29	628	UK	73	1,256	Stochastic volatility	48
4	*Journal of Derivatives*	21	362	Taiwan	69	597	Option pricing models	47
5	*The Journal of Finance*	20	3,660	Canada	46	1,202	Costs	46
6	*Review of Quantitative Finance and Accounting*	19	125	South Korea	37	255	Real options	43
7	*Journal of Financial and Quantitative Analysis*	17	679	Hong Kong	35	570	Investments	37
8	*Mathematical Finance*	15	1,272	Australia	31	249	Options	30
9	*Applied Financial Economics*	14	66	France	27	892	Implied volatility	29
10	*Review of Derivatives Research*	13	119	Germany	25	402	Black–Scholes model	25
11	*Journal of Financial Economics*	11	1,977	Italy	24	404	Commerce	22
12	*Computational Economics*	10	14	India	21	65	Option pricing model	21
13	*Financial Review*	10	56	Switzerland	18	368	Decision-making	20
14	*Real Estate Economics*	10	216	Singapore	15	434	GARCH	20
15	*Asia-pacific Financial Markets*	9	75	Spain	14	132	Black–Scholes	19
16	*Handbook of Financial Econometrics, Mathematics, Statistics and Machine Learning (in Four Volumes)*	9	1	Japan	13	122	Valuation	18
17	*International Review of Economics and Finance*	9	29	The Netherlands	12	270	Mathematical models	17
18	*Journal of Economic Dynamics and Control*	9	271	Greece	11	54	Modelling	14
19	*Journal of Econometrics*	8	794	New Zealand	9	51	Risk assessment	14
20	*Journal of Financial Research*	8	130	Portugal	9	50	Volatility	14

Source: Authors' own creation

Table 4. Timeline of 50 models used by different authors for option pricing (filtered manually)

S. no	Author	Model used	Paper/book title	Summary
1	Black and Scholes (1973)	Classical BSM model	"The pricing of option and corporate liabilities"	"The Pricing of Option and Corporate Liabilities" is a seminal paper in finance that introduces a mathematical model for pricing options and other financial contracts. It also provides a general formula for pricing other types of financial contracts (other than options), such as bonds, swaps and futures, that are based on the same underlying principles. The Black–Scholes model has since become one of the most widely used models in finance and is considered to be a cornerstone of modern finance theory
2	Zadeh (1975)	Fuzzy set theory	"The concept of a linguistic variable and its application to approximate reasoning-I"	The fuzzy set theory introduced by Zadeh has been applied in option pricing as a means of dealing with uncertainty and vagueness in the pricing problem. It can lead to improved results in situations where the information is incomplete or uncertain
3	Rendleman (1979)	Binomial distribution (to derive BSM)	"Two-state option pricing"	Binomial distribution is used to calculate the expected value of the option, taking into account the two possible states of the underlying asset. The expected value is then used as an input into the BSM formula to derive the fair price of the option. This approach provides a simple and intuitive way to price options and highlights the close relationship between the binomial distribution and the BSM formula
4	Capozza and Cornell (1979)	BSM, Merton model, Binomial model	A variance forecasting test of the option pricing model	The authors use a variety of option pricing models, including the Black–Scholes model, the Merton model and the Binomial model. They also use various measures of stock market volatility, including the standard deviation of returns and the implied volatility derived from option prices. However, the authors find that the accuracy of these forecasts varies across models and across measures of volatility
5	Sterk (1982)	Roll model vs BSM	Tests of two models for valuing call options on stocks with dividends	The paper compares the performance of Roll's option pricing model with a modified version of the Black–Scholes model. The main difference between the two models is that the Roll model allows for the possibility of dividend payments on the underlying stock, while the Black–Scholes model assumes no dividends. The results suggest that the Roll model provides a more accurate representation of the true value of options than the Black–Scholes model, especially in cases where dividends are a significant factor

(*continued*)

Table 4.

S. no	Author	Model used	Paper/book title	Summary
6	Williams (1991)	Used in lease and real estate contracts (asset valuation)	"Real estate development as an option"	It is a seminal paper that introduced the concept of treating real estate development projects as financial options. In the paper, the author argues that real estate development projects can be viewed as options that give developers the right, but not the obligation, to pursue a project under certain conditions. This approach provides a way for developers to reduce risk and increase flexibility, as they can make decisions based on real-time market conditions and adjust their plans accordingly
7	Heston (1993)	Stochastic volatility model	"A closed-form solution for options with stochastic volatility with applications to bond and currency options"	In this paper, the author presents a closed-form solution for the price of options with stochastic volatility. The model takes into account the arbitrary correlation between the volatility and spot-asset returns and also introduces stochastic interest rates
8	Duan (1995)	GARCH model	"The GARCH option pricing model"	The paper by Duan proposes a new method for pricing options using the GARCH model to estimate the volatility of stock returns. The author uses the GARCH model to estimate the volatility of stock returns and incorporates this information into an option pricing model. The results of the study show that the GARCH option pricing model provides more accurate option prices compared to traditional option pricing models that assume constant volatility
9	Grenadier (1995)	BSM used in lease and real estate contracts (asset valuation)	"Valuing lease contracts: a real-options approach"	The real-options approach proposed by Grenadier in the paper is used to value lease contracts and real estate contracts. This approach considers the uncertainty and flexibility associated with lease contracts, such as the ability to renew or terminate a lease, as real options. The value of these real options is estimated using option pricing models, such as the Black–Scholes model
10	Bates (1996)	Jump-diffusion model with stochastic volatility	"Jumps and stochastic volatility: exchange rate processes implicit in deutsche mark options"	The paper presents a jump-diffusion model for exchange rates that incorporates both stochastic volatility and jumps in the underlying process. The findings of the paper provide insights into the behaviour of exchange rate processes and the role of jumps and volatility in determining option prices
11	Scott (1997)			

(continued)

Table 4.

S. no	Author	Model used	Paper/book title	Summary
		Jump-diffusion model with stochastic volatility and interest rate	"Pricing stock options in a jump-diffusion model with stochastic volatility and interest rates: applications of Fourier inversion methods"	This paper focused on the pricing of stock options in a similar jump-diffusion model with stochastic volatility and interest rates. The paper uses Fourier inversion methods for pricing and applies the model to stock options
12	Heston and Nandi (2000)	Closed-form GARCH model	"A closed-form GARCH option valuation model"	The paper by Heston and Nandi extends the work of Duan by proposing a closed-form GARCH option pricing model. A closed-form model is a mathematical model that provides an exact solution for the price of an option. The authors use a closed-form GARCH model to price options and show that the model provides more accurate option prices compared to other option pricing models that use the GARCH model
13	Arnold (2006)	Stochastic volatility jump-diffusion model (SVJ) by using generalized method of moments (GMM)	Using GMM to flatten the option volatility smile	The model used in this paper is the stochastic volatility jump-diffusion (SVJ) option pricing model. The parameters of this model are estimated using the generalized method of moments (GMM) estimation procedure. The paper compares the performance of the SVJ model with a stochastic volatility (SV) option pricing model and evaluates the robustness of the models by considering performance beyond the estimation data
14	Duffie *et al.* (2000)	Affine jump-diffusion model	"Transform analysis and asset pricing for affine jump-diffusions"	This paper provides valuable insights into the use of transform analysis in the context of affine jump-diffusion state processes and its applications in finance, making it a crucial contribution to the field
15	Geman (2002)	"Pure Jump levy Model"	"Pure jump Lévy processes for asset price modelling"	This study aims to show that some types of Lévy processes, such as the hyperbolic motion and the CGMY, are particularly suitable for asset price modelling and option pricing. The authors also focus on two specific classes of pure jump Lévy processes, the generalized hyperbolic model and the CGMY model, and report on the goodness of fit obtained for both stock prices and option prices

(*continued*)

Table 4.

S. no	Author	Model used	Paper/book title	Summary
16	Mun (2012)	Valuation of strategic investment business using BSM	"Real Options Analysis-Tools and Techniques for Valuing Strategic Investments and Decisions"	The author discusses how the BSM model can be used to value the flexibility of waiting for better information, expanding the scale of a project or abandoning a project entirely. The author provides a comprehensive treatment of the BSM model and its applications in real options analysis, making it a valuable resource for those interested in using the model in business valuation
17	Kou (2002)	"Double exponential jump diffusion model"	"A jump diffusion model for option pricing"	Kou (2002) demonstrated that this model provides a more accurate representation of the underlying financial process compared to traditional option pricing models, such as the Black–Scholes model, which do not account for the possibility of price jumps
18	Zapart (2002)	Wavelets and artificial neural networks are used in stochastic volatility models	"Stochastic volatility options pricing with wavelets and artificial neural networks"	This study explores the use of wavelets and artificial neural networks in pricing options under stochastic volatility models. The authors propose a new pricing model that combines wavelet analysis and artificial neural network techniques to handle the complex dynamics of the volatility process. The results show that the proposed model is able to accurately price European call and put options and provides a good fit for the option prices obtained from market data
19	Carr and Wu (2004)	"Time changed levy process"	"Time-changed Lévy processes and option pricing"	To address the limitations of the BSM model, time-changed Lévy processes have been proposed as an alternative framework for option pricing. These processes incorporate the three main deviations from the Black–Scholes model by allowing for non-normal return innovations, time-varying volatilities and correlated returns and volatilities. This framework provides a more accurate representation of the underlying financial process, which can lead to more accurate option pricing
20	Wu (2004)	Fuzzy pattern of BS model-single point estimate	"Pricing European options based on the fuzzy pattern of Black–Scholes formula"	The authors of this paper likely use fuzzy set theory to model the inputs to the Black–Scholes formula as fuzzy variables rather than precise numbers and then use these fuzzy variables to determine the option price. This approach would provide a more robust estimate of the option price by taking into account the uncertainty in the inputs and would result in a wider range of possible option prices rather than a single point estimate as provided by the traditional Black–Scholes formula

(continued)

Table 4.

S. no	Author	Model used	Paper/book title	Summary
21	Muzzioli and Torricelli (2004)	Multiperiod binomial model	"A multiperiod binomial model for pricing options in a vague world"	The authors argue that traditional models, such as the Black–Scholes model, do not provide an adequate solution for options pricing in markets characterized by high uncertainty or vagueness. To address this issue, they propose a multiperiod binomial model that incorporates the concept of vagueness into the option pricing process
22	Lee *et al.* (2005)	Fuzzy binomial option pricing model	A fuzzy set approach for generalized CRR model: an empirical analysis of S&P 500 index options	The paper applies fuzzy set theory to the Cox, Ross and Rubinstein (CRR) model to set up the fuzzy binomial option pricing model (OPM). The purpose of this study is to provide investors with a more accurate method of pricing options by incorporating the uncertainty of certain parameters, such as volatility and risk-free interest rates. The authors use fuzzy volatility and fuzzy riskless interest rate to replace the corresponding crisp values in the CRR model and establish the fuzzy binomial OPM. This model allows investors to correct their portfolio strategy according to the right and left values of triangular fuzzy numbers, thereby providing a more flexible approach to pricing options
23	Chen and Palmon (2005)	Non-parametric-option pricing models	"A non-parametric option pricing model: theory and empirical evidence"	In traditional option pricing models, such as the Black–Scholes model, the underlying financial process is modelled using a set of assumptions about the distribution of future asset prices. These models are known as "parametric" models, as they rely on a specific set of parameters to describe the financial process. In contrast, non-parametric models do not make any assumptions about the distribution of future asset prices. Instead, they use historical data to estimate the distribution of future asset prices, allowing for a more flexible representation of the financial process
24	Chang (2006)	Subordinated binomial option pricing	"Subordinated binomial option pricing"	This study discusses the extension of the binomial option pricing model to incorporate the concept of subordination, which allows for a more accurate representation of price dynamics while retaining computational simplicity. The authors introduce a trinomial tree structure in which the asset price in each binomial period evolves based on two independent Bernoulli trials for trade occurrence/non-occurrence and up/down price movement

(*continued*)

Table 4.

S. no	Author	Model used	Paper/book title	Summary
25	Yoshida *et al.* (2006)	Mean value for fuzzy random variables	"A new evaluation of mean value for fuzzy numbers and its application to American put option under uncertainty"	The paper starts by introducing the concept of fuzzy numbers and a new evaluation of their mean value. The author then applies this evaluation method to pricing American put options under uncertainty using the mean value of fuzzy numbers as the underlying asset price. The results show that the new evaluation method provides a more accurate representation of the underlying asset price and results in a more accurate pricing of American put options under uncertainty compared to traditional methods
26	Wu (2006)	GARCH model – A modified lattice approach	"The GARCH option pricing model: a modification of lattice approach"	This study proposes a modification to the traditional lattice approach for option pricing that takes into account the generalized autoregressive conditional heteroskedasticity (GARCH) model for volatility. The GARCH model is a commonly used statistical model for volatility that captures the time-varying nature of volatility in financial time series data
27	Wu (2007)	Fuzzy pattern of BSM-boundary of possible prices	"Using fuzzy sets theory and Black–Scholes formula to generate pricing boundaries of European options"	In summary, the paper "Using Fuzzy Sets Theory and Black–Scholes Formula to Generate Pricing Boundaries of European Options" presents a method for pricing European options that combines the traditional Black–Scholes formula with concepts from fuzzy set theory to model uncertainty in the inputs. The approach provides a more robust estimate of the option price by generating a range of possible prices rather than a single point estimate
28	Daal and Madan (2005)	Variance-Gamma model	An empirical examination of the variance-gamma model for foreign currency options	The results of the study indicate that the VG model provides better out-of-sample pricing performance compared to the modified Black–Scholes model or the JD model. In addition, the authors use a cross-entropy analysis to show that the VG model is more consistent with the general criterion of utility maximization and optimal portfolio selection
29	Wang (2009)	Hybrid GARCH approach (neural network and GARCH)	"Using neural network to forecast stock index option price: A new hybrid GARCH approach"	A new approach for forecasting stock index option prices using a hybrid model combining a neural network and a generalized autoregressive conditional heteroscedasticity (GARCH) model. The neural network is used to capture the non-linear relationships between option prices and their underlying factors, while the GARCH model is used to model the volatility dynamics. The results

(*continued*)

S. no	Author	Model used	Paper/book title	Summary
				indicate that the hybrid model outperforms other models in terms of forecast accuracy
30	Cai and Kou (2011)	Mixed exponential jump-diffusion model	"Option pricing under a mixed-exponential jump diffusion model"	It studies the pricing of financial derivatives under a mixed-exponential jump-diffusion model, which is a combination of exponential jump-diffusion and classical diffusion models. This model is able to capture both the continuous and jump components of asset returns. The results show that the mixed-exponential jump-diffusion model provides a good fit for the market prices of options and outperforms the other models in terms of pricing accuracy
31	Ulusoy and Onbirler (2014)	GARCH-M model	"Performance evaluation of black-Scholes and Garch models on USD/TRY and EUR/TRY call options"	The results of the study indicate that the Black–Scholes model outperforms the GARCH-M model in terms of pricing accuracy. The authors also perform statistical tests to confirm their findings and conclude that the Black–Scholes model provides a closer result to the actual prices
32	Rao (2015)	"Mixed Fractional Brownian motion with Jumps model for Option"	"Option pricing for processes driven by mixed fractional Brownian motion with superimposed jumps"	The paper "Option pricing for processes driven by mixed fractional Brownian motion with superimposed jumps" presents a mathematical model for pricing options when the underlying asset is driven by mixed fractional Brownian motion with jumps. This type of process is more complex than traditional Brownian motion and can better capture the behaviour of financial markets that exhibit long-range dependence and sudden changes in price due to jumps
33	Byun *et al.* (2015)	Discrete-time option pricing model by incorporating variance-dependent pricing kernel	"The role of the variance premium in Jump-GARCH option pricing models"	The authors use a Jump-GARCH model to capture the time-varying volatility and the presence of jumps in the asset return. They incorporate the variance premium in the model and investigate its impact on option pricing. The results of the study indicate that the variance premium has a significant effect on option prices, especially for options with longer maturities
34	Jerbi (2015)	J-Model as an extension of BSM model	"A new closed-form solution as an extension of the Black–Scholes formula allowing smile curve plotting"	In this paper, the authors present a closed-form solution for pricing European options under a uni-dimensional option pricing model called the J-model. This solution is based on a new stochastic process, the J-process, which extends the Wiener process and satisfies the martingale property. The J-process is based on a new statistical law called the J-law, which is an extension of the normal law and has interesting asymmetry and tail properties. The authors

(*continued*)

Table 4.

Table 4.

S. no	Author	Model used	Paper/book title	Summary
				provide a smile curve related to this closed-form solution by inverting the Black–Scholes formula
35	Li *et al.* (2017)	Pure jump model	"Pure jump models for pricing and hedging VIX derivatives"	The model used in the paper is a novel class of parsimonious pure jump models for VIX, which is based on the additive time-change technique. The model time changes the 3/2 diffusion by a class of additive subordinators with infinite activity, yielding pure jump Markov semi-martingales with infinite activity and infinite variation
36	Dang *et al.* (2017)	Monte Carlo method, jump-diffusion and stochastic variance	"A dimension and variance reduction Monte-Carlo method for option pricing under jump-diffusion models"	The paper describes a Monte Carlo method for pricing European options under jump-diffusion models, which includes stochastic variance and multi-factor Gaussian interest short rates. The authors aim to achieve high efficiency by reducing the dimension and variance of the option pricing model
37	Chen *et al.* (2017)	SIR, stochastic volatility, double exponential JD and compare with BS	"Option Pricing under the Double Exponential Jump-Diffusion Model with Stochastic Volatility and Interest Rate"	This paper proposes an efficient option pricing model that incorporates stochastic interest rate (SIR), stochastic volatility (SV) and double exponential jump into the jump-diffusion settings. The model comprehensively considers the leptokurtosis and heteroscedasticity of the underlying asset's returns, rare events and an SIR. The authors use a characteristic function approach and an MCMC method with latent variables to estimate the parameters of the model and show that the model provides improved results compared to existing models
38	Siddiqi (2019)	Black–Scholes and stochastic variance model	"Anchoring-Adjusted Option Pricing Models"	This study discusses the use of anchoring as a heuristic in decision-making for option pricing. Anchoring involves using a starting point as a reference for making subsequent estimates. The authors of the paper argue that stock volatility can serve as an anchoring point for estimating call option volatility. The paper focuses on adjusting existing option pricing models (Black–Scholes, Heston and Bates) to account for the use of stock volatility as an anchoring point. The authors find that these adjustments can capture various anomalies in option returns and improve the accuracy of the models
39	Su and Wen Wong (2019)	Two-state lognormal model (TLN), two-state constant-elasticity-variance	"Testing the alternative two-state options pricing models: An empirical analysis on TXO"	The results presented in the text suggest that the two-state option pricing models (TLN, TCEV and TJD) performed better than the Black–Scholes model when pricing options on the Taiwan stock index. Specifically, the TLN model was the most accurate, followed

(*continued*)

Table 4.

S. no	Author	Model used	Paper/book title	Summary
		model (TCEV) and two-state jump-diffusion model (TJD) and compare with BSM model		by Black–Scholes, TCEV and TJD. The study also found that the models performed better in pricing put options compared to call options
40	Necula *et al.* (2019)	Gauss–Hermite expansion	"A general closed form option pricing formula"	The new option pricing model described in this research aims to improve upon traditional option pricing methods by using a modified Gram–Charlier series expansion, known as the Gauss–Hermite expansion. This expansion is designed to converge for fat-tailed distributions, which are commonly encountered in financial returns and often not accounted for in traditional option pricing models
41	Jiang and Hua (2019)	TGARCH-M and GED (generalized-error distribution)	"Option Pricing for TGARCH-M with GED Based on Improved EEMD"	The TGARCH-M with GED option pricing model seeks to address some of the challenges faced in traditional option pricing models by considering three important factors in the pricing framework. Firstly, it takes into account different frequency risks by using the improved EEMD. Secondly, it considers the impact of information asymmetry on option pricing. Thirdly, it addresses the non-normality of asset price processes by using the generalized error distribution. By incorporating these factors, the TGARCH-M with GED model aims to capture more volatility features and provide more accurate option pricing
42	Alitab *et al.* (2019)	Realized volatility option pricing model with jump component	"A realized volatility approach to option pricing with continuous and jump variance components"	The authors of the paper are addressing a limitation of traditional stochastic and time-varying volatility models, which fail to accurately price out-of-the-money put options at short maturities. To overcome this limitation, the authors extend realized volatility option pricing models by adding a jump component. The jump component provides a rapidly moving volatility factor and helps improve the fitting properties of the model under the physical measure (i.e. the actual behaviour of the underlying asset)

(*continued*)

Table 4.

S. no	Author	Model used	Paper/book title	Summary
43	Edeki *et al.* (2020)	He-separation of variable transformation method (HSVTM), closed-form of BSM	"Closed-form solutions of the time-fractional standard Black-Scholes model for option pricing using he-separation of variable approach"	The HSVTM is a mathematical technique that combines different methods, including he's polynomials and the homogeneous separation of variables, to solve partial differential equations in finance. The authors claim that this method is efficient and effective, and that it can be used to obtain solutions to financial models based on either Ito or Stratonovich stochastic differential equations
44	Xie *et al.* (2021)	Analytical approximation vs filtered historical simulation (FHS)	"Accelerating FHS Option Pricing Under Linear GARCH"	According to the authors, the analytical approximation technique offers several advantages over the standard FHS method. One of these is that it eliminates random sampling error, as it does not rely on simulation
45	Wattanatorn and Sombultawee (2021)	Stochastic volatility model (Heston) vs BSM	"The Stochastic Volatility Option Pricing Model: Evidence from a Highly Volatile Market"	Findings indicate that the Heston option pricing model is a better tool for pricing options in the Thai market, particularly for call options. It is able to capture the volatility smile present in the market and produce more accurate option prices compared to the standard Black–Scholes model
46	Mozumder *et al.* (2021)	Pure jump Levy, jump-diffusion, stochastic model, GARCH model (applied to BSM model)	"Option Pricing Model Biases: Bayesian and Markov Chain Monte Carlo Regression Analysis"	Systematic and unsystematic option pricing biases are investigated by using pure jump Lévy, jump-diffusion, stochastic volatility and GARCH models (applied to the Black–Scholes–Merton model)
47	Dash *et al.* (2021)	Fuzzy jump-diffusion	"A new method to solve fuzzy stochastic finance problem"	Fuzzy jump-diffusion model suggests that the paper is focused on developing a method to address uncertainty in financial markets that takes into account the possibility of sudden changes in prices, in addition to more gradual fluctuations
48	Casas and Veiga (2021)	Asymmetric stochastic volatility model	"Exploring Option Pricing and Hedging via Volatility Asymmetry"	Asymmetric stochastic volatility models refer to models that allow for volatility to be different in different market conditions, such as bullish or bearish markets. These models recognize that volatility can be asymmetrical, meaning that it can be higher or lower depending on market conditions. By incorporating asymmetric volatility into option pricing models, researchers can more accurately reflect the impact of volatility on option prices

(*continued*)

S. no	Author	Model used	Paper/book title	Summary
49	Venter and Maré (2022)	GARCH model (best OPM) when applied to VIX	"Price discovery in the volatility index option market: A univariate GARCH approach"	In this paper, the authors may have used a univariate GARCH model to analyse the volatility index options market and determine the extent to which the price of options on the volatility index contributes to price discovery in the underlying asset market. The goal of this study is to estimate the conditional volatility of the volatility index and explore the information content of options prices in predicting future volatility
50	Artn and Ozbayoglu (2022)	Deep learning-based model and compare with BSM	"Deep Learning Based Hybrid Computational Intelligence Models for Options Pricing"	The hybrid deep learning-based options pricing model they developed can produce more accurate prices compared to the widely used Black–Scholes model. The fact that the improvement was significant, with a 94.5% improvement in terms of mean squared error, indicates that the hybrid model may be a more reliable and effective method for option pricing

Source: Authors' own creation

Table 4.

shows that the SV model, GARCH model, jump-diffusion model, BSM fuzzy pattern and Monte Carlo method are widely applied in the literature, which are nothing but some of the restricted or unreal assumptions of the BSM classical model. With the exponential growth of retail investors during the COVID period, the need for new and more realistic models has emerged. Emerging models, such as BSM with machine learning, deep neural network models, computer intelligence, algorithms, fuzzy pattern of BSM, fuzzy jump-diffusion and GARCH, generate accurate findings that are closest to actual option prices.

In summary, Table 4 presents the top 50 OPMs in a timeline format, highlighting the evolution of OPM over the past four decades. The BSM model remains popular, but new models with more realistic assumptions have emerged in response to the changing needs of the market.

4.2 Conceptual and intellectual structure for RQ2

Conceptual framework of the study area aids in getting an understanding of the fundamental characteristics of organizations as well as explanations of various ideas and their underlying characteristics. Understanding the many activities of an organization is also aided by a conceptual framework, which aids in identifying the major themes in a given study (Aria and Cuccurullo, 2017).

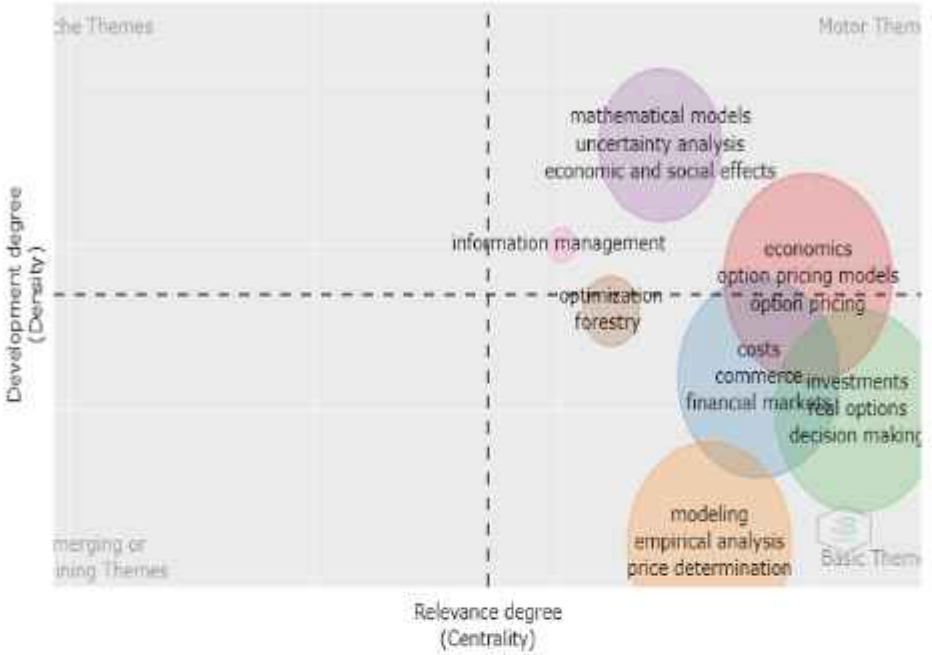
Co-word analysis of publication themes is used to generate the theme map and Sankey diagram (thematic evolution) used in the bibliometric package in the R programme in the related field of research to develop the conceptual framework of the various OPM used in various studies (Zupic and Čater, 2015; Bamel *et al.*, 2020, 2022).

4.2.1 Thematic map. Under the thematic map, themes and subthemes are plotted on a graph and divided into four groups [dropping or emerging themes, fundamental themes, highly developed and isolated themes (niche) and motor themes] to visualize the intellectual structure (refer Figure 3).

Motor theme. Mathematical models and uncertainty analysis are the motor theme (right upper quadrant) with the highest dominance and density. Keywords in this area include parameter analysis, real option pricing, economic and social impacts, Monte Carlo technique, extended double exponential jump-diffusion and more. The Sankey diagram reveals that Mathematical models and uncertainty analysis represent the motor theme with the highest dominance and density, indicating their importance in the field of OPM. However, the relatively smaller size of the cluster implies that there is still potential for further research in this area. The majority of papers in this category focus on Mathematical models and uncertainty analysis.

Fundamental/basic theme. The right-side lower quadrant, known as the basic theme, is characterized by high density and low centrality. This theme includes keywords such as BSM, SV model, Real options, NPV, Binomial, Jump-diffusion model, GARCH model and Empirical analysis. The size of the cluster indicates that this theme attracts the maximum number of publications. OPM covered under this theme includes the theoretical price of options, evaluation of alternative OPM and comparison with the classical BSM model.

Niche and emerging theme. The R software does not show any clear indication of niche or emerging themes, as it is a programming language and software tool used for statistical analysis, data visualization and data manipulation across many fields of study. However, it is important to keep in mind that the absence of niche or emerging themes within the R software may be due to limitations in the data or methods used to analyse it. To gain a comprehensive understanding of whether niche or emerging themes are present within the R software, it may be necessary to conduct further investigation and analysis. Therefore, a thorough examination of the literature (refer Table 4) suggests that fuzzy and machine



Source: Authors' own creation

Figure 3. Conceptual structure of different option pricing models extracted through R studio (Biblioshiny) by using co-word analysis of publication titles identifying four themes by taking development degree on Y-axis and relevance degree on X-axis

learning-based models are a rising subject with medium relevance and development degree. It appears that experts around the world are just beginning to pay attention to this topic, which includes models such as BSM with machine learning, deep neural network models, computer intelligence, algorithms, fuzzy pattern of BSM and fuzzy jump-diffusion. As more individuals become active in electronic trading, there is a growing need to investigate more accurate options pricing methodologies. Improved option pricing could lead to more stable market dynamics and increased resistance to market intervention.

4.2.2 Sankey diagram. Sankey diagram of OPM used by different authors in financial derivatives context. It is used to comprehend the thematic progression of the OPM research over a period of time. These nodes depicted in the Sankey diagram serve an important role in understanding the growth of a field, its direction and forecasting future trends. It helps to show the path to reflect the movements of values from one-time era to another time era (Aria *et al.*, 2020).

In Figure 4, the nodes indicate the study field, the size of the nodes symbolises the quantity of research in each topic and the pathways connecting the nodes show the growth of themes and evolutionary links among them through time (Cobo *et al.*, 2011). The Sankey diagram was designed consisting of 930 words chosen from the Keyword Plus option in the document title and a weighted inclusion index based on word occurrences.

"Keyword Plus" is a feature provided by some academic databases that identifies additional keywords related to the article that may not have been included in the article's metadata or abstract. These additional keywords can provide more information about the content of the article and help researchers find relevant articles more easily.

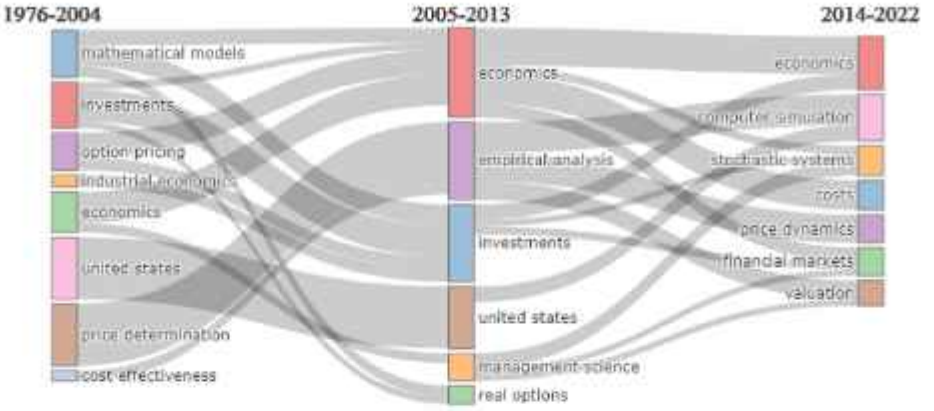


Figure 4.
Sankey diagram of OPM research in past three decades from 1976 to Jan'2022

Source: Authors' own creation

The inclusion index used in the construction of the Sankey diagram was weighted based on word occurrences. This means that the importance of each keyword was determined by how frequently it appeared in the article titles within the data set. Keywords that appeared more frequently were considered to be more important and given a higher weight in the inclusion index. By using a large set of keywords and weighting them based on their occurrence, the Sankey diagram was able to provide a comprehensive and representative overview of the evolution of research topics in the field of interest over time.

To construct a relevant map, the publishing period was analysed from 1976 to January 2022, separated into three eras (1976–2004; 2005–2013; 2014–2022), and this was based on the representative size of research.

"This figure depicts that during 1976–2004, Economics, the Black-Scholes Model, Markov Processes, Random Processes, and Stochastic Volatility were key research themes within the OPM research area. Investment, decision-making, real options, and approximation theory appeared as the foundation or basic themes, while Mathematical Models, decision theory, risk management, and cost-effectiveness were the Motor themes. Surprisingly, Mathematical Models, Investments, and Economics, which were covered under the Basic subject in the first era, were shifted to the Motor theme in the second era.

During the 2005-2013 period, real options, uncertainty analysis, decision theory, and investment decisions were the main research topics in the OPM research field, in addition to the topics covered in the first era. Management Science, stochastic models, jump diffusion, and contingent claim were the basic topics under these management science themes. Empirical analysis, regression analysis, price determination, and financial markets emerged in this era. Unexpectedly, there was no topic under the niche or peripheral theme in this phase.

During the third era (2014–Jan'2022), new research topics such as partial differential equation, financial markets, NPV, sustainable development, commodity price, Monte Carlo analysis, probability, discrete time models, and pricing kernels emerged. Real options, the Black-Scholes model, and discrete time models fell under the basic themes in era three. There were few researches on models like Monte Carlo, Fuzzy Algorithm models, Machine Learning, Deep Neural Networks, and computer intelligence in OPM literature. It is concluded that research in era three is still developing and progressing".

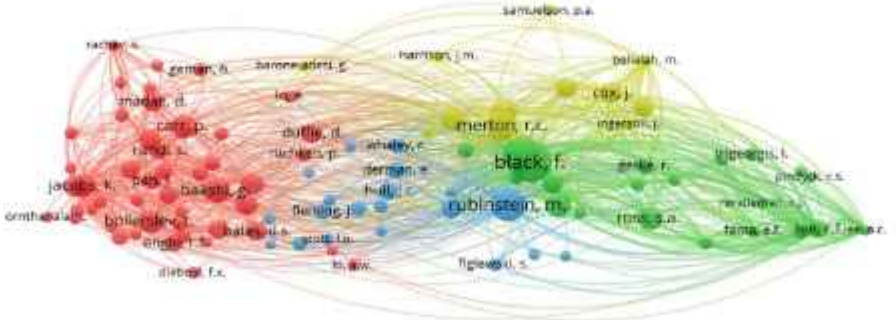
Figure 4 shows how different OPMs have been used by various authors, which has progressed over time. The diagram illustrates how a specific study topic originated and

paved the way for the emergence of another topic. For instance, investment was covered under the niche (highly developed but isolated) theme of research during the first era, but it was later converted into a motor theme (highly contributory theme). Similarly, empirical analysis and regression analysis, which fell under the motor theme during the first era, disappeared during the past two eras. Additionally, research on the GARCH model, Monte Carlo method, fuzzy algorithm, machine learning and computer intelligence in the context of OPMs is developing at an increasing rate as a basic theme, but there is a need to develop some niche research under these areas.

In conclusion, Figure 4 validates that the OPM research area within the financial market industry is constantly changing, with various research themes coming together and diverging over the past three decades.

4.2.3 Bibliographic coupling of primary documents. Bibliographic coupling is a forward-looking concept that can be used to identify new themes and directions in a subject area over a period of time by considering primary documents (Vogel, 2012). If two papers both cite the same document, they are considered bibliographically linked, and the references in bibliographically connected texts have a high degree of resemblance (Van Eck and Waltman, 2014). Bibliographic coupling states that when two or more documents cite similar documents, they are considered linked bibliographically, and the references used by these documents have a high degree of similarity as they are coupled bibliographically. This study is composed of a network of four such clusters. Based on the selection criteria of "minimum citation count of an author" and the "number of authors to be included", a total of four clusters have been formed. Each cluster includes authors who meet the specified citation and author count thresholds. The top 100 original sources with the highest link strength are interlinked, the result of which is described in the following four Clusters.

Cluster 1 is the major cluster consisting of 47 items (refer Figure 5) that cover the various OPMs used by different publications. The highest link strength is associated with the time-changed Levy process, and a comparison is made between the BSM model and the time-changed Levy process (Carr and Wu, 2004). S&P 500 options are examined,



Notes: The top 100 original sources with the highest link strength are interlinked, the result of which is described in the following four clusters

Source: Authors' own creation

Figure 5. Bibliographic coupling network

and it is found that SV and jumps are important in deriving prices and ensuring internal consistency. This study has 1,214 citations (Bakshi *et al.*, 1997). The SV/jump-diffusion model produces more realistic volatility process parameters and predicts nearest option prices (Bates, 2000; Nandi, 1998). This study discusses the correlation between volatility and returns by using the SV model. It is concluded that a non-zero correlation in the SV model gives better results in the case of mispricing in out-of-the-money options. Additionally, a pricing formula based on a fuzzy pattern of BSM is proposed by Duan and Yeh (2010) and Wu (2004, 2005, 2007).

Cluster 2 uses non-parametric tests to conclude that strike price biasness and out-of-the-money calls with shorter maturity periods are priced higher compared to calls predicted based on the BSM model (Rubinstein, 1985). The exact calibration approach shows more accurate results than the error minimization concept in terms of price and hedging performance (Jarrow and Kwok, 2015). The CEV OPM is used to derive the theoretical prices of options (Cox, 1996). The fuzzy pattern of binomial OPM is applied to S&P 500 index options, which gives a nearest value compared to the generalized Cox, Ross and Rubinstein model (Lee *et al.*, 2005). Different approaches, such as the lognormal distribution, differential and integral calculus and the BSM model, can be formed using the binomial distribution. Stochastic calculus is not required if risk is considered neutral for the formulation of the BS model (Lee *et al.*, 2016).

Cluster 3 is located at the bottom-left side in green with 20 items. Initially, it was assumed that no relationship existed between historical stock market returns and option prices. However, it was concluded that historical or past stock returns have a significant impact on index option prices (Amin *et al.*, 2004). Models such as the CEV model, jump-diffusion model, SV model, displaced diffusion model and implied binomial tree approach are compared based on their performance. All better performing models show a negative correlation between index level and volatility (Jackwerth and Rubinstein, 2012). This paper describes extensions of some non-parametric methods and implied binomial trees. The performance of all four kinds of SV pricing models is compared. The models included are the *ad hoc* BS, including implied volatility, "Heston and Nandi's [Rev. Financ. Stud. 13 (2000) 585] GARCH type model", "Madan *et al*'s [Eur. Financ. Rev. 2 (1998) 79] variance gamma model" and "Heston's [Rev. Financ. Stud. 6 (1993) 327] continuous-time stochastic volatility model". It was concluded that in terms of hedging, in-sample pricing and out-sample pricing, Heston's model outperforms all others (Kim and Kim, 2004).

Cluster 4. The GARCH model, including filtered historical innovations, is applied on S&P 500 index options to derive the theoretical price of options. This model gives better performance in comparison with other competing models for option pricing, such as *ad hoc* BS model and GARCH (Barone-Adesi *et al.*, 2008). BS model is used to examine the dual-purpose funds by using a contingent-claims analysis approach (Ingersoll, 1976).

Samuelson's work in warrants and option pricing provides a bridge between early and later OPM (Merton, 2006).

5. Conclusion, implications and future research direction

This paper conducts a comprehensive analysis of OPM within the financial derivatives domain, using bibliometric and network analysis techniques. The study spans an impressive time frame, covering almost 45 years, from 1976 to 19 January 2022 and delves into influential authors, significant works, frequently used keywords and prolific countries in this field. Our findings reveal a notable upward trajectory in publications related to OPM in the context of financial derivatives, with an annual growth rate of 6%. This growth signifies the increasing quantitative and qualitative impact of OPM research

on the financial derivatives sector. In terms of a broader overview and publication trends, our study identifies the top five productive authors as Câmara A, Renault E, Zhang JE, Kim S and Lee CF. The peak year for publications in this area was 2009, with 42 publications, while 2020 and 2021 saw a tie with 39 publications each. Notably, the USA, China, the UK, Taiwan and Canada stand out as the top five countries with the highest number of publications in this research area (refer Table 5). To provide a more insightful analysis top 50 models used by different authors in the area of "Option Pricing Models used in Financial Derivatives" are screened out manually for better interpretation (refer Table 4). While classical models like BSM and binomial models serve as the foundation, they have been complemented by innovative approaches such as BSM with machine learning, deep neural network models, computer intelligence, algorithms, fuzzy pattern of BSM and fuzzy jump-diffusion and the GARCH model. These contemporary models yield results that closely align with real-world option values, overcoming the unrealistic assumptions of classical models.

Table 5: Conclusion of the Study			
Year Studied	1976-19.1.2022(45 Years)		
Area	Option Pricing Models used in Financial; Derivatives		
Approach	Bibliometric & Network Analysis using R&Vosviewer		
Broad Description & Publication Trends Conclusions for RQ.1			
Most Impactful Authors	**Most Productive Journals**	**Publications (Year with No. of Publications)**	**Most Productive Countries**
CÂMARA A	Journal of futures markets	2009(42)	United states
RENAULT E	Quantitative finance	2013(42)	China
ZHANG JE	Journal of banking and finance	2014(40)	United Kingdom
KIM S	Journal of derivatives	2020(39)	Taiwan
LEE CF	The journal of finance	2021(39)	Canada
Timeline of 50 Models used by different Authors for Option Pricing (filtered manually)			
1973-1983	**1984-1994**	**1995-2004**	**2005-2022**
BSM, Binomial, Fuzzy Set theory (but not used extensively)	SVM, BSM used in Real Option	GARCH, Option Models used in Real Option, Jump Diffusion Model, Fuzzy Pattern of BSM, Multiperiod Binomial Model	Fuzzy BSM Model, Deep Learning based Model, Machine Learning, Algorithm, GARCH, SV vs. BSM
Conceptual & Intellectual Structure Conclusions for RQ.2			
Thematic Evolution			
Motor Theme	**Basic Theme**		**Emerging Theme**
Mathematical Models, Uncertainty Analysis, Classical BSM model	Classical BSM model, NPV, GARCH		Machine Learning, Fuzzy theory, Deep Neural Network Models
Sankey Diagram			
1976-2004	**2005-2013**		**2014-Jan'2022**
Economics, BSM, SV	Real Options, Decision Theory, Investment Decisions		Fuzzy Theory, Machine Learning, Real Options, Discrete time models
Bibliography Coupling of Primary Documents			
Cluster1	**Cluster2**	**Cluster3**	**Cluster4**
BSM & Time changed Levy Process	Non parametric test	Comparison of Stochastic volatility models	GARCH with Filtered Historical Approach
Source: Authors own creation			

Table 5.
Conclusion of the study

Additionally, this study outlines the conceptual framework of OPM research within the financial derivatives context. We use the thematic evolution and Sankey diagram approach using the R programme to categorize themes into four groups: basic, niche, emerging and motor themes. This approach visually demonstrates the evolution of topics such as BSM, uncertainty analysis and SV models, highlighting their contributions to the emergence of other key themes like the fuzzy BSM model, machine learning and the GARCH model. Furthermore, we construct a bibliographic coupling network analysis to discern historical, current and potential future developments related to OPM in the financial context. In essence, our study provides a comprehensive and insightful analysis of the evolving landscape of OPM in the realm of financial derivatives, shedding light on the increasing importance and diversity of this research field.

The study's implications encompass both practical and social aspects. On a practical level, it offers valuable insights for future research in OPM in financial derivatives, helping researchers pinpoint influential authors, seminal work and productive countries while also highlighting commonly used OPMs and emerging themes such as machine learning and deep neural network models.

5.1 Future research directions

Through a rigorous analysis using bibliometric and a systematic literature review, spanning nearly 45 years, this study has identified following several significant research gaps that highlight unexplored and inadequately addressed areas within the field.

- Very few studies are conducted related to OPM in developing nations, especially in India context.
- It is evident that the classical BSM model is the foundation of option pricing, but there are few studies conducted on the comparative analysis of alternative models existing for option pricing.
- A flurry of new models evolved as a result of rejecting BSM's core assumptions. However, there is limited and ambiguous research exists that demonstrates a linkage between the assumptions and the models emerged by breaching BSM assumptions for option pricing.
- More studies need to be conducted on emerging new option pricing methods such as fuzzy theory, machine learning and other advanced analyses due to technical and usage of market.

This research has pinpointed several significant research gaps (referred above) within the field. Notably, there is a scarcity of research on OPM in developing nations, particularly in the Indian context. Furthermore, while the BSM model serves as the foundation for option pricing, there is a notable lack of comparative analyses of alternative models. Additionally, the study reveals a dearth of research that clearly links the rejection of BSM's core assumptions to the emergence of new models for option pricing. Finally, there is a pressing need for more research on emerging option pricing methods, such as those using fuzzy theory, machine learning and advanced analytics, driven by technical advancements and market demands. These research gaps provide valuable insights for future investigations and scholarly contributions.

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Study of Financial Management Techniques and Methods for Organisation Effectiveness

Dr Asha Chaudhary

ABSTRACT

Finance is always the strength of an organisation and firms' survival is not possible without it. Every organisation, whether operating on small scale or big, requires finance to carry on operation and also in order to expand its operations. Every organisation needs to ensure how efficiently a manager is acquiring and utilizing the funds. Finance manager has to ensure that funds need to be managed in such a way that it generates maximum revenue for the entity. A balance between liquidity and investment has to be taken care so that company has adequate cash reserve to pay short term liabilities and meet emergencies like day-to-day expenses, bills, payment to suppliers etc. On the other hand, long term source of finance is allocated for meeting out the long-term obligations like project investment, unexpected large purchases, repayment of long-term loans etc. Thus, allocation of funds requires qualified skilful financial expert as fund need to be allocated in such a way that it meets financial requirement adequately. In the present research the focus is on the various financial management tools. The information has been gathered through secondary sources. Thus, paper has made an attempt to highlight the financial management techniques and methods used in India

Keywords: Financial management, Funds, Procurement and Finance Manager

1. INTRODUCTION

Finance is considered as the blood of an organisation because it's the foundation for all economic activities. Organisation financial activity is that activity which is focuses on how to procure and allocate funds so as to fulfil financial requirements and organisational goal (wealth maximisation). Finance is acts as a backbone of an organisation which has given birth to financial management concept. Financial management is process includes management process, i.e., to plan and control the funds of the entity. It procures fund from the most suitable sources and efficiently allocate it in such project which generates fund. Financial management plays an imperative role in every business and also in the development of a country. It has a close relationship between finance and management. Funds need to be controlled and managed by implementing effective financial techniques and methods. Finance is considered as the blood for every business and without finance and its management organisation growth turns motionless. Earlier venture's objective was to maximise earnings and grow business. But with the change in the time, business has to fulfil social corporate responsibilities, thus the firm's existence relies on the progress of entity's stakeholders. Now, the objective of any venture is to maximise the shareholders wealth and enhance the value of the firm. Thus, concept of financial management is attaining attention in the recent years. For fulfilling this objective, financial managers are professionally armed with latest techniques and methods. These financial management techniques and methods helps finance manager to take right financial related decisions and utilise funds efficiently and effectively. Thus, sound financial management ensures success of the organisation. Modern financial management is concerned for shareholders wealth maximisation along with the enhancing the value of the firm. Thus, finance manager needs to monitor environment and adapt the changes occurring in the economic environment conditions. Finance manager ability of finding financial sources and manage it, determines the success of the enterprise and economy. The role of financial management is assuming great importance in solving complex business problems. Earlier financial management role was confined only to the obtaining of money on reasonable terms and its utilisation was out of its peripheral. With the change in business circumstance since the mid-1950, traditional outlook of finance function outlived. A number of factors like technology, innovations, business operation size, intense competition etc necessitated to ensure efficient and effective utilisation of firm's financial resources. Thus, the scope of financial management changed and the modern approach was developed which includes both obtaining and effective utilisation.

2. OBJECTIVES

- Utilization of fund in such a way that it maximizes wealth of the organization.
- Allocation of fund in such a manner that it generates revenues timely also with the least cost.

- **Concept Financial Management**

By Joseph L Massie "Financial Management is the area of business management means effective and efficient formation, administrating, organizing, pointing and regulating the financial transaction. Vital Role of Financial

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ORIGINAL PAPER

Fractional cross entropy-based loss function for classification of IoT services with semantic graph based on IFTTT recipes

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Abstract

Recently, learning through multi-classifiers is of huge interest in economic as well as industrial domains. In addition, the neural network becomes an emerging technique for learning. Nevertheless, the accuracy of the neural network is imperfect due to its loss function. Hence, a new cross entropy-based function is devised. The aim is to develop a model to classify IoT services and build a semantic graph network using a fractional cross entropy-based loss function (FCEBLF). Originally, the service recipe of IFTTT (if-this-then-that) is considered to extract the title and description. Here, the edge and nodes are used for constructing a semantic graph, where semantic features are obtained. Meanwhile, term frequency and inverse document frequency (TF-IDF) are accomplished using IFTTT recipes. Moreover, the natural language processing (NLP) features are extracted to further increase the efficiency. In addition, the obtained features are fused. Thus, the fusion of features is executed by using deep neural network (DNN) based on Hellinger distance. Lastly, the classification of IoT service is attained based on deep residual network (DRN) in which loss function is enhanced using FCEBLF. The proposed FCEBLF + DRN outperformed with high micro-F1 of 91.2%, precision of 91%, and recall of 91.4%.

Keywords IoT service classification · Semantic modeling · Deep neural network · IFTTT recipes · Deep residual network

1 Introduction

The emerging module named as IoT is modeled for transforming the domain of information and communication techniques (ICT). Devices of IoT are increasing rapidly as an outcome of quick network access and fast design of wireless techniques. Since 2027, there are approximately 41 billion devices of IoT [17] having unpredictable development because of IoT's vibrant and prevalent nature. The majority of heterogeneous and interrelated devices of IoT accumulates, generates, and shares a large quantity of streaming data generated by IoT and interacts amid each other automatically without requirement of human. Thus, data goes on multiplying that makes it foreseeable which can be heterogeneity amidst them. The IoT idea devises that everything is pleasantly networked which can be capable to exchange and easily reach through the network for providing services to end users [9, 11]. As IoT extends rapidly and hence associated devices and interfaces amid them involves sensors, actuators, mobile phones, and other applications. The preface of novel communiqué techniques like fifth-generation (5G), IPv6 helps to elevate the efficacy of data broadcast and offers adequate addresses of network. Development of associated items is speeded by this kind of techniques. Since 2020, it is noted that exist 24 billion IoT devices that involves tablets and smart phones and there can be more than 50 billion terminals in usage amidst all over the mobile networks [1].

The adequate quantity of context-aware data is generated by the interface of these aspects [1, 12]. Moreover, numerous immeasurable mixtures of operations and its interface outcomes in a huge variety of semantics that is semantics amid things, semantics between people and semantics between individuals. Hence, the combination of several contextual semantics is an issue for attaining a faultless merger of physical, informational, and human worlds [1]. It is inadequate for developing ontologies and improved semantic techniques. The aim of ontology development must rely on elevation

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Chapter 10
Investigating the Impact of Human Resource Practices on Employee Satisfaction in the Corporate Sector of India:
A PLS-SEM Analysis

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ABSTRACT

This research delves into an effect of human resource (HR) practices, including recruitment and selection, training and development, compensation, performance appraisal, and supervision, on employee satisfaction within diverse corporate entities in the North and West regions of India. Employing a structured questionnaire, data was collected from 236 participants across different corporations. The results, obtained through a structural equation model (SEM), demonstrate a significant and positive effect of HR techniques on employee contentment within various corporations in the North and West part of India. This empirical study offers valuable insights for HR managers, policymakers, and other stakeholders, aiding them in making strategic decisions to enhance both productivity and employee satisfaction.

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WASTE TO WEALTH (W2W) MISSION IN INDIA: PERCEPTIONAL STUDY OF LOCALITIES FROM UDAIPUR CITY

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1.1 ABSTRACT

Purpose of the study: The study's purpose was to identify respondents' perceptions of the effectiveness of the waste-to-wealth mission.

Research methodology: The research was carried out with 250 localities of Udaipur city using survey method via personal investigation through questionnaire. 10 Likert statements were framed to identify the perception of respondents on the execution of wealth to waste mission.

Principle Findings: The opinion survey revealed that the respondents fully favour the mission. However, they find its execution part a little weak. Nevertheless, they acknowledge that introducing and embracing such a mission is necessary to thrive on sustainable waste management grounds and are willing to cooperate in its follow-up. The essence of this mission is to strengthen India's waste management system by identifying and validating innovative technology solutions and models to achieve a zero landfill and zero waste nation.

Novelty in Research: The study is novel and unique as not much work has been done on the present theme as of now. We have attempted to touch the perception of true beneficiaries who gave raw and impartial answers to witness the original state of the concept prevalent in the city.

Applications of the study: The study is very apt and relevant to the present scenario as it comes from

WASTE TO WEALTH (WTW) MISSION IN INDIA: PERCEPTIONAL STUDY OF LOCALITIES FROM UDAIPUR CITY

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Applications of the study: The study is very apt and relevant to the present scenario as it covers from the most practical walk of life, "Sustainable waste management." The research implies that no sphere of life is untouched by and involves coverage of every product used.

Keywords: Waste to Wealth (WTW), Sustainable waste management, localities of Udaipur city.

Internationalization of Education in India: Exploring Trends, Challenges and Strategies for Global Engagement

Abstract

The internationalization of education has emerged as a significant trend globally, driven by the increasing need for cross-cultural understanding, global mobility and knowledge exchange. The National Education Policy (NEP2020) being the new education policy of India also recognizes and pays ample significance on the importance of fostering global competencies among students, enabling them to engage with diverse cultures, ideas, and knowledge systems This research paper aims to provide an in-depth analysis of the internationalisation of education in India, exploring the current trends, challenges and opportunities. and developments in the internationalization of education in India. It investigates the factors contributing to the growth of internationalization, the strategies adopted by Indian institutions, and the impact of internationalization on students, faculty, and the overall educational landscape in India.

Keywords: Internationalization, education, cross- cultural, exchange, global.

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I. INTRODUCTION

The National Education Policy (NEP2020) of India marks a significant milestone in the country's educational landscape. One of the key emphasized in the policy is the internationalization of Internationalization refers to the integration of global perspectiv cultural understanding, and exposure to international educational

within the national education system. It aims to enhance the quality of

Education Policy and Leadership: Examining Role of Academic Leadership in Indian Education System

Dr. Shavita Deshwal

Abstract

The paper discusses the role of academic leadership for quality education. In practise, educational leadership is the act of inspiring others in academic context to achieve the set goals, which needs actions. Controlling people necessitates authority, which can be obtained from vertical relationships as well as through as other methods. Quality educational leadership refers to the knowledge, qualities and features that an educational institution's leader must have in order to be an effective leader. These higher education leaders are referred as "educational leaders". Academic leaders inspire academics at universities, faculties and departments by providing challenging opportunities and fostering acceptable academic settings in which academics can improve themselves.

Keywords: Academic leadership, quality education, leaders, knowledge.

Introduction

Indian colleges have struggled to achieve world-class status since only a few Indian higher education institutions have made it through the global rankings. We must comprehend the particular issues confronting the Indian higher education industry, as well as what academic leaders at globally recognised institutions are doing to address those challenges. Authorities are connected with consolidating and mixing of six regions, which are portrayed in the activities of the pioneers. The pioneers need to adjust them fittingly, as improvements happen inside instructive establishments.[1] The primary regions that are considered in authority are, laying out objectives and assumptions, vital resourcing, arranging, co-ordinating and assessing educating and educational plan, advancing and taking part in educating growing experiences and advancement and guaranteeing the development of a precise and restrained climate.[2][3] The pioneers need to concentrate upon the advancement of expert connections, their work and their learning on the centre business of instructing and learning and the more prominent the influence on understudy results. Authority is viewed as the most important factor in enhancing school viability. Inside instructive organizations, the people, who are taken part in educating positions are expected to level up their instructive abilities and capacities. They should be exceptional with the subjects and ideas, which they need to confer to the learners. Notwithstanding generating awareness as far as subjects and scholarly ideas, they are expected to place into activity certain variables. These are, adjusting undertakings to targets and techniques; building commitment, optimism, trust and co-activity; creating and engaging subordinates; empowering and facilitating aggregate getting the hang of; deciphering the event of intricacies; making arrangement.[4]

Academic Leadership's Role: Towards an Enlightened India

An educational establishment in the customary sensation of the term has a development that is more smoothed out driven generally by scholastics who are district specialists partook in their own field in teaching, examination or guiding, the academic leadership being only the first among ascends to . The others are support staff (non-showing ones) who offer critical assistance to the labour force for the establishment to perform well.[5] The faculty should occupy the central and functional core of an educational institution. All things considered, they describe significance and sufficiency of an establishment in the characters of external accomplices. However, a large number of students make up the organization's core clientele (internal customers) and are the primary focus of its efforts to better serve them. Their number, quality and sensation of belongingness choose a conclusive advancement of an educational foundation. The monetary and social accord and achievement as creators of huge worth not altogether settled by the external accomplices including corporate and society at large. Likewise, last yet maybe the most critical are the owners/sponsors of these establishments who are in a general sense enthused about ROI of their venture.[6]

The academic leadership primary trouble is to push execution or advance greatness without a great deal of force and designation. Tragically, in India, we have either government or semi-government foundations or confidential area establishments, large numbers of which are supported by firmly held confides in held by noticeable lawmakers

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or individuals irrelevant to schooling. Large numbers of them are habitually found to be keen on issues other than instructive achievement, bringing about a framework full with scholarly pioneers with no or lacking ability to do anything significant without satisfactory intellectual and monetary independence. [7][8]

Responsibility

The pioneers are the ones, who have the obligation to do the assignments and exercises in regards to themselves and

Table 1: Evolution of Education Policy In India

Education Policy	Year
Commission of University education system	19
Commission of Secondary Education	
Education Commission under Dr. D.S. Kothari	
National Policy on Education	1968
42nd Constitutional Amendment	1976

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DESIGN THINKING & VIRTUAL MANAGEMENT TRAINING: A SYSTEMATIC LITERATURE REVIEW

-Arushi Bathla, Research Scholar, Indian Institute of Foreign Trade, New Delhi
-Dr. Ginni Chawla, Assistant Professor, Indian Institute of Foreign Trade (IIFT), New Delhi
-Dr. Vikas Bharara, Associate Professor, Institute of Information Technology and Management, Guru Gobind Singh Indraprastha University, New Delhi
-Shikha Shokeen, Assistant Professor, Maharaja Surajmal Institute, affiliated to GGSIP University, New Delhi

ABSTRACT

Does the time of 21st century training necessitate exploration into emerging research pedagogies like design thinking for a better understanding of how design influences business and management? This review explains the changes in training perspectives within management settings using creative engagement methods like design thinking which call into question the future of dynamic business innovation. The paper undertakes a Systematic Literature Review of this nascent field, followed by a Bibliometric Analysis, Content Analysis to present a taxonomy of the field, and finally outlines interesting questions for future research to address.

Keywords: Design Thinking, Virtual, Management Training, Systematic Literature Review.

INTRODUCTION

In recent literature, Design thinking is advancing popularity across almost all academia disciplines, inclusive of administration, academia, entertainment, and information technology Although the implementation of design thinking in managerial challenges is rather recent and uncharted, organizations are attempting to apply this notion to many situations, and academics and global practitioners are attempting to redefine and construe it (David & Martin, 2006). Contemporary literature explores how Design thinking has the potential to solve problems across several management functional areas specifically it is gaining dexterous traction in management business training. Notwithstanding, according to recent research, the problem encountered by a trainer today is complicated and hardly resolved by linear answer. To tackle training challenge creatively, design thinking might be employed through continuous practice (Henriksen et al., 2017). Nonetheless, as participants work in multidisciplinary teams, business management students and/or trainees throughout the world encounter a variety of problems. They can be well equipped to

Self attested.

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SCOPE OF SNBL PLATFORMS AND THEIR ROLE IN ESCALATING THE FINANCIAL INDEPENDENCE OF ITS USERS

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Abstract. *This research paper aims to explore the global and domestic scope of "Save Now, Buy Later" (SNBL) apps/platforms and their role in enhancing the financial independence of individuals who adopt these services. SNBL apps have gained significant popularity in recent years, offering consumers the ability to save towards a purchase and defer the payment to a later date. The study investigates the impact of SNBL platforms on consumer behaviour, financial decision-making and overall financial independence. Additionally, it analyses the potential benefits and risks associated with these platforms, taking into account both global and domestic perspectives. The research employs a mixed-method approach, combining qualitative interviews with SNBL users and quantitative analysis of relevant data and financial indicators. The findings provide valuable insights for policymakers, financial institutions, and consumers, contributing to a comprehensive understanding of the SNBL phenomenon and its implications for personal financial management.*

Keywords: Save Now, Buy Later, SNBL, financial independence, consumer behaviour, financial decision-making, financial management, global perspective, domestic perspective.

I. Introduction

1. In recent years, the rise of digital technology and the transformation of consumer behaviour have paved the way for innovative financial solutions that cater to the changing needs and preferences of individuals. One such solution that has gained considerable traction is the concept of "Save Now, Buy Later" (SNBL) apps/platforms. SNBL platforms offer consumers an opportunity to save money towards a desired purchase and defer the payment to a later date, enabling them to achieve their financial goals while maintaining financial flexibility. These platforms have become increasingly popular among individuals seeking convenient and structured ways to make purchases without relying on traditional credit or loans. The widespread adoption of SNBL platforms can be attributed to various factors. Firstly, the convenience and accessibility of these apps/platforms have significantly contributed to their popularity. With just a few taps on a smartphone, users can set saving goals, contribute funds, and monitor their progress, making the process of saving for a purchase both efficient and user-friendly. Secondly, SNBL platforms align with the changing consumer mindset, particularly among younger generations, who value experiences and delayed gratification over immediate ownership. The ability to save towards a desired item and defer payment allows individuals to exercise financial discipline while still enjoying the benefits of their purchase. Lastly, the COVID-19 pandemic and its economic repercussions have further

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INSIDE

Outcome Based Learning: Changing Dimensions of Legal Education

Dr. Tanya Malik*

[As the legal landscape undergoes significant transformation, legal education faces the imperative to adapt. In response to changing professional demands and pedagogy of criticism, legal academia is placing an increasing emphasis on Outcome-Based Learning (OBL), which is examined in this article. This pedagogy of skill seeks to close the current skill gap, improve employability, and promote more accountability within legal education institutions by utilizing OBL's emphasis on concrete skills and abilities. This article outlines the reasons behind the adoption of OBL, offers a methodical framework for its successful incorporation into legal education, and underlines the merits of its application in research-oriented legal courses.]

As the world continues to evolve, so does the legal profession. Given the importance of legal education to the legal profession, it makes sense that it should both anticipate and adapt to these developments. Legal education is expected to have a dynamic and diversified future as it responds to the shifting demands of rapidly evolving society, legal profession, and law students. Upon observing present patterns, it becomes clear that future shifts and advancements in legal education will demand pedagogical adaptations to prepare lawyers future ready. Transitioning to Outcome-Based Learning (OBL) is often referred to as the solution to this problem. OBL, also known as outcome-based education (OBE), is an educational approach that focuses on the specific skills, knowledge, and abilities that students should achieve by the end of a learning process or course. Rather than making learners simply complete a set of tasks or assignments, the main objective of this technique is to ensure that they achieve the desired outcomes.

While applying the OBL approach, the instructor begins with clearly defined learning outcomes, serving as the foundation for the entire learning experience. These outcomes, categorized as knowledge, skills, and attitudes, guide instructors in designing curriculum, assessments, and learning activities that contribute to achieving the desired outcomes. OBL emphasizes key aspects such as clear and measurable learning outcomes, curriculum alignment, assessment and feedback, a learner-centered approach, and continuous improvement. By focusing on these aspects, OBL ensures that learners acquire necessary skills and competencies for success in their careers or further education. Because of its many benefits, this approach is widely used across various educational settings, from primary schools to higher education and vocational learning.

What prompted the emergence of the OBL approach in legal education?

In law schools, traditionally the most commonly employed pedagogical tool is the lecture method. The lecture method is a teacher led, information focused methodology in which the teacher serves as the sole guide within the classroom. The students essentially act as passive listeners because the teacher is the only one who speaks in this method. While this is an effective method for explaining legal terminologies or legal theory or notions to the students, it is not a one-size-fits-all solution to legal education.

In recent times, legal academia has experienced pressure to undergo reforms, as critics contend that current legal education does not sufficiently equip students for their professional lives as efficient legal professionals. To be precise, legal education should aim to prepare legal professionals who play distinctive roles not only as advocates but also as legislators, policy makers, judges, public officials, civil society activists and legal counsel in private sector. This demand for change has given rise to the adoption of outcome-based education within law schools. The following paragraphs underscore factors driving the increased demand for outcome-based model in legal education:

1. Skill gap: Traditional legal education has been criticized for not adequately preparing students with the necessary practical skills, knowledge, and

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Twitter-Based Analysis of Python Learning Community: A Data-Driven Approach

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Abstract

Python programming language has become increasingly popular in recent years resulting in a large and vibrant community consisting of developers, learners and fans. This paper presents a study that uses data mining to analyze python learning communities on twitter. This work aims at discovering some trends, perceptions and conducts within python learning community therefore giving out how it is learned and put into practice. Data was gathered from Tweets related to Python learning using Twitter API. Sentiment analysis was carried out to understand overall sentiment among people while topic modeling was used to establish famous topics discussed in the community. On top of that, network analysis examined connections as well as interactions within this group. The results show an active community discussing everything from beginner tutorials to advanced topics in data science and machine learning. Sentiment analysis indicates that there is mainly positive sentiment towards python indicating its popularity and usefulness. Topic modeling identifies key areas where discussions took place during this period.

Keywords: Python, Twitter, data mining, sentiment analysis, topic modeling, network analysis, online learning communities, community engagement, data science, machine learning, web development and automation.

Introduction

By utilizing data mining to examine trends, preferences, and practices, this research delves in to the Python learning community on Twitter. Web development, AI and data science are some of the areas where Python is commonly used. It is important for developers, educators and learners

Objectives Of The Research

- **Community Landscape**: We will take apart the community structure, look for the main influencers, its interaction patterns and engagement levels. Through network analysis we will know who is driving it and how members are connected.
- **Learning Discourse**: Topic modeling will find what central issues that were argued about by a community. Trends can be expected in programming tutorials, best practices, emerging technologies, and real-world Python applications.
- **Sentiment Analysis**: Evaluating emotional tone in tweets will tell us about overall satisfaction with Python as a programming language, enthusiasm and other feelings.
- **Learning Patterns**: We have to understand how learning occurs within the community. This entails types of questions asked, shared resources and support systems available for those who want to become pythonistas.
- **Actionable Insights**: Above all this research aims at empowering educators, developers and learners. Expect tailor made recommendations for each group informed by our data-driven insights.

Significance of the Research

To investigate the Python learning community on Twitter using data mining techniques is important as it offers valuable insights for educators, developers and community managers. By getting to know what kind of resources and materials are useful to learners, what difficulties they face within the community, those who teach or develop using Python can come up with better ways to reach out to them. Moreover, this information may help in developing online platforms

Knowledge Extraction using Bert Towards Building Swot Applications

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ABSTRACT

Semantic web technologies are a key driver of semantic interoperability in IoT (Internet of Things)-generated data, since they leverage common vocabularies in an ontology-driven manner. Despite the growing interest in IoT ontology standardisation, there is still no widespread endorsement of a unified IoT ontology. Existing ontologies contain a wide range of relationships and concepts to address various IoT data properties and the same IoT concepts are always being redesigned by new ontologies, making it difficult to reuse and combine multiple IoT ontologies that contain repetitive ideas. The most popular terms in IoT ontologies, including the W3C Web of Things, the W3C SSN/SOSA, the ETSI M2M SAREF, and the Komninos ontologies, have been examined in this study, and Lov4IoT smart cities ranking data corpus has been used. The Lov4IoT catalogue is used to automatically identify the vocabulary to be extracted from ontologies of various IoT application domains using machine learning approaches and by making use of IoT publications containing domain-specific knowledge. Vocabulary extraction is done using BERT Optimization along with K-Means clustering in order to boost the accuracy. The k-mean approach produces semantically consistent clusters for the smart city domain, with an accuracy of 70.9%. Using this study, ontology engineers will be able to apply and mix existing ontologies to achieve semantic interoperability. To our knowledge, no study has looked into the significance of automatically finding the relevant topics for iot.schema.org using these machine learning techniques.

KEYWORDS: *IoT, Ontology, Lov4IoT, BERT, Vocabulary extraction, Semantics.*

INTRODUCTION

The Internet (IoT) endeavours to connect nearby devices to the Web, with the goal that data generated by them can be transmitted and managed [1]. By 2025, as per an estimate by International Data Corporation (IDC), around 42 billion devices, generating over 79 ZB data would be used [2]. Applications for smart cities are progressively made possible by IoT. Foundations for smart cities are costly to create, construct, use, and keep up with. Cost-saving interoperability is fundamental, and it is expected at a wide range of levels, prominently i) the framework, ii) the plan, iii) the work process for handling IoT information, iv) the services and applications, and v) the utilization of information for decision making. A semantic methodology, especially one made feasible by the utilization of relevant ontologies, can support interoperability and better adapt to the variety of IoT connected devices, supporting their related data types. The issue of picking the right catalogue and ontologies emerges from the way that there are various ontology catalogues that are appropriate to smart cities and IoT cities. The Santander smart city project in Spain is an example of an IoT based

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(18)

The Effect of Energy Consumption on Economic Growth: a Scientometric Analysis

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Received: 30 January 2024 / Accepted: 25 April 2024

Abstract

This research employs science mapping techniques to conduct a comprehensive bibliometric analysis of 409 scholarly articles extracted from Scopus, spanning the period from 2003 to 2023. The primary objective of this study is to compile and categorize existing literature, identifying its primary thematic focuses within the domain of energy consumption and economic growth. Additionally, we aim to pinpoint gaps in the existing literature and propose potential research opportunities within this realm. Our findings reveal several significant insights. Firstly, prior studies predominantly examine the linkage between energy consumption and economic growth at an aggregate level, with limited exploration of specific energy sources such as fossil fuels, renewable energy, and hydroelectric power. Secondly, a dearth of research exists on the nexus between CO_2 emissions, energy consumption, and GDP growth in Asian countries. Lastly, urbanization, globalization, government spending, financial development, and population factors remain largely unexplored in relation to energy consumption and economic growth. This study holds substantial value for both researchers and policymakers. By delineating the thematic focuses and identifying gaps in the literature, it offers crucial insights to guide future research endeavors. Furthermore, it provides a foundation for policymakers to formulate informed strategies aimed at addressing the intricate interplay between energy consumption and economic growth.

Keywords Energy consumption · Economic growth · Scopus · Systematic literature review · Research agenda

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Challenges Faced by Users and Developers in Cross-Platform Mobile Application Development Using Flutter and React

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ABSTRACT

High-tech mobile gadgets are widely available, and this has significantly changed people's daily activities. People might want to think about adding these devices to their list of essentials. People's reliance on mobile devices has grown as a result of their widespread use.

An increase in the number of mobile phone users is indicated by the substantial consumer interest in mobile technology. With the increasing number of mobile users and mobile devices, there is an increasing demand for high-quality apps for mobile devices. In today's industry, developers face excessive pressure to address issues that users are having with their mobile application. Our goal in writing this essay is to assess the myriad issues surrounding mobile apps, both from the perspective of users and developers.

I analysed the ways in which I fall short and the problems that our users and engineers encounter. I also provided a solution to reduce the gap between the mobile app users and developers.

Keywords: Mobile Applications, Mobile App Development, App Developers, Mobile Users, Android, iOS, Cross-Platform App Development, Flutter, React Native.

W The popularity of mobile devices and the apps that run on them has grown significantly over the past few years. As a result, solving the challenges faced by stakeholders such as mobile app developers, users, and platform owners could have a significant impact. In the development of cross-platform mobile applications using frameworks such as Flutter or React.

The Biggest Challenge One of the biggest challenges faced by users and developers in cross-platform mobile application development using frameworks like Flutter or React is performance optimization. Users expect mobile applications to be fast and responsive, regardless of the platform they are using. Performance optimization involves ensuring that the app runs smoothly and efficiently, with fast loading times, smooth transitions, and minimal lag or delays.

Literature Review:

The field of cross-platform mobile application development using frameworks like Flutter and React Native has garnered significant attention in recent years. Researchers and practitioners alike have explored various aspects of this domain, including challenges faced by users and developers, performance optimization strategies, and techniques for enhancing user experience and platform consistency.

1. **Challenges in Cross-Platform Development:** Several studies have investigated the challenges encountered by both users and developers in the realm of cross-platform mobile app development. Similar to the findings presented in this research paper, studies have highlighted issues such as performance optimization, inconsistent user experience, limited access to native features, device fragmentation, security concerns, and debugging complexity. For instance, research by Sarker et al. (2019) delves into the challenges faced by developers in cross-platform mobile app development, emphasizing technical hurdles, UI/UX consistency, and debugging complexities.
2. **Performance Optimization Strategies:** Performance optimization remains a critical area of investigation in cross-platform development. Scholars have explored various techniques to mitigate performance bottlenecks and enhance the responsiveness of cross-platform apps. The paper aligns with existing literature by discussing strategies such as profiling, code optimization, caching, asynchronous operations, and the utilization of native modules. Research by Al-Basri et al. (2020) provides insights into performance optimization techniques for React Native apps, emphasizing the importance of minimizing bridge overhead and leveraging native components for computationally intensive tasks.

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ANALYSIS OF STOCK MARKET USING STOCK MARKET SIMULATION

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ABSTRACT

Stock market simulation offers a dynamic platform for analyzing financial markets without the risk of real capital. This research paper explores the significance, methodologies, applications, and challenges of stock market simulation in financial analysis. It discusses various simulation types, from simple spreadsheet models to complex computer-based platforms, evaluating their strengths and limitations. Methodologies for data collection, model calibration, and scenario analysis are outlined, along with applications such as portfolio performance assessment and risk mitigation. Challenges including data accuracy and computational complexity are addressed, as well as emerging trends like AI integration. This paper aims to equip readers with a comprehensive understanding of stock market simulation for effective financial decision-making.

Keywords: Simulation, Stock Market, Volatility, Liquidity, Equity.

1. INTRODUCTION

The stock market stands as a cornerstone of global finance, serving as a hub where investors, traders, and corporations converge to buy and sell financial assets (Fama, 1970; Shiller, 1981). Over the years, the stock market has evolved into a complex ecosystem driven by a multitude of factors, including economic indicators, geopolitical events, investor sentiment, and technological advancements (Malkiel, 2003; Lo, 2004; Taleb, 2007). Stock market simulation emerges as a powerful instrument in the arsenal of financial analysts, providing a controlled environment to experiment with investment strategies, evaluate risk exposures, and gain insights into market behavior (Farmer & Foley, 2009; Lux & Marchesi, 2000). Unlike traditional methods of financial analysis, which often rely on historical data and theoretical models, stock market simulation enables researchers and practitioners to interact with dynamic market conditions in real-time, without exposing actual capital to risk (Gao et al., 2013; Ziemba, 2012).

This research paper seeks to explore the realm of stock market simulation, delving into its significance, methodologies, applications, and challenges in the context of financial analysis. By providing a comprehensive overview of stock market simulation, this paper aims to equip readers with the knowledge and insights necessary to navigate the complexities of today's financial markets effectively (Ross et al., 2017; Verma et al., 2024).

The paper is structured as follows: following this introduction, the subsequent sections will delve into the concept of stock market simulation, elucidating its various types and methodologies. Furthermore, the paper will explore the practical applications of stock market simulation, ranging from portfolio optimization to risk management. By examining how simulation models can be utilized to address real-world financial challenges, this paper aims to showcase the transformative potential of stock market simulation in shaping investment strategies and decision-making processes.

Finally, the paper will conclude with a synthesis of key insights and recommendations for leveraging stock market simulation effectively in financial analysis and decision-making. Through this comprehensive exploration of stock market simulation, this research paper aims to contribute to the ongoing discourse on financial modeling and analysis in an ever-evolving global marketplace.

2. RELATED WORK

The realm of stock market analysis has been extensively explored in academic literature and professional research, with a plethora of studies focusing on various methodologies and techniques for understanding market dynamics and predicting asset prices. Within this vast body of work, stock market simulation has emerged as a valuable tool for researchers and practitioners alike, offering a controlled environment to study market behavior and test investment strategies.

One prominent area of related work centers on the development and validation of stock market simulation models. Researchers have proposed various simulation methodologies, ranging from simplistic models based on historical price data to complex agent-based models that simulate the behavior of individual market participants.

For instance, early studies by academics such as Eugene Fama and Robert Shiller laid the groundwork for simulation-based research in finance by investigating the efficiency and predictability of stock prices. Fama's efficient market hypothesis (EMH) posited that asset prices reflect all available information, making it impossible to consistently outperform the market through stock picking or market timing.

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AI in Chatbot

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ABSTRACT

The automation of tasks through artificial intelligence (AI) has led to significant transformations in multiple sectors, notably in the utilization of chatbot technology. These chatbots, designed to imitate human conversation, have experienced remarkable progress owing to advances in AI techniques. This investigation seeks to analyze the current state of AI-powered chatbot technology, highlighting recent improvements and emerging trends. The analysis will explore the application of natural language processing (NLP), various machine learning algorithms, and deep learning methodologies in chatbot construction to comprehend their functionalities and constraints.

Moreover, this study will shed light on notable innovations in AI-driven chatbots, such as the development of virtual assistants and incorporation of voice recognition capabilities. These innovations have had a profound impact across diverse industries, offering innovative solutions for virtual customer service and enhancing interactions between customers and companies. The research will underscore the significance of context comprehension and the delivery of tailored responses in chatbot engagements, tailored to individual user preferences and requirements.

Additionally, the fusion of complementary technologies like speech recognition and sentiment analysis augments the efficiency of chatbots, fostering higher levels of user satisfaction and engagement. Nevertheless, amid the advantages, issues surrounding ethics and data privacy emerge, particularly in areas like medical chatbots, emphasizing the need for conscientious evaluation and the establishment of ethical guidelines.

A comprehensive understanding of AI advancements and their influence on chatbot technology is essential in recognizing the array of opportunities and obstacles they present. By addressing ethical and privacy considerations, chatbots can effectively mold human-computer exchanges, contributing to a broader comprehension of AI's impact on industrial evolution and the enhancement of user experiences.

Keywords:

- Artificial Intelligence (AI)
- chatbot technology
- natural language processing (NLP)
- machine learning algorithms
- deep learning methodologies
- virtual assistants
- voice recognition
- context comprehension
- tailored responses
- speech recognition
- data privacy
- Siri
- ChatGPT
- NLP capabilities
- machine learning chatbots
- dialogue management
- versatility
- data-centric approach

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Preface

Burnout is a state of emotional, physical and mental exhaustion caused by excessive and prolonged stress. It occurs when you feel overwhelmed, emotionally drained and unable to meet constant demands.

Most studies of burnout have focused largely on the investigation of background variables like marital status, age, year of teaching and gender as predictors of burnout. in fact, studies involving dimensions such as focus of control, extra version, neuroficism and emotional intelligence as antecedents are fewer in number.

This book aims at exploring factors that are suspected to influence the extent of burnout among teachers at secondary and senior secondary levels. Principals factors selected for investigation include focus of control, extraversion neuroficism and emotional intelligence.

—Dr. Poonam Beniwal

Burnout of Teachers Working in Secondary/Senior Secondary Schools

DR. POONAM BENIWAL

About the Author

Dr. Poonam Beniwal is currently working as Head of Department in Maharaja Surajmal Institute. She has more than 20 years of experience in academics, research, evaluation, supervision, planning and administration with University of Delhi, GGSIPU, IGNOU, NCERT, SCERT's, NIOS, SIEMAT, and DEP-SSA etc. She has served as IGNOU B.Ed. program inchage for 3 years from 2008 to 2010. She has done research project at Maharaja Surajmal Institute funded by SIEMAT UP government in 2014. Recognizing her talent and contribution Maharaja Surajmal Institute Awarded her Best faculty award in 2016. She has been involved in various NCERT projects. She has also been member of various curriculum development teams at IGNOU. She has conducted workshops at Jammer, Shamli, Wayanad, Imphal and SCERT Gurugram etc. She has been supervising dissertation work at post-graduation level.

Recognizing her talent and contribution she had been assigned the responsibility of training teachers through teleconferencing at IGNOU. She has published and presented many research papers at National and International level. She has been invited as visiting faculty at various colleges.

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African Journal of Biological Sciences

A Study Towards Understanding The Consumer Psychology And Credence In Organic Food In Post-Pandemic India

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ABSTRACT
This study looks at the link between price and customer trust. The study is an attempt to understand how consumer trust influences the relationship between purchase intents, health and safety concerns, and how availability influences this relationship. This survey aimed at various Indian demographic groups to gather data. According to the research, although greater costs might raise people's opinions of quality, they can also breed doubt if they're seen & perceived to be overpriced excessively. Concerns about health and safety are a major draw for consumers shopping for organic food, but their buying intentions are heavily influenced by how much they believe in the advantages and authenticity of the product. Furthermore, the price-trust link is moderated by the availability of organic food, with greater availability lessening the detrimental impact of high costs on trust. Through smart pricing, better availability, and clear communication of the health and safety advantages, organic food industry stakeholders may increase customer trust and their buying intentions. These findings provide insightful counsel in this regard.

Keywords: Organic Food, Consumer Trust, Purchase Intentions, Price Perception, Health and Safety Concerns, Customer Behaviour.

INTRODUCTION

Concerns about health and safety are a major draw for consumers shopping for organic food, with a greater emphasis now being placed on safety, health, and general well-being. Organic food has garnered significant attention in this context because of its alleged health advantages and safer cultivating methods. The increasing attention and consumer confidence in organic food continues to be a crucial element that may greatly impact buying preferences. There are several reasons to trust organic food, including beliefs of safety, authenticity, and quality. The purpose of this study is to investigate, in the aftermath of the epidemic, what variables influence the faith that Indian consumers have in organic food.

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EMOJI PREDICTION USING SENTIMENT ANALYSIS

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ABSTRACT
Emoji prediction through sentiment analysis is a process integral to natural language processing (NLP). It involves evaluating the emotional tone of text and suggesting appropriate emojis to convey sentiments, categorizing them as positive, negative, or neutral. The innovative aspect lies in utilizing sentiment analysis to foresee and recommend emojis aligned with expressed feelings, thereby enhancing user experience and fostering more engaging digital conversations. Addressing challenges such as ambiguity and cultural variations, this study broadens emoji applicability beyond textual communication, extending to social media and customer feedback sentiment analysis. Emphasizing the evolving importance of emojis in contemporary communication, it explores their role in diverse digital interactions, employing sentiment analysis to predict contextually relevant emojis. The research critically reviews existing methodologies, focusing on machine and deep learning models, assessing their strengths, weaknesses, and potential for further development. Ambiguity and cultural disparities are identified as significant challenges affecting precise emoji prediction. Additionally, the study examines practical applications of emoji prediction technology, including integration into social media analytics, customer feedback sentiment analysis, and personalized recommendation systems. Proposing enhancements to user experience and engagement, the research highlights the transformative potential of this technology in digital communication. It concludes by advocating for robust datasets, improved algorithms, and considerations of cross-cultural disparities to advance emoji prediction through sentiment analysis, envisioning a future where this approach enriches digital communication across diverse contexts.

Keywords: Emoji prediction, Sentiment analysis, Natural language processing, Digital communication, Cultural variations

1. INTRODUCTION
Emojis have exploded in popularity in digital communication, with over 92 emoji categories expressing a vast array of human emotions and serving as visual cues to sentiment. This has driven interest in leveraging emojis to enhance sentiment analysis, a pivotal natural language processing (NLP) technique that computationally evaluates subjective text to understand emotional tone and opinion. Recent studies have focused on emoji prediction through sentiment analysis, proposing innovative methods to suggest emojis matching the sentiment of accompanying text, as shown in figure 1.

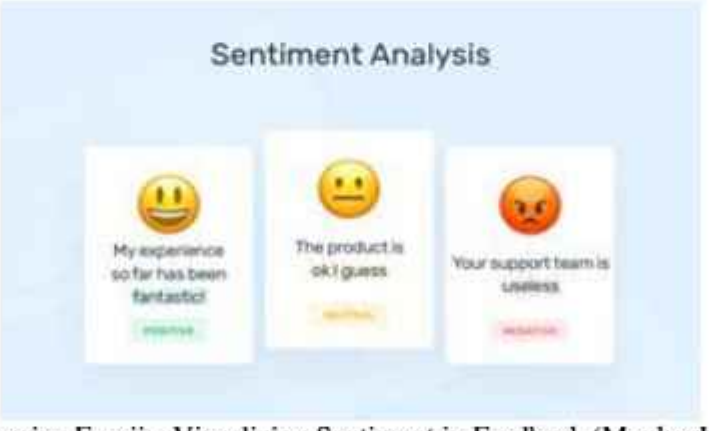

Fig 1: Expressive Emojis: Visualizing Sentiment in Feedback (MonkeyLearn 2024)

This paper presents a comparative analysis of 10 recent research papers that have explored sentiment-based emoji prediction using diverse techniques. The examined studies span traditional machine learning classifiers like Support Vector Machines (SVM), Linear SVC, Random Forests to sophisticated deep learning models including CNN-LSTM and BERT. Some works focus solely on emoji prediction while others emphasize the value of emojis in improving overall sentiment analysis accuracy. The papers have utilized varied datasets ranging from a few thousand tweets to millions of Twitter images labeled for sentiment/emojis.

By reviewing the techniques, datasets, results and limitations in a comparative framework, this analysis assesses the current state of emoji prediction for sentiment analysis. It highlights the relative merits and drawbacks of the approaches, while surfacing key challenges like managing ambiguity, accounting for cultural variability in

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DESIGN AND IMPLEMENTATION OF AN ECONOMICAL RADAR SYSTEM USING ARDUINO PLATFORM

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ABSTRACT
The ability of radio detection and ranging (Radar) systems to use electromagnetic waves powers their applications in military installations, academic institutions, and commercial buildings. In this instance, an ultrasonic wave divides the radar from any object-based non-contact technologies.In contrast, a tiny servo motor is used to regulate the sensor's movement. The Arduino Uno board serves as the microcontroller for this radar. "Processing Development Environment Software" would be used to process the sensor signal, and the output would be shown on a PC screen. Numerous advancements have been made in the years since Radar systems gained notoriety. A few of these falls under the categories of energy optimisation, target recognition and tracking, navigation and location, and other applications. This study looks at current radar technology and builds a Radar system using an Arduino platform. This has the dual benefits of significantly lowering power usage and giving designers access to a large number of online Arduino programming communities and open-source reusable code. An Arduino microcontroller, a servo motor, an ultrasonic sensor, and a Java programme for mapping electromagnetic waves make up the system. This has the dual benefits of significantly lowering power usage and giving designers access to a large number of online Arduino programming communities and open-source reusable code.

Keywords: Radar, Arduino, Embedded System, Simulation, Microcontroller

1. INTRODUCTION
Radar systems have been integral in modern technology, providing crucial information for object detection, ranging from aircraft and ships to weather formations and terrain (Onoja et al., 2017). These systems have evolved significantly, utilizing various techniques such as electromagnetic waves and ultrasonic sensors to determine object size, distance, direction, and speed (Biswas et al., 2020).

The origins of radar trace back to the late 19th century, with early experiments by Heinrich Hertz revealing the reflection of radio waves by metallic objects (Bochare & Mukesh, 2017). It was during the 20th century that radar systems began to be widely developed, initially for military applications, particularly during World War II, by nations such as the United Kingdom, Germany, and the United States (Kelkar et al., 2024).

Among the diverse applications of radar technology, ultrasonic radar systems have emerged as cost-effective solutions for distance measurements and object detection (Vijay Raj et al., 2021). Ultrasonic waves, beyond the audible frequency range, serve as the foundation for these systems, allowing for non-contact measurement and robustness in various environmental conditions (Hatem et al., 2018). The integration of ultrasonic sensors with microcontrollers, such as Arduino boards, has facilitated the development of low-cost radar detection systems with programmable capabilities (Benjamin et al., 2020).

The advancement of radar technology has not been confined to military domains; it has found widespread applications in civilian sectors, including air traffic control, marine navigation, meteorology, and medical diagnostics (Mehta & Tiwari, 2018).

Furthermore, the convergence of radar technology with digital signal processing has enabled the extraction of valuable information from high-noise environments, enhancing the accuracy and reliability of radar-based systems.

In this context, this paper seeks to present an analysis of the state-of-the-artin ultrasonic radar systems, drawing insights from a diverse range of research papers. By synthesizing findings from these studies, we seek to identify key trends, challenges, and opportunities in the field of radar technology, with a particular focus on low-cost, high-performance solutions for object detection and distance measurement.

2. LITERATURE REVIEW
Recent advancements in sensing technologies, particularly ultrasonic and radar systems, have revolutionized various fields by enabling precise object detection, distance measurement, and navigation assistance. A comprehensive review of the literature reveals significant contributions and innovations in these areas.

Ultrasonic sensing technology has witnessed widespread applications across diverse domains. Studies by Dutt (2014), Tamhankar et al. (2009) and Dejan (2017) have elucidated the principles and workings of ultrasonic

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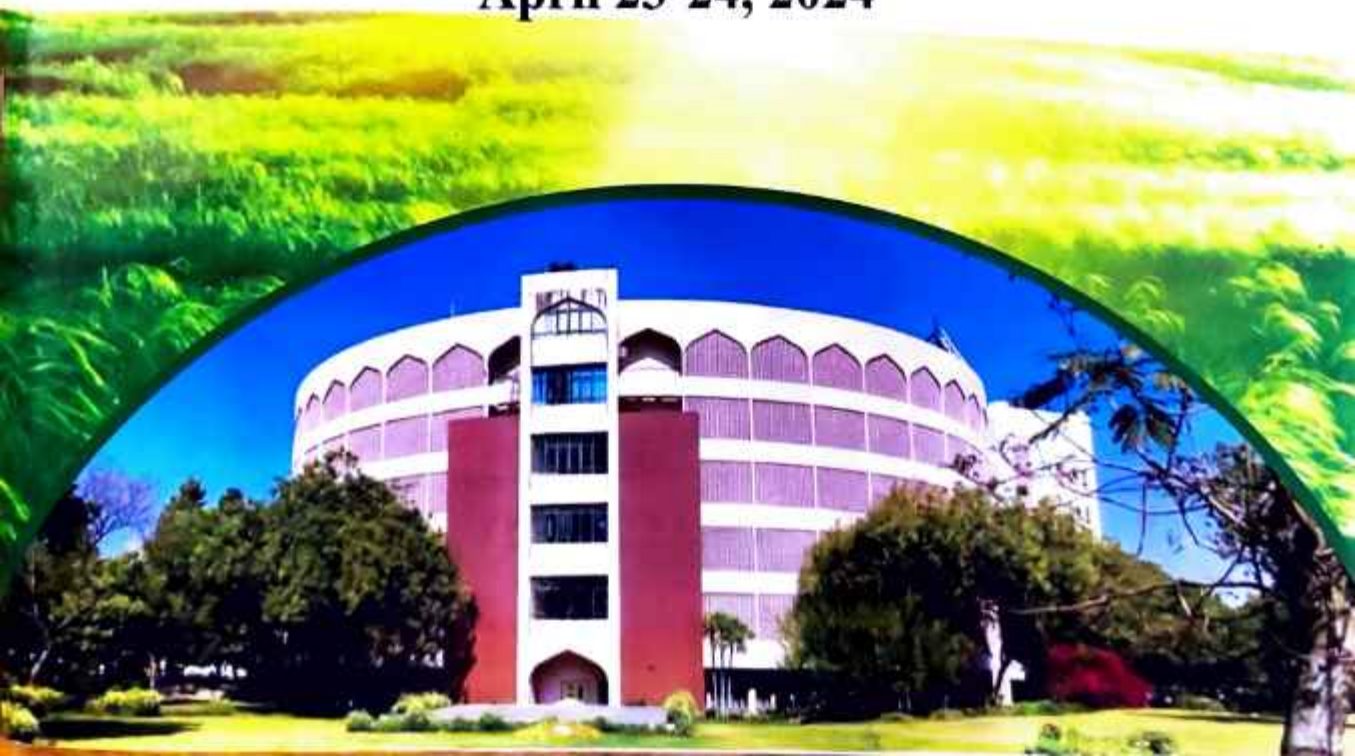

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120	243	*Mohd Asif, Aqeel Khalique	Envisioning Sixth Generation (6G) Wireless Net-works: Architecture, Capabilities, and Key Engineering Challenges
121	78	Mr. Ashish Sharma, Dr Sandeep Tayal, Dr Yogesh Sharma, Ms. Savita Sharma, *Divleen Kaur Chugh, Tripti Jain, Aryan Birla	Comprehensive Analysis and Implementation of A Multi-Factored Detection System for Accident and Risk Analysis In Smart Cities
122	263	*Amit Bansal, Siddhartha Sankar Biswas, Md. Tabrez Nafis and Suraiya Parveen	Unlocking the Future: A Visionary Discourse on IoT's Revolutionary Applications
123	184	Sundus Shafi, *Dr. Syeedun Nisa, Dr Sadaf Siraj	Urban Mobility & Sustainable cities: An empirical investigation of the perception of City dwellers of Delhi-NCR
124	267	Prashant Kumar Mishra, Prakhar Mishra, Rakesh Kumar, *Sonia Deshmukh	Human computer interaction through gesture control system
125	273	*Dr. Richa Gupta, Mr. Lavkush Gupta, Prof. Parul Agarwal, Dr. Suraiya Praveen	Invasive and non-Invasive diagnosis of diabetic retinopathy using imaging biomarkers in perspective of Artificial Intelligence.
126	210	*Nazish Baliyan, Digvijay Puri	Efficient Implementation of ECC-Based Homomorphic Encryption for Data Forwarding in Cloud Environments
127	208	*Nazish Baliyan, Digvijay Puri	The Role of Artificial Intelligence in Continuous Integration and Continuous Deployment (CI/CD) Pipelines
128	3	*Khyati Chopra and Suruchi Bala	Comparing Signal-to-Noise Ratio Estimation Techniques in the Additive White Gaussian Noise Channel
129	16	*Sonia Rathee, Amita Yadav, Shalu	Enhancing Gaming Experience with Real-Time Posture Detection
130	35	*Akshit Goyal, Abheet Sethi, Tejna Khosla, K.C. Tripathi, and M.L. Sharma	Empowering Communication: American Sign Finger Spelling Recognition
131	48	*Yash Veer Singh, Prof. (Dr.) M.L. Sharma, and Tejna Khosla	A Comprehensive Review of Network Monitoring and Analysis Tools
132	55	*Jasleen Kaur, Nilesh Tiwari, Nikhil Nair, and Dr. Subitha D	Review on Challenges in Securing Emerging Cyber-Physical Systems
133	58	*Shalu, Amita Yadav, Sonia Rathee, Rhythm Choudhary	Automatic Grading System for Subjective Exams using OCR and Semantic Similarity
134	59	*Himani Tyagi, Rajendra Kumar, Santosh Kr Pandey	A Trust evaluation and prediction framework for RPL based IoT attacks using Artificial Intelligence- Study, Analysis and Design
135	64	*Nikita Malik1, Riddhima Bhalla, Tamharjeet Singh Walia, and Shreya Srivastava	Using Support Vector Machines for Breast Cancer Prediction
136	71	*Zow Afshan, Dr. Sherin Zafar	Internet of Things (IoT) Water Quality Monitoring : A Study
137	72	DewendraBharambe, *Atharav Kiran Maindarge, Omkar Vijay Naik, Satyam Ashok Shinde	Open AI Desktop Assistant
138	79	*Deepanshu Anand, Yugansh Gupta, Arnav Sabharwal, Vinay Kumar Saini, and Anshu Khurana	Extractive Text Summarizer: An Application based study
139	105	Ayesha Hena Afzala, *Prof.Ozair Alamb, Dr.Sherin Zafar, Prof.M.Afshar Aalam	Comprehensive Investigation of Cichorium Intybus Components: Unravelling the Mechanism and Validating

Review on Challenges in Securing Emerging Cyber-Physical Systems

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Abstract: As we hurtle towards a future of interconnected devices, protecting the security and privacy of the cyber-physical landscape has emerged as a formidable challenge. The boundary between the digital and physical worlds has become a prime target for attackers seeking to inject nefarious signals or extract sensitive information from sensing systems. While previous research has largely focused on abstract models for signal injection, this review paper presents a comprehensive survey of the broader CPS arena, illuminating attack patterns, potential new threats, and effective countermeasures against emerging cyber-physical hazards. From signal injection and side-channel information leakage to sensor-based attacks, we explore various facets of security and privacy in CPS, laying bare the complexities of safeguarding our interconnected systems. Our review underscores the pressing need for holistic approaches to secure CPS and charts a roadmap for future research directions. With insights borne of rigorous analysis and careful evaluation, this paper serves as an invaluable resource for researchers and professionals navigating the ever-changing terrain of the cyber-physical world.

Automatic Grading System for Subjective Exams using OCR and Semantic Similarity

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Abstract: The rising interest for proficient and objective grading methodologies in education has prompted the development of an Automatic Grading System for Subjective Exams. Our research work makes an attempt to utilize Optical Character Recognition (OCR) technologies and semantic similarity models for automating the evaluation of subjective answers. The suggested system facilitates instructors in generating exams, uploading answer keys, and empowers students to submit their individual PDF responses. The OCR module transforms image-based responses into text, while the semantic similarity module, leveraging sbert models and cosine similarity, evaluates the alignment between student answers and the predetermined correct solutions. The evaluation of the system involves a comparative analysis with human-graded answers, focusing metrics for accuracy. Results indicate the system's effectiveness, opening avenues for the integration of automated grading systems to enhance educational assessment processes.

A Trust evaluation and prediction framework for RPL based IoT attacks using Artificial Intelligence- Study, Analysis and Design

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Abstract: Most of the vulnerabilities found by researchers and OWASP are related to attacks and threats either on the IoT network or the data exchange process. Hence, it becomes vital to discuss and propose the solutions for the emerging vulnerabilities on IoT networks. The most popular are the routing attacks that can harness the working of IoT based routing protocols like Routing protocol for low power and lossy networks (RPL). The main objective of these attacks is to degrade network performance by draining nodes energy. Therefore, this paper presents the working principle and security concerns in RPL in details. Further, the available datasets used for validation of security solutions are also discussed. Additionally, the proposed security solutions for popular attacks on RPL with limitations and future study is highlighted. At last, based on the study, a trust based security framework for routing attacks on IoT networks using artificial intelligence is proposed.

Using Support Vector Machines for Breast Cancer Prediction

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Abstract: Cancer is one of the worst diseases of progressive nature that causes abnormal growth in cells and attacks the healthy cells that exist. All of us are born with a potential for cancer, however, certain triggers exist that may speed

up the formation of cancerous cells, such as tobacco, radioactive substances, etc. In this project, our main aim was to ensure better care for cancer patients, specifically breast cancer, and to do so, develop a Machine learning model that would assist in cancer prediction by analyzing the inputs regarding a cell sample in the breast. A supervised machine learning model, Support vector machine (SVM) was used for our predictions, and the dataset used was the Breast Cancer Wisconsin (Diagnostic) Data Set. The paper outlines Machine Learning as a whole alongside SVM, with results analyzed based on the accuracy of the model and classification report.

Internet of Things (IoT) Water Quality Monitoring: A Study

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Abstract: Water contamination is one of society's major problems. Water is important for health. Water quality must be checked in real time for safety and supply. Traditional water monitoring might take 24 to 96 hours to find pollutants. This undertaking develops a sensor-based IoT water quality monitoring system. The water quality index is calculated using sensor measurements of temperature, pH, and turbidity. A microcontroller will evaluate sensor data and send alarm messages to the user via an android app built by MIT app inventor if irregularities are detected. For crucial water quality monitoring and rectification, the ThingSpeak GUI platform displays sensor data. Phase two will use a machine learning system to estimate short- and long-term water quality using sensed data saved in the cloud or locally.

Open AI Desktop Assistant

Dewendra Bharambe, *Atharav Kiran Maindarge, Omkar Vijay Naik, Satyam Ashok Shinde
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Abstract: Realizing natural human-machine communication is the main objective of artificial intelligence (AI), a popular technology. To increase human-machine interaction, many IT-based businesses have also made use of conversation network technology to develop different kinds of Virtual Personal Assistants. Examples of these include Alexa, Cortana, Google Assistant, Siri, and many others. We createda virtual assistant that works similarly to Microsoft's "Cortana" voice assistant. It uses Python to carry out simple operations on the Windows platform, following instructions. Python is utilized in this case as a scripting language because of its extensive library, which is used to carry out commands. A customized virtual assistant identifies and interprets theuser's voice using Python libraries. Voice assistants are an amazing development in the field of artificial intelligence that has the potential to change people's lives in many different ways. When the voice based assistant first appeared on cellphones, it became widely used. It was universally acknowledged. Voice assistants were formerly mostly found incomputers and smartphones, but they are currently becoming more and more common in smart speakers and different homeautomation systems. Numerous technologies appear to be becoming smarter in their unique ways, enabling them tohave basic linguistic conversations with people. Desktop voice assistants are computer programs that recognize speech patterns and respond via an integrated speech system. This essay will describe the various types of voice assistants and discuss the main drawbacks and difficulties they have. This study discusses how to construct a voice-based assistant without using cloud services, which would encourage the development of such gadgets in the future.

Extractive Text Summarizer: An Application based study

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Abstract: Text summarization is an essential tool for extracting important information from lengthy texts or documents. Text Summarization has two main methodologies namely: Extractive Summarization and Abstractive Summarization. This study concentrates on extractive summarization, which selects significant sentences straight from the source material to create a summary. It is a popular option for many practical applications since it frequently produces summaries that are more accurate in terms of substance. In Abstractive Summarization, the summaries are

86

The Impact of Digital Marketing on Sales of Businesses: An Empirical Study with Special Reference to Pathshala

Dr. Richa Arora, Dr. Dimpy Sachar,***
*Dr. Richa Nangia,*** Dr. Rashmi Singel*****
*& Dr. Suman Yadav******

ABSTRACT

Digital marketing was an already trending technique of marketing but it has got a huge boost due to the COVID 19 pandemic. There are multiple marketing techniques that can help boost lead generation and conversion process. Pathshala, one of India's education market place where people can manage, search, advertise and sell educational products and services has implemented various digital marketing techniques . The present study assesses the impact of digital marketing in generating more leads and high conversion rate thereby efficiently assisting businesses by increasing their productivity. For this purpose, primary data is collected through structure questionnaire on five point Likert scale from the students who have pursued atleast one course from Pathshala. Convenient sampling method which is a non-probabilistic method is used and further data analysis is done using Cronbach's reliability test, correlation using SPSS software. Results show the strong correlation relationship between digital marketing practices and productivity of a business.

Keywords: *Digital Marketing,Covd-19 Pandemic, Sales, Productivity, Pathshala.*

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Analysis of Financial Performance Pre and Post Use of Artificial Intelligence Applications Via CAMELS Lens: With Special Reference to HDFC Bank

[1]Dr. Mamta Gupta, [2]Neha Garg, [3]Dr. Neetu Jain, [4]Dr. Pankaj Saini, [5]Dr. Sanjoy Roy, [6]Dr. Minakshi Sati

Submitted: 13/09/2023 **Revised:** 22/10/2023 **Accepted:** 11/11/2023

Abstract: Now a day, banks are focusing on more investments towards emerging technologies like artificial intelligence as customer loyalty and delight through digital transformation has become their main aim. This study is focused on examining the impact of AI techniques through CAMELS approach to crisscross the financial performance of the bank. HDFC bank is selected as sample for analysis being largest private sector bank and one of the leaders in adopting AI technology for enhancing customer experience. Authors have considered 4 pre-AI adoption years (FY2012-2016), 4 post-AI adoption years (FY2018-2021) and 2017 is considered as technology implementation cooling period. Further the study attempts to assess the HDFC performance in terms of financial parameters pre and post adoption of Artificial Intelligence applications in banking by comparing their mean values. SPSS and Microsoft Excel are used to test paired sample t on the secondary data collected and findings shows that there is a improvement in almost all the CAMELS ratios and significant improvement is observed in seven parameters namely Tier 1 Capital Ratio, BPE (Business per employee), PPE (Profit per employee), Market price (MP), Dividened per share (DPS), Cost - Income ratio, Expense to Interest Earned Ratio. Authors found that the encouraging impact of AI is being seen but significant change may take time.

***Keywords**: Artificial intelligence, pre and post analysis, CAMELS, HDFC bank, financial performance, AI applications.*

1. Introduction

Banks are increasingly transforming their businesses and forming collaborative ecosystems with third parties. As a result, banks are integrating numerous digital services into their business operations, resulting in the creation of new digital solutions through considerable banking sector innovation. The massive quantity of data that forms the basis for productivity, efficiency, ease, and scalability is at the core of every business, industry, and government operation. Use of AI in banking industry makes banks more efficient, trustworthy and user friendly. Artificial Intelligence basically means computer's ability to perform tasks independently. It helps modern banks maintain their competitive advantage in the digital age. The adoption of AI in banking shall reduce cost of operation, increases customer service and aid in process automation.

Banks are beginning on a rough but rewarding journey to dress in digitization to enhance their core banking services in the long run. In its recent study, global research and consultancy firm Gartner estimates that banking sector in India and security business giants would have spent $9.10 billion approximately on IT infrastructure in the financial year 2017. In 2016, banks and security services firms increased their spending on IT services by 11.7 percent. As people increasingly use digital banking, more money is projected to pour into AI and other emerging technologies in financial services industry.

By assets and market capitalization, HDFC Bank is the largest private bank in India. The adoption of AI as a technology is encapsulated by a variety of application cases. In 2016, HDFC Bank introduced OnChat, an AI-powered chatbot on Facebook Messenger. The chatbot, developed in collaboration with Niki.ai, saw a 160 percent month-over-month increase in transactions within a year of its introduction. More than 3 lakhs customers have interacted with HDFC Bank OnChat and the amount of transaction is close to Rs.250 lakhs as per latest HDFC bank's Annual audit report. AI has been used widely in the field of customer service. HDFC Bank's virtual chatbot named Eva. It has answered over 50 lakh

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A Study on Optimizing the Personalization of Recommendations and Customer Services Using Artificially Intelligent Neural Networks to Improve Electronic Commerce

Anudeep Arora, Ranjeeta Kaur, Prashant Vats, Mamta Gupta, Gayatri Chopra, Shikha Mehmi, and Trishali Khanna

Abstract Artificial intelligence (AI) has developed with e-commerce businesses as a critical breakthrough that enables businesses to optimize procedures, improve consumer relations, and expand operational capabilities. Artificial intelligence (AI) systems may assess consumer data to offer tailored ideas, respond to customer service requests, and enhance inventory control. Additionally, AI can detect fraud and enhance pricing strategies. With the increasing use of machine learning in e-commerce, businesses can genuinely compete and offer better customer encounters. This paper explores how AI is changing the e-commerce industry and presenting new opportunities for businesses to improve their operations and fuel growth. Artificial intelligence (AI) technology has developed into a key element of the e-commerce industry, allowing businesses to improve their processes and provide a more individualized client experience.

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Chapter 19
Towards Intelligent Governance: The Role of AI in Policymaking and Decision Support for E-Governance

Anudeep Arora, Mamta Gupta, Shikha Mehmi, Trishali Khanna, Gayatri Chopra, Ranjeeta Kaur, and Prashant Vats

Abstract This paper examines the role of artificial intelligence (AI) in policymaking and decision support for e-governance. With the increasing digitization of government services and the growing complexity of policy challenges, there is a need for innovative solutions to enhance governance processes. AI offers a range of tools and techniques that can assist policymakers in analyzing vast amounts of data, identifying patterns, and generating insights to inform evidence-based decision-making. The use of AI in policymaking can help streamline administrative processes, improve service delivery, and optimize resource allocation. Machine learning algorithms can analyze large datasets and extract valuable information, enabling policymakers to identify trends, anticipate future scenarios, and develop proactive strategies. Natural language processing algorithms can automate the analysis of public opinion, social media data, and public sentiment, providing policymakers with real-time feedback and a deeper understanding of citizens' needs and preferences.

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Section: Research Paper

THE ATTITUDE OF TOP MANAGEMENT TOWARDS SETTLING QUALITY STANDARDS IN THE HEALTHCARE INDUSTRY: A QUALITATIVE REPORT

Kunal Rawal[1,2], Nishtha Pareek[3], Nisha Solaki[4], Satish Chander Sharma[5]

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ABSTRACT

Accreditation helps control performance. Stakeholders' certification commitment is crucial to integrating standards into daily practice. This study examines hospital administrators' views on accreditation established by the quality council of India's national accreditation program for hospitals and healthcare. The hospital directors and administrators were interviewed to conclude this study from different single and multispecialty hospitals and healthcare institutes in India. Virtual, audiotaped, verbatim transcribed, and NVivo-12 thematically analyzed. The normalization process theory guided the study's conceptual framework and heuristic conclusions on normalizing accreditation standards (coherence, participation, activities, and monitoring) (May, C.R., 2009). Accreditation pleased hospital directors, especially those with more experience. The hospital administrators encourage the need and significance of accreditation. This approach standardized daily processes. The standards' clarity, the accessibility of full-time quality professionals, and the alignment of accrediting objective elements and standards with hospital policies and strategies enabled hospital executives to comprehend accreditation (coherence) and involve personnel (cognitive participation). This goal-driven involvement started deliberate operational efforts to incorporate quality standards (collective actions) (Campbell SM, 2000). Distribution of the standard set to the pertinent owners, evaluation of deficiencies, the creation of remedial plans, and project prioritizing within time constraints were all involved in the integration process. Notwithstanding structural and economic conditions, conditions on increased safety culture, team spirit, communication, public trust, safety issue reporting, and process standardization. Objective assessment of accreditation benefits (reflexive monitoring) was necessary to correct issues, improve performance, and sustain performance after integration (Brubakk K, 2015). Standards integration requires knowledge of certification and how operations integrate standards. According to the normalization process idea, culture, cooperation, and leadership impact how measures are combined in a sequential, connected manner. The outcomes clarified the operating accreditation technique, which may help stakeholders and policymakers make informed decisions.

KEYWORDS: Accreditation, Attitude, Quality, Hospital Administrator, NABH, Healthcare industry

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ENTREPRENEURSHIP: A KEY COMPONENT FOR NATIONAL DEVELOPMENT IN AGRICULTURE, HEALTHCARE AND TECHNOLOGY

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Abstract
Entrepreneurship is essential for the economic growth of a nation, creation of jobs, and social welfare. In addition to having significant consequences for policymakers, donors, development organisations, business owners, and managers, the meeting point of the entrepreneurship and development economics is a difficult and potentially fruitful area of research for social scientists. The concept of entrepreneurship, however, is rarely discussed in writings that also take into account how important technology, healthcare, and agriculture are to the growth of impoverished and emerging countries. Digital technology entrepreneurship provides commercial companies and the public sector with digital services, facilities, and solutions that consumers can only partially generate on their own, which helps to tackle a substantial portion of the challenges associated with the digitalisation of the economy. The global advancement of healthcare depends on the notions of creativity, innovation, and entrepreneurship. The healthcare industry has seen tremendous improvements over the years that have improved life expectancy and quality of life. A larger and more disadvantaged portion of society can be directly employed by and supported by the agricultural entrepreneurship sector, which has a huge potential to increase national income.
Keywords: Entrepreneurship; Economy; Development; Technology; Healthcare; Agriculture.

Analysis of entrepreneurial skills among the students of higher education system in India

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Abstract: The Government of India is offering a range of opportunities to the population for developing entrepreneurship and taking the economy to a new height. As per the 2019 Report of the Ministry of Skill Development, the campaign is teaching skills among one crore annually, and the pace is increasing with the time as the system, and supportive ecosystem has been already created. Ministry of Human Resource Development (MHRD) has come with the initiative of the Institutional Innovation Council (IIC) and Atal Ranking of Institutions on Innovation Achievements (ARIIA) for the ranking of higher education institutions. This ranking motivates the institutions to adopt practical and experiential learning for the students. The chairman and senior managing director, Accenture also emphasised to fill the gap of skills, especially in the area of artificial intelligence (AI) to capture the 1.97 trillion in the GDP of India. This report highlights the importance of skill development.

Keywords: entrepreneurship; entrepreneurial skills; higher education system; Skill India.

Reference to this paper should be made as follows: Solanki, N. and Mehta, Y. (2023) 'Analysis of entrepreneurial skills among the students of higher education system in India', *Int. J. Business and Globalisation*, Vol. 35, No. 3, pp.350–358.

Biographical notes: Nisha Solanki is a post graduate in Management and pursuing her PhD in Entrepreneurship. She is involved in teaching also. Her research area is entrepreneurship, HR and general management. She has also published various case studies and research articles in various journals.

Yogesh Mehta is a science graduate and has multiple post-graduate degrees such as MSc (Higher Mathematics), MBA (Finance), MCA, and Doctor of Philosophy in Management. He is an academician cum researcher, fond of analysing the primary and secondary data using advanced statistical tools. His research area of interest is finance, HR, marketing, and entrepreneurship. He is also one of the research paper reviewers of Inderscience and web of science journals, PhD supervisor, PhD thesis reviewer, and evaluator for various universities.

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Semantic Web of Things for pollution measurement and validation interoperability using AI Techniques

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Abstract

In response to the growing IoT device diversity, efforts are underway to better integrate data, applications, and services. The Semantic Web, known for its simplicity in integration, has the potential to improve data interpretation and interoperability. In this research, a pollution management model is used, combining the Semantic Web of Things (SWoT) and Artificial

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IMPACT OF COGNITIVE BIAS ON CONSUMER BUYING DECISIONS

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RESEARCH ARTICLE

FINANCIAL PLANNING BY WORKING WOMEN: TESTING FOR PERCEPTION ON SELF-RELIANCE, COMPETENCE AND PROBLEMS FACED

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ABSTRACT

The current research explores a significant financial dimension that involves women competing with men on equal footing. Due to increasing literacy rate among women, better educational and employment opportunities, and women empowerment friendly government policies, women are moving towards financial independence. Women must organise their finances at every stage of their lives in order to be prepared to tackle any unforeseen circumstances on their own. In order to be secure in the event of a financial crisis, women must be active participants and knowledgeable about all their financial planning. Irrespective of a woman being single, married, widowed or divorced, they must ensure their well being and financial stability. In this area, although some women are still reluctant getting involved, many have now started taking interest and being aware. Guidance can be sought from financial investment experts who can customise portfolios to cater to individualised risk tolerance and objectives.

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INTRODUCTION

When it comes to coping with issues affecting their lives, women are more compassionate, considerate, open-minded, and progressive. It isn't their investment conservatism; rather, it's a balancing act between forgoing their current happiness and their loved ones' future stability. As a result, they are more suited to use the money they have for a wise and moderately hazardous investment because of these attributes. The young women should take on greater risk and uncertainty to achieve their financial goals holistically. The risk occurs for several reasons, including physical limitations, career objectives, health concerns, family situations and expectations, employment market uncertainties, the need to maintain a particular lifestyle, etc. These factors may not be financial in nature but still they have an indirect influence on the task of financial planning. Quoting the words of executive vice-president and Head of Marketing Department (2014) of DSP Black Rock Investment Managers Pvt. Ltd.; Aditi Kothari, *"Women are inclined towards safety while investing and hence put more money in instruments that yield fixed returns.* "Women who separate from their husbands face significant difficulties when it comes to dividing their financial assets. Even with a limited number of options, decisions can occasionally be difficult to make.

OBJECTIVES OF THE STUDY

Following were the objectives of the study:

- To study the perception about self-reliance among women working in Higher Education Institutions with respect to their:
  - Marital status (Married /Unmarried)
  - Nature of Institution they work in (Private and Government)
  - Working experience (below 15 years and above 15 years)
- To study the perceived competence among women working in Higher Education Institutions with respect to their:
- Marital status (Married /Unmarried)
- Nature of Institution they work in (Private and Government)
- Working experience (below 15 years and above 15 years)
- To identify the problems faced by women working in Higher Education Institutions in the process of their financial planning with respect to their:
  - Marital status (Married /Unmarried)
  - Nature of Institution they work in (Private and Government)
  - Working experience (below 15 years and above 15 years)

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A Fractured Trust: Examining the Case of the Saradha Chit Fund

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ABSTRACT

The Saradha Chit Fund scandal of 2013 is a pivotal event in India's financial history. This case study explores the elements that allowed this extensive Ponzi scheme to thrive, eventually cheating investors out of over 4,000 crore rupees. It investigates the social and psychological factors that made investors susceptible to the scheme's promises and scrutinizes the Saradha Group's operational practices, revealing how they exploited regulatory loopholes in the chit fund industry. Additionally, the paper examines the alleged political connections and possible Naxal links that may have enhanced the group's perceived legitimacy and enabled it to operate without significant interference. Based on the insights gained from this case, the study offers recommendations to strengthen regulatory frameworks, enhance financial literacy, and promote ethical conduct within financial institutions. By addressing the vulnerabilities revealed by the Saradha Chit Fund debacle, this case study aims to contribute to a safer and more transparent financial environment for all investors.

Keywords: Saradha Chit Fund, Ponzi Scheme, Sudipto Sen, Chit Funds Act 1982, Saradha Group

1. INTRODUCTION

A Fractured Trust: Examining the Case of the Saradha Chit Fund

When someone has money to invest, they are always seeking a good investment scheme. But how can they recognize one? An ideal investment scheme should provide high returns and allow easy withdrawal of funds. Chit funds are one option that enables even those with lower incomes to invest and earn interest on their deposits.

As defined by Section 2(H) of the Chit Funds Act, 1982, a chit fund is a rotating savings and credit association system, commonly practiced in India. These schemes can be managed by financial institutions, unorganized money market players, or informally among friends, family, or neighbors. Some chit funds are tailored with specific savings goals in mind. They are especially popular in areas with limited banking access, where people prefer investing their money in a chit fund.

In a chit fund, a fixed number of investors commit their money with the promise that their investment will grow quickly with unaranteed returns. This system involves a specific group of subscribers making regular installment payments over a set period. A chit fund works by bringing together a group of members, known as subscribers. An organizer, who could be a company, a trusted relative, or a neighbor, forms the group and manages its operations. In return for their efforts, the organizer is compensated either monthly or at the time of withdrawal, though this fee might be waived in informal settings.

In a variation of the chit fund model called an auction chit, a designated lump sum (e.g., Rs. 100,000) is presented to a group of members through monthly auctions. Each member bids by proposing a discounted interest rate (e.g., starting at 5%) on the total amount. The member with the lowest interest rate bid wins the auction and receives the entire lump sum upfront.

Following the auction, the remaining members continue contributing their agreed-upon monthly share (e.g., Rs. 10,000) to a collective pool. This pool is utilized to pay the interest to the winning member and to accumulate the remaining sum. This cycle repeats for a fixed duration (e.g., 10 months), allowing each member an opportunity to participate in the auction to access the full amount. This approach offers potential advantages such as reduced interest rates for the winner compared to traditional loans. However, it also introduces competition and uncertainty. Members may not secure the auction early, leading to a delay in accessing the full sum. Additionally, the winning interest rate may vary based on the requirements of individual members.

How chit funds are registered?

The Chit Fund Act of 1982 governs the chit fund industry in India. Under this act, a "chit" encompasses any transaction, whether referred to as a chit, chit fund, chitty, kuri, or by any other name, where an individual enters into an agreement with a specific number of participants. Each participant commits to subscribing a certain sum of money (or an equivalent quantity of grain) through periodic installments over a defined period. Through a process determined

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A Novel Machine Learning-Based Model for Cardiovascular Disease Prediction

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Abstract*— This study addresses the urgent global health problem of heart disease (HD) by proposing an ensemble machine learning architecture for cardiovascular disease prediction. Typical HD symptoms include frailty, difficulty of breath, and swollen feet, but traditional diagnostic methods lack efficiency and precision. Accuracy is improved by using feature selection techniques like Recursive Feature Elimination (RFE) and Principal Component Analysis (PCA) inside the suggested model, which is an amalgamation of the Elastic Net, Logistic Regression, Gradient Boosting, and Extreme Gradient Boosting (XG Boost) algorithms. It makes use of all obtainable features for prediction using parallel processing. Compared to state-of-the-art approaches, experimental data show that the diagnosis accuracy is significantly higher. The precision of 92.86%, recall of 85.22%, F1-Score of 88.87%, and total accuracy of 88.30% are just some of the impressive metrics demonstrated by the models in the present research. In addition, the robustness of the model is validated by an Area Under the Curve (AUC) value of 0.95. The suggested ensemble model demonstrates superiority in precision when compared to other methods, which makes it a potentially useful technique for the prediction of cardiovascular disease.

***Index Terms*— Cardiovascular, Disease, Feature. Diagnosis, Heart, Machine Learning.**

I. INTRODUCTION

Heart disease (HD) affects many people, making it a major global health concern [1]. Weakness in the body, shortness of breath, and swollen feet are the HD symptoms that are most frequently experienced [2]. Slow execution and faulty Machine Learning (ML) models are two reasons why today's methods for diagnosing heart disease fall short. Researchers have made many recent attempts to bring new ML algorithms for early detection; however, there are still issues with efficiency and effectiveness [3]. Without a trained specialist and state-of-the-art equipment, diagnosing and treating heart disease could be difficult [4]. Numerous people's lives can be saved with the use of modern diagnostic tools. There are 3.6 million new HD patients per year worldwide, as reported by the European Society of Cardiology [5,6]. Heart disease accounts for about 3% of the healthcare budget; however, only about half of people diagnosed with the condition live for more than two years [7]. Congestive heart failure (CHF) is a progressive disease that takes time to infest the body and causes significant disruptions to the cardiovascular system's ability to perform its functions. Fig 1 depicts a picture of a patient with congestive heart failure and a normal heart.

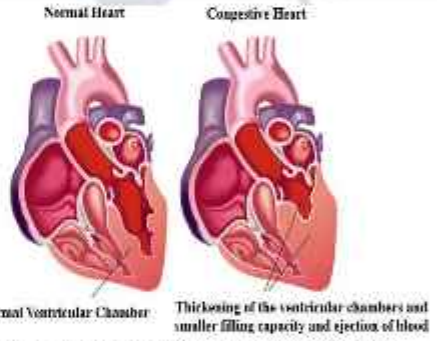

Fig. 1. Congestive Heart Failure [8].

Traditionally, the diagnosis of cardiac disease is based on the patient's symptoms, the doctor's knowledge of the patient's medical history, and the results of a physical examination. Identifying HD patients cannot be done with any degree of efficiency or precision using the results acquired from these procedures. In addition to this, these approaches are computationally challenging as well as costly [9]. The accurate diagnosis of HD requires developing non-invasive diagnostic tools based on machine learning [10,11,12]. The mortality rate for heart disease patients can be lowered with the help of expert decision systems that use machine learning and artificial fuzzy logic (AFL) [13,14]. The predictive machine learning models necessitate the correct data for their training and testing to function properly [15]. The effectiveness of the machine learning model can be significantly improved by using data sets that are evenly distributed for training and testing. In addition, the predictive skills of the model can be improved by selecting the appropriate and connected features from the data set. Therefore, picking the right characteristics for the model and

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Investigating the factors affecting sensory marketing based on consumer's perceptions

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Abstract
This article discusses sensory marketing as a strategic marketing approach that seeks to influence individuals' behaviour and emotions. The consumer seeks not simply to acquire a product or service, but also desires a personalized and unique experience associated with their purchases. Our survey study, consistent with previous research, demonstrates how customers assessed the atmosphere of fashion retail outlets based on their cognitive and emotional reactions. The integration of the four senses results in a synergistic effect, which refers to the customer's internal cognitive and/or emotional reaction to the stimuli present in the environment. The four senses, including sound, sight, touch, and smell, originate from them. According to the survey findings, this study highlights the significance of recognizing that the point-of-sale environment influences the customer's cognitive and emotional reactions through sensory marketing experiences. The answers encompass an increased sense of satisfaction and a heightened perception of product excellence experienced by the customer.

Keywords: Sensory marketing, emotional response, consumer behavior and point of sale

Introduction

The current state of the economy provides firms with an additional motivation to invest in sensory marketing, indicating their intention to do so. Historically, human senses have been neglected or considered as distinct from the field of marketing. Despite the significant significance that the senses play in human experience, this line of thinking has continued to prevail. Every person has a unique way of perceiving their surroundings, which can be attributed to their possession of the five senses.

Having a deeper understanding of an individual's sensory capabilities is likely to lead to a more efficient marketing strategy for a company, as well as a better tailored sensory experience for the customer. This scenario would be advantageous for all parties involved. The fundamental catalyst for the emergence of sensory marketing is the capacity of firms to differentiate themselves in the actual market or the specific market they are focusing on. Historically, the brands have achieved great success in terms of visual appeal, utilising elements such as colour codes, design, and logos (Dosquet 2015) [6].

Thus, sensory marketing provides a unique experience for customers. According to Dauce and Rieunier (2002) [5], sensory marketing is using the point of sale environment to evoke emotional, cognitive, and behavioural responses from customers to influence their purchasing decisions. The constituents of the selling points' atmosphere include tactile, gustatory, olfactory, visual, and auditory aspects. The tactile aspects encompass the physical properties of the materials used and the temperature inside the store. The gustatory factors refer to the overall atmosphere of the fashion store. The hearing factors pertain to the music playing in the surrounding environment.

Sensory marketing is a specific type of marketing that seeks to establish a deeper emotional bond with the target audience by appealing to the subconscious elements of the human mind. This type of marketing is commonly known as "experiential marketing."

This encompasses the customer's subjective experiences, encompassing their thoughts, memories, perceptions, and emotions, which are inherently personal and exclusive to them. Sensory marketing is a marketing strategy that aims to be a powerful tool for influencing both the attitudes and behaviours of consumers. The ultimate objective of the sensory marketing approach is to achieve this goal.

Blockchain in Healthcare: Overview of Applications, Challenges, and Future Directions

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Abstract

There are numerous healthcare issues which show the potential of blockchain technology such as transparency, interoperability and security of data. Through this study, it aims to offer a very deep explanation of where the Blockchain applications today stand for in the healthcare domain emphasizing on possible benefits from the technology and some known challenges that are being faced while adopting them. We focus our blockchain applications to the above mentioned aspects to explain different aspects of use of Blockchain in healthcare like supply chain management, clinical trials, secure medical data exchange and patient empowerment. We also talk about Blockchain from implementation point of view – smart contracts, consensus methods and data privacy. In this publication, we determine whether deploying Blockchain in healthcare raises ethical and legal issues and how existing issues can be addressed. In conclusion, we describe future directions for research and opportunities to use Blockchain to improve healthcare delivery and outcomes.

Keywords: Blockchain, healthcare, data security, interoperability, supply chain management, clinical trials, patient empowerment, smart contracts, regulatory compliance.

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इण्डियन जर्नल ऑफ सोशल कन्सर्न्स

A RESEARCH JOURNAL OF HUMANITIES AND SOCIAL SCIENCES
(An International Peer-Reviewed & Refereed Journal)
(कला–मानविकी–समाजविज्ञान–जनसंचार–विधि–वाणिज्य–विज्ञान, वैचारिकी की अंतरराष्ट्रीय द्विमासिक शोध पत्रिका)

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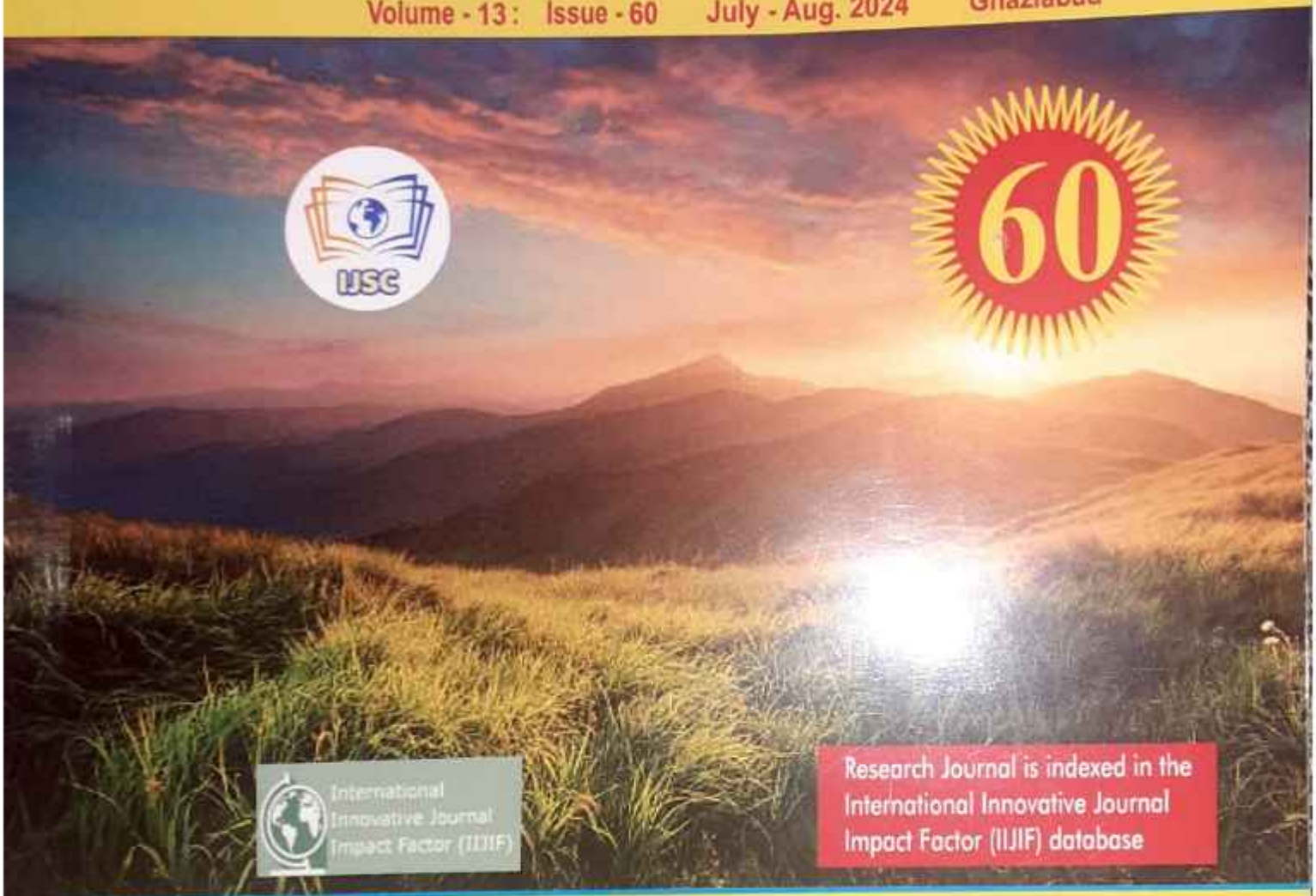

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अनुक्रमणिका

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UNVEILING GENDER DYNAMICS IN FINANCIAL AWARENESS AND RISK PERCEPTIONS AMONG COLLEGE GOING STUDENTS

Dr. Monika Tushir Bohra, Associate Professor, Maharaja Surajmal Institute, Delhi

Abstract:
This research delves into the awareness levels of college-going students, focusing on gender-specific insights regarding financial products for investment and risk perception. Assuming a foundational financial knowledge, the study aims to understand the awareness and risk preferences of future investors—college students. Through a questionnaire distributed to 179 participants, the data suggests a general awareness of financial products without significant gender-based differences. Additionally, the study reveals that gender does not play a significant role in shaping risk perception among college students. Furthermore, the interaction between investment awareness and gender does not impact risk perception. These findings provide valuable insights for financial institutions, banks, and the financial market to view college students as potential customers, emphasizing the importance of addressing their needs irrespective of gender.
Key Words: Financial Products, Investments, risks, college-going students

Introduction:

In the dynamic realm of financial markets, characterized by a multitude of offerings with varying risk-return profiles, a crucial consideration is understanding the awareness levels and risk perceptions of emerging investors gender-wise, specifically among college-going students. The evolving mindset of these future generations has the potential to reshape financial markets and product dynamics, influencing perspectives on risk and returns. This research aims to assess the awareness levels of college students regarding various investment options, assuming a foundational understanding of fundamental financial concepts such as budgeting, regular savings, and interest rates. Additionally, the study seeks to explore gender-specific risk perceptions of future investors in relation to investment options.

The insights derived from this research can offer valuable input to financial institutions, enabling them to design innovative financial products tailored to meet the evolving needs of future investors. Furthermore, the outcomes of this study can assist higher educational institutions in planning workshops, seminars, and conferences aimed at elevating students' awareness of diverse financial products and services, fostering financial literacy. Ultimately, this research contributes to empowering students with the knowledge needed to comprehend investment options, assess associated risks and returns, and make informed financial decisions.

Objectives:

1) To know the awareness level of college going students about the various financial products.
2) To examine the differences in the level of awareness related to various financial products gender-wise.
3) To know the risk perception towards financial products.
4) To understand gender-wise differences in the risk perception of college going students.

Grenze International Journal of Engineering and Technology, June Issue

Study of Health Promoting Behaviours and its Determinants for University Students in India

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Abstract— **The study examines the healthy behaviour of University students in New Delhi, India and infer association with socio demographic profile. A cross sectional study was performed on 286 University students in Capital City of India in the month of Feb-March 2023 to assess their healthy promoting behaviour. The survey comprised of two sections: first section had 11 questions related to socio demographic profile and second section comprises of 51 questions to assess Health profile of students using Health Promoting Lifestyle Profile (HPLP) II tool. The health profile was evaluated on six subscales i.e., health responsibility, spiritual growth, physical activity, interpersonal relationships, nutrition, and stress management. The overall 51-item HPLP tool had a Cronbach's alpha of 0.938 indicating good reliability.**

The data was analyzed using descriptive and inferential statistics to find the determinants for health behaviour of university students. The students showed an average score of 61%(2.44) for overall health behaviour. The highest average score 2.79 was obtained for Interpersonal growth and Spiritual growth. The average body mass index (BMI) of the students was 22.44 kg/m2, the BMI of male students was higher than female students. Interpersonal relationship was found to be determined by gender, BMI, faculty of study and physical activity was determined by gender and family income.

Index Terms— **Health Behaviour, HPLP, Regression, Anova, t-test.**

I. Introduction

A healthy lifestyle is an individual perspective on incorporating healthy choices in their life. Youth is generally considered as the healthy period; hence the government pays less attention to make them aware of the health promoting behaviour. In this age they experience an abundance of physical, social, mental challenges and are greatly influenced by culture, family, socio economic status, belief and individual preferences. Hence, we need to assess the health behaviour of youth and educate them to inculcate healthy lifestyle.

According to WHO report [2], the health of adolescent needs to be addressed as priority by all nations specifically developing countries. The report quoted that at least 20% of the youth are likely to experience some form of depression, mood disturbances, substance abuse, suicidal behaviours or eating disorders etc. Many boys and girls in developing countries enter adolescence undernourished, making them more vulnerable to disease and early death. Only 1 in 5 adolescents meets the WHO guidelines on physical activity. WHO has also pointed that non-communicable diseases are the major cause of illness and deaths worldwide specifically in developing countries and account for over 60% of deaths worldwide. Non communicable diseases are dependent on behavioral and

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Employee Attrition Prediction Using Machine Learning Techniques

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Abstract: *Effective employees are regarded as the most precious assets and the foundation of any business. Companies invest a lot of money in staff training programs because they believe they will pay off in the long run. Therefore, it is crucial to keep a long-term, promising staff; as has been seen throughout the years, this is one of HR's most challenging duties. This study aims to determine the key variables influencing employee attrition and develop a machine learning model to predict employee attrition based on the variables given. This will make it easier for management to spot workers who are likely to quit, allowing them to take preventative measures and make wise decisions about appraisal and recognition. The four most popular classification algorithms utilized in this study were KNN, Naive Bayes, Random Forest and Logistic Regression. It was shown that Naive Bayes classifier outperformed the others by 89% in terms of accuracy and produced more accurate predictions.*

Keywords: Naive Bayes, SVM, KNN, Logistic Regression and Machine Learning, Employee Attrition

1. Introduction

Employee attrition refers to the phenomenon of employees leaving an organization over a specific

Layoffs: Employees are laid off due to organizational changes, financial constraints, or a decrease in the demand for certain roles.

Parichay Maharaja Surajmal Institute Journal of Applied Research

G-20 Collaboration Worked for Attainment of SDG

Dr. Bhoomika Saroha[1]

Abstract

In the bedrock of financial turbulence globally, the forum of G-20 emerged for international governance and cooperation. With the passage of time & increasing complexities of the world, G-20 has gone beyond the sphere of economic and financial crises and contributed a lot to the Sustainable Development Goals across the various dimensions may be economic, social or environmental etc. India's presidency of G-20 in 2023 needs a special mention as it played a vital role to carry forward its objectives.

Keywords: G-20, SDG- Sustainable Development Goals, Globally, Economic

Introduction

G-20 initially owes its origin to 1997-98 financial crisis of East & South East Asian countries. Because of Global financial crises in 2008 it was upgraded to the levels of head of government. And in 2008 it was declared as the main forum for "International. Economic Cooperation":

G-20 comprises 19 countries and the European Union accounting for 85% of the GDP, 75% of international trade and about 67% of the world population .G-20 has 2 parallel tracks

- Finance track -focuses on financial & economic issues
- Sherpa track- socio economic issues

Objective of the Role

Role played by G-20 in attainment of SDG and their progress

Literature Review

- Furman et al 1998, accoreded G-20 the statue of the main forum for resolving economic and financial crises
- Kirton. J. J. 2016, highlights the role of G-20 in managing & overseeing the global financial system to say a few- creation of financial stability Board etc.
- Renu Modi, 2021 highlighted the positive role played by G-20 in economic and social areas of global governance and development.
- Rajiv Kumal 2021 explored the Importance of G-20 as an economic and financial forum by focusing on past performers and also the issues like balancing priorities and managing diversity
- Sach et al, 2022 - G-20 focused on mitigating the pandemic situation, challenges in international trade created by COVID-19.

Research Methodology

Research is based on secondary data that is published in newspapers, journals and the websites of national & international organizations. The G-20 envisions the SDG 2030 document as a **"living document"**. Then the contribution by the G-20 to ward's the global efforts can be seen as under

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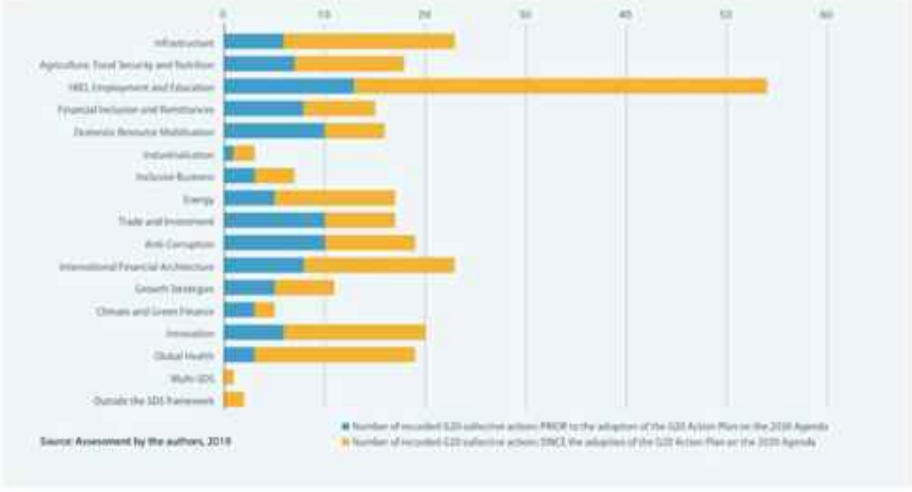

Number of Recorded G20 in Sustainable Development Sectors (2010-2019) Source: OECD by UNDP2019

G-20 worked to ensure balanced, sustainable and inclusive growth. To achieve this they used monetary, fiscal as well as structural policy tools.Focused on the revival of International trade along with the integration of developing countries, thus contributing

SDG 8- economic growth

SDG 10- on inequalities

SDG 17-regarding global partnership

Further it ensured free flow of FDI globally. Therefore bringing infrastructure and global trade to the forefront in the international markets and fostering industrialization.

In terms of social dimensions G-20 focused on human resource development, employment generation and educating the citizens of different countries so as to have an able & skilled workforce. Thus focus on SDG relation to education, health, etc.

From the environmental perspective it laid emphasis on climate and green finance as only 19% of carbon emission by G-20 is equated with EUR 30 per tonne of CO2. Issues like Clean Energy, Gender equality, Innovation & Cooperation are also being addressed in detail.

Conclusion

It can be clearly seen that G-20 has contributed positively a lot towards the SDG attainment and here needs Special mention of India's 2023 Presidency of G-20 which focused on further accelerating the progress of SDG by emphasizing on LIFE (Green Development, climate finance and Life for Environment); Reforms of multilateral institutions, keeping pace with technology transfer and development of infrastructure. And also to promote socio- economic development along with inclusive growth & development by making it- women led development.

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Scientific mapping of Green Finance Research: A Bibliometric Perspective

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Abstract

Purpose- Green finance is an essential instrument for combating climate change and a major force behind sustainable economic expansion. Green financing may support sustainable development, encourage innovation, and create green jobs by channelling financial resources towards environmentally conscious initiatives and activities.

Design, methodology, and approach- Using a bibliometric examination of more than 700 publications published between 2000 and 2024, this study investigates the development of green finance. Several important issues are highlighted in the report, including "Green financing," "Green bonds," "fintech," and " green innovation," all of which are crucial for advancing sustainable development and reducing climate change.

Findings- Most relevant articles appear in journals devoted to environmental and sustainability concerns, suggesting that green financing is an integrative discipline that bridges environmental sciences and finance. **Practical Implications-** However, the study recognizes certain limitations, including the potential exclusion of important studies and the reliance on authors' keywords, which may impact the precision of theme identification and clustering.

Originality- A key contribution of this research is the identification and emphasis on crucial sources, prominent authors, and key documents in preparation for the bibliometric paper.

Topics Mentioned- Introduction, Research Methodology, Descriptive Statistics Generation, Keyword Analysis, Thematic Map, Findings, Conclusion & Discussion, Future Research Directions

Keywords: green finance, bibliometric perspective, green innovation, sustainability

Introduction

Green finance has gained prominence recently due to the global agreement on environmental The worldwide agreement on climate change action, environmental preservation, and the 2030 Sustainable Development Goals of the United Nations (SDGs) have all contributed to the rise in popularity of green financing (Widagdo and Amidjaya 2019; Schulz and Dilory 2018). Additional terms for green finance include "climate finance," "sustainable financing," "environmental financing," and "green investment." Green finance reached a crescendo of relevance at the 11th G-20 session in Hangzhou, China in 2016 (Schäfer 2018; Liu et al. 2019), and it was covered and discussed in great detail. Multiple explanations of green finance draw attention to the various facets of the concept that the researcher deems significant, resulting in a range of viewpoints and degrees of interest in the area. The IFC (2009) defined green finance as financial mechanisms that promote economic prosperity, provide social justice, and safeguard the environment. The theory suggests that financial firms' policies promote the green economy, according to Lindenberg (2014). The "finance" aspect of the concept shows how capital and investments are distributed through financial systems (Weber & ElAlfy 2019; Berensmann et al. 2017).

Heart Disease Predictive Analysis Using Machine Learning Approaches

Publisher: IEEE

Abstract:
Machine Learning (ML) has found widespread applications in the healthcare sector worldwide, including the diagnosis and treatment of heart diseases, locomotor disorders, ... **View more**

Metadata
Abstract:
Machine Learning (ML) has found widespread applications in the healthcare sector worldwide, including the diagnosis and treatment of heart diseases, locomotor disorders, and various other medical conditions. ML methods have revolutionized healthcare by enabling the analysis of large and complex medical datasets, leading to valuable insights and predictions that aid healthcare professionals in providing better patient care. ML's ability to analyze vast amounts of healthcare data, uncover patterns, and make predictions has significant potential to improve patient outcomes, optimize medical workflows, and advance medical research. However, it's essential to address privacy and ethical considerations when using ML in healthcare, ensuring the responsible and secure use of sensitive patient information. Supervised Learning methods like SVM, Random Forest, and Logistic Regression are used for the analysis of the dataset downloaded from Kaggle. The various performance parameters such as Precision, F-1 score, Accuracy, and Recall were used to compare the performance of different ML classification techniques. Among the various methods evaluated, the Random Forest classification algorithm was found to outperform the other methods across the fourteen available parameters.

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HOW TO DEVELOP AND ANALAYSE SKILL

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ABSTRACT

A "Make in India" shouts could be heard inside Vigyan Bhawan in New Delhi on September 25, 2014, the day Narendra Damodardas Modi was elected as India's 15th prime minister. The "Make in India" initiative of Mr. Modi intends to make India a powerful industrial participant on the global stage. The capacity to conduct research to ascertain its acceptance, impact, and sustainability has been made possible by such a growth-oriented programme. The Make in India initiative may have an impact on a variety of difficulties, however few specialists have authored research papers on these topics due to its young beginning. To explore this work, a review of roughly twelve research publications was conducted.It was determined after examining a number of research that domestic and foreign enterprises might create jobs in India. In this article, the potential for skill development and the advantages of Make in India for employment were assessed. We must pay close attention to Indian workers if we want them to obtain the proper training to meet industrial norms. Only 10% of the workforce, according to the survey, receives formal training to help them develop the requisite abilities. Only 4.3 million of the 22 million workers are enrolled in the formal education required for the essential industrial training. It would be fascinating to watch if the "Make in India" initiative generates new employment or if there is a greater need for trained labour. But it became evident from reading several articles that India has a serious skills gap.

Keywords: Employability, Make in India, the skill gap, and skill development

1. INTRODUCTION

The MAKE IN INDIA initiative was the cornerstone of India's most recent plan to launch an economic revolution by presenting the nation as a hub for global manufacturing and inviting both domestic and international industrialists to invest in India, which will lead to the creation of employment and the general prosperity of the nation. The creation of jobs, lower-cost, higher-quality goods and services, economic growth, and industrial expansion are all supported by the manufacturing sector, which is the foundation of every economy. The creation of jobs and the improvement of skills across 25 different economic sectors are "Make in India's" main goals. The project's main objectives are to uphold high standards of quality and to minimise any adverse environmental consequences. It also places a lot of attention on improving the infrastructure, technology, and economics, all of which will promote the expansion of other businesses and sectors and improve the image of Indian industry abroad.

The MAKE IN INDIA campaign aims to improve living conditions, foster employment, and boost GDP per individual in the nation. If the manufacturing sector wants to create the highest-quality goods and compete on the global market, it must make significant investments in the newest technology, the design and construction of the required infrastructure, and the training of its personnel. If India wants to attract investors and become a centre for global manufacturing, its workers must obtain the requisite skills through skill development and upgrading in addition to gathering the necessary financial requirements. Agriculture only employs 51% of the workforce, yet it generates 17% of India's GDP. On the other hand, 22% of the workforce works in the industrial sector, which accounts for 26% of India's GDP. It has been shown that there is a sizable skill gap between the skilled labour force that is easily accessible and the skilled labour that businesses require. The manufacturing sector must develop at a rate that is sustainable and meets the government's aim of 10% in order for the "MAKE IN INDIA" initiative to be successful. In order to satisfy the industrial skill needs of the "MAKE IN INDIA" initiative, this article will examine the employability of the Indian labour force.

2. OBJECTIVES

1. To assess, via a review of the literature, how the "Make in India" movement has affected employment.

2. To determine if skill-development programs can decrease the skills gap in India's labor force and workforce through a literature review.

The analysis's goal would have been accomplished if subsequent skill-development initiatives had contributed to the success of "Make in India" in India

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3. METHODOLOGY

The "MAKE IN INDIA" initiative won't work unless the manufacturing sector grows at a sustainable rate and fulfils the 10% target set by the government. In order to satisfy the requirements for industrial skills set forth by the "MAKE IN INDIA" project, the employability of the Indian labour force will be examined in this article.

4. LITERATURE REVIEW

The industrial production of the globe is now ranked tenth. Around 28% of the total GDP and 17% of all jobs in the labour force are contributed by manufacturing. The amount of cash a manufacturing firm is willing to invest and the kinds of personnel it aims to attract will determine the company's foundation. To strengthen the health of the manufacturing sector and make it a top option for both local and international investors and industrialists, it is imperative to develop both fund-based and non-fund-based financial services. Manufacturing businesses must spend a lot of money on R&D, infrastructure development, the purchase of raw materials, staff training, and surviving the global competition (Goyal, Kaur, & Singh, 2015).

If India is converted into a manufacturing powerhouse that draws both domestic and global investors, the country's labour population will have plenty of employment opportunities (Goyal, Kaur, & Singh, 2015).

Only 13% of India's GDP in 2013 was accounted for by manufacturing, according to data from the World Bank. The GDP only accounted for 28% of the industrial sector's output. India makes up just 1.8% of global manufacturing. These statistics clearly demonstrate how poorly performing India's industrial industry is (Goyal, Kaur, & Singh, 2015).

The industrial output of the globe is now rated seventh. Manufacturing contributes around 28% of GDP and employs approximately 17% of the labour force overall. The foundation of a manufacturing business will be determined by the quantity of cash it is willing to commit and the sorts of personnel it intends to recruit. To strengthen the health of the manufacturing sector and make it a top option for both local and international investors and industrialists, it is imperative to develop both fund-based and non-fund-based financial services.

CAN MAKE IN INDIA CREATE OPPORTUNITIES FOR WORK?

India's economy has grown significantly over the past ten years, but not enough jobs have been created to support the country's expanding labour force. A reduction in India's growing unemployment rate would be aided by the 100 million more manufacturing jobs that would be generated. Make in India is the name of this initiative. Only 14% of Indian workers hold jobs that are regarded as official. December 2015 (Green). With the help of programmes like "Smart City Development," "Skill India," "Digital India," "Start up India," "FDI Enhancement," and "National Investment & Manufacturing Zone," India will become a centre for international manufacturing. Employment will increase significantly as a result of the increasing industrial demand. (2015) Goel, Narang, Kaul Sharma.

In light of MAKE IN INDIA, how important is skilled labour in the manufacturing sector?

If India wants to stay up with the manufacturing revolution known as MAKE IN INDIA, its share of the global economy must rise to at least 25%. To attain this, India requires a labour force that is physically healthy, educated, and competent. India's projected literacy rate for the year 2011 was just 73%, which is much lower than that of nations like China, Mexico, Malaysia, and Brazil, where the proportion is above 90%. In India, just around one in four people are literate. 2015 (Deodhar) (Deodhar)

The Indian labour force is flexible and educated. If a business wants to flourish and grow over time, it must invest in developing its people resources. If an organisation wants to prosper in the extremely competitive global market, it must continually invest in enhancing the knowledge, skills, and competences of its employees (Goyal, Kaur, & Singh, 2015).

In order to increase the bar for competence in the country's manufacturing sector, a novel manufacturing strategy that placed a significant focus on skill development was put into practise in 2010. The DGE&T was really compelled to develop the Modular Employable Skills (MES) system, which aims to develop the skills of less educated unskilled employees in the unorganised sector. The relevant industry integrates the necessary skills into the school curricula (Okada, 2012). The Federation of Indian Chambers of Commerce and Industries (FCCI) and the Chamber of Indian Industries (CII), two private sector organisations that offer seminars and workshops, have greatly promoted institutional change and increased public awareness of skill development.

Primary education must be made mandatory in India. The manufacturing sector's labour force needs to have a higher skill level. The Armed Forces and the Railways may be utilised to leverage this process since they have thousands of qualified and experienced workers for the introduction, maintenance, and upgrading of all sorts of mechanical and electrical equipment. Having such skilled staff members might be very beneficial for ITIs and other technical and industrial training centres.

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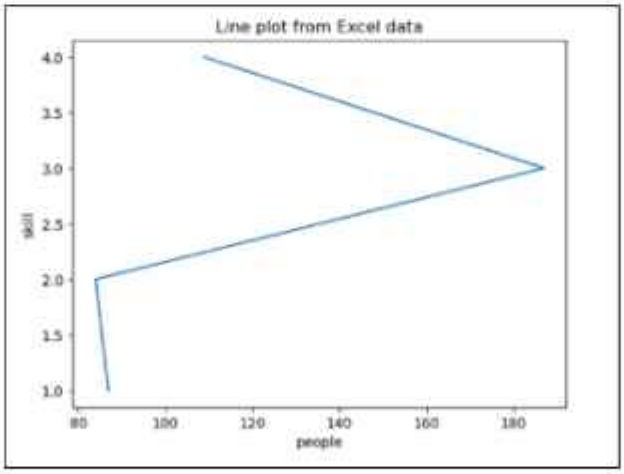
Government of India initiatives for skill development:

The proliferation of contemporary firms and the availability of brilliant, skilled labour have significantly aided India's economy's recent fast expansion. In view of the nation's rising economic success, it is crucial to emphasise the significance of the young of the nation acquiring and upgrading their knowledge and skills. India continues to have much lower skill levels than the rest of the world. According to Table 1, just 10% of Indian workers, or 2% officially and 8% formally, receive any type of skill training. Furthermore, 80% of new hires do not even have access to opportunities for training to upgrade their abilities, according to FICCI, Ernst &Young, September 2012. Due to the 12.8 million new workers that join the market each year, the Indian government is aware that there is a significant skills gap. It is likely that the majority of these new hires lack experience, which is to be anticipated (Okada, 2012).

Code to plot graph:

```
import pandas as pd
import matplotlib.pyplot as plt
# Read the Excel file into a pandas DataFrame
filepath = r'C:\Users\asus\Downloads\\data.xlsx'
df = pd.read_excel(filepath)
# Extract the x and y values from the DataFrame
x = df['people']
y = df['skill']
# Create the plot
plt.plot(x, y)
# Add axis labels and a title
plt.xlabel('people')
plt.ylabel('skill')
plt.title('Line plot from Excel data')
# Show the plot
plt.show()
```




```
creation skill =4
literature skill =3
finance skill = 2
tech skill= 1
import matplotlib.pyplot as plt
x=["Male","Female"]
h=[264,202]
plt.bar(x,h,width=0.3)
plt.xlabel('gender')
plt.ylabel('number of people')
plt.title("Males and Females in the survey")
```

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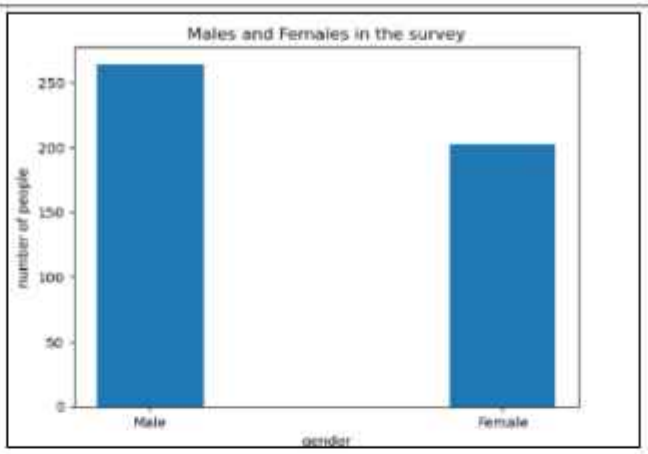
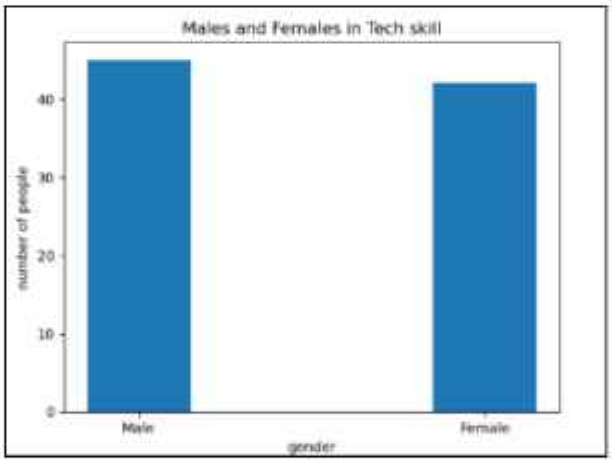
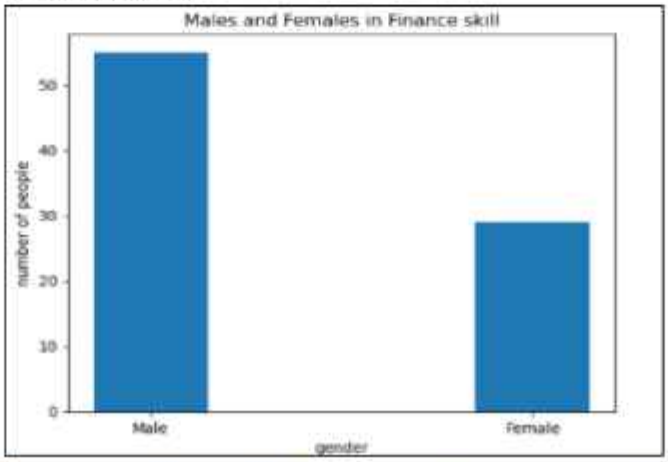



```
import matplotlib.pyplot as plt
x=["Male","Female"]
h=[45,42]
plt.bar(x,h,width=0.3)
plt.xlabel('gender')
plt.ylabel('number of people')
plt.title("Males and Females in Tech skill")
```




```
import matplotlib.pyplot as plt
x=["Male","Female"]
h=[55,29]
plt.bar(x,h,width=0.3)
plt.xlabel('gender')
plt.ylabel('number of people')
plt.title("Males and Females in Finance skill")
```



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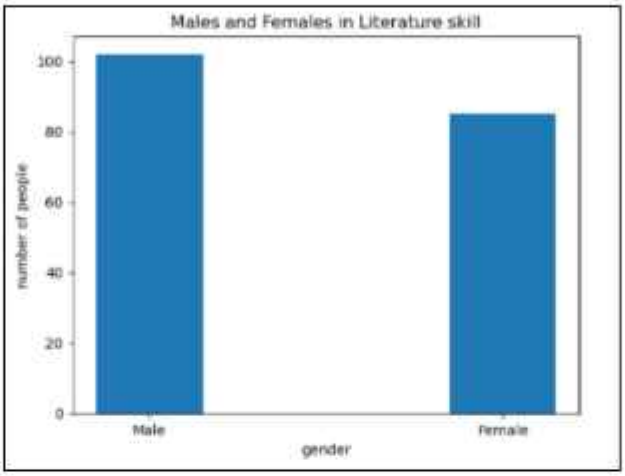
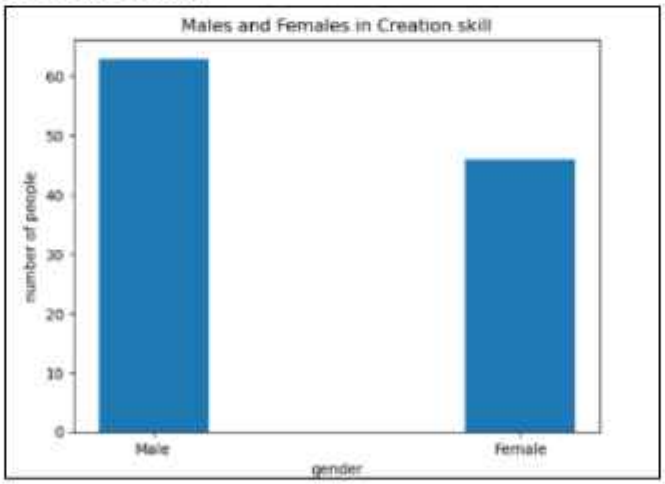
```
import matplotlib.pyplot as plt
x=["Male","Female"]
h=[102,85]
plt.bar(x,h,width=0.3)
plt.xlabel('gender')
plt.ylabel('number of people')
plt.title("Males and Females in Literature skill")
```




```
import matplotlib.pyplot as plt
x=["Male","Female"]
h=[63,46]
plt.bar(x,h,width=0.3)
plt.xlabel('gender')
plt.ylabel('number of people')
plt.title("Males and Females in Creation skill")
```



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Article

Mapping the Evolution of Sensory Marketing: A Bibliometric Analysis

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Rupa Rathee[1], Monika[1] and Pallavi Rajain[2]

Abstract

In recent years, sensory marketing, particularly in the context of atmospheric and ambient environments, has witnessed substantial growth in research activities. However, despite this proliferation of studies, there has been a lack of comprehensive scientific mapping in this domain. To address this gap, this study employs bibliometric analysis to examine the body of research in sensory marketing. Data were extracted from the Scopus database using article classification, a journal coverage criterion. The analysis used the Biblioshiny application within the bibliometric package developed in R-Studio and VOS Viewer. The findings indicate an exponential growth in research within this field, with most publications originating from the United States of America and China. Key topics that emerged prominently in this research include 'sensory marketing', 'sensory brand experience', 'customer satisfaction', 'five senses', and 'aesthetics'. In this article, the core elements of sensory marketing are defined as 'background music', 'advertising', and 'sensory brand experience', offering valuable insights for marketers seeking to leverage sensory marketing for long-term benefits. The study makes a variety of contributions. It details the development of sensory marketing during the last few decades. In conclusion, sensory marketing is a complex strategy that harnesses the power of the human senses to provide memorable brand experiences. The study shows the scope of assisting future digital sensory marketing in shaping consumer perceptions and preferences and

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Certificate of Acceptance & Publication

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Signed Ankit Agarwal ***Date*** 30-04-2024

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CHAPTER

19 Fostering Collaboration and Teamwork: Fuelling Creativity in Children

[1]Dr. Promila Dabas

Abstract

Collaboration and teamwork have a quintessential role to play in fueling creativity in children. Collaboration and teamwork arepowerful tools that help children in a variety of ways. It increases creativity, improves problem solving and reasoning ability, enhances productivity, helps in building stronger relations and provides a greater sense of purpose to achieve a common goal. Collaborative learning, also known as Cooperative learning, is an approach of education in which students learn through interaction with each other and they have a shared responsibility for academic achievement. Lev Vygotsky, a Russian psychologist has been credited for stating the Social Interactionist theory according to which we learn through interactions with our peers, parents and teachers. It explains how people can learn in different social settings and how creating a more active learning environment can positively impact a learner's ability and help meet individual learner goals.

***Keywords**: Collaboration, Creativity, Student, Teacher, Teamwork, Problem Solving, Group Work.*

How Collaboration and Teamwork Fuels Creativity

a. **Creativity:** Creativity is not easy to define. The subject of creativity is very vast and complex. It is not specific to a particular field. Creativity is an attribute which is possible in all fields and at all levels. From a rural household to an urban city, from a primary classroom to a secondary classroom, from a profession related to menial work to a job requiring higher order thinking skills, Creativity is the factor which is present everywhere. Creativity is the ability to generate novel and out of the box ideas. A creative person uses all his senses. Creativity depends on a range of factors such as flexibility, experience, efforts, knowledge, intuition, motivation, and

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from Maharaja Surajmal Institute, GGSIPU, Delhi has presented the paper titled The Green Advantage: Leveraging Technology for Sustainable Transportation at the **ICSSR** Sponsored **1st International Conference on Business Research and Innovation (BRAIN'24)**, held on **9th - 10th August 2024** at the Department of Management Studies, Netaji Subhas University of Technology, New Delhi.

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Dr. Dinesh Kumar
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CORPORATE GOVERNANCE COMPLIANCE IN CENTRAL PUBLIC SECTOR ENTERPRISES OF INDIA

Renu Hooda*

Purpose: *Abrupt failure of corporations around the world resulted in formulation of guidelines concerning good governance by various authorities. This paper examines the adherence level of the CPSEs of India via CGI.*

Design/Methodology/Approach: *Data were collected from annual reports of Maharatna status CPSEs of India from 2009-10 to 2018-19 using content analysis and further analyzed using statistics techniques such as mean, standard deviation and coefficient of variation.*

Findings: *It is found that the compliance score of all the sampled companies was improved during the period under study, except, of ONGC. For variable-wise compliance, sampled companies showed a highest compliance for disclosure reliability variables with minimum variation.*

Originality/ Value: *This study is among the few studies conducted in India to evaluate companies' as well as variable wise adherence level. This paper assists the policy makers to determine the possible changes and evaluating the present corporate governance guidelines effectiveness.*

Keywords: *Corporate Governance, Corporate Governance Index (CGI), CPSEs, Board structure, Committees, Disclosure, Senior management.*

JEL Classification: *G18, G3, G34*

Corporate governance has been addressed by the corporate in their functioning since 1900 centenary. But the term has become popular among the corporate in the 1970s following the savings and loans crisis across the world. Further, it has become buzz word in the late 20th century and early 21st contrary due to several corporate failures such as Enron scam, WorldCom (US), Barring Bank (UK), Polly Peck (UK), Satyam Scam 2008 (India), and the global financial crisis 2008 across the world. These corporate failures lead to formation of various corporate guidelines and policies across the world to protect the interest of all stakeholder and management and India is far away from this. The companies act 2013, has defined the term "corporate governance", as, "the relationship between the investor, the management team and the board of directors". However, there were several committees has been formed since 1990s such as Birla committee, Naresh Chandra committee, Naryana Murthy committee and J. J. Irani committee (Hooda & Chhikara, 2020).

There were several studies have been conducted in the past to address the issues of corporate governance in the organisational context (Rajput & Jhunjhunwala, 2019) (Garg, 2007). Literature in this arena is focused towards impact of corporate governance and its impact on performance in the listed companies where as there is paucity of literature in the context of public sector undertakings. To address the corporate governance focusing the public sector undertaking, the researcher has focused on the corporate governance disclosure and its impact on corporate performance using the content analysis method of qualitative research.

This paper is framed as follows; next section discusses the literature review in the corporate governance their impact on performance of public sector undertaking in India.

I. Review of Literature

Dwivedi, N & Jain, A.K. (2005) studied corporate governance compliance of 367 listed companies from 1997-2001. The results of the study show that statistically weak but positive impact of board size and foreign ownership on the firm value. Whereas public shareholding has negative linear relationship and directors' holding has nonlinear association with firm value.

Kumar, N., & Singh, J. P. (2013) studied the corporate governance compliance of BSE listed companies during 2008-09. The findings presents that board size is negatively associated with the firm value. Whereas the promoters' shareholding shown a positive association on firm value.

Chatterjee, C & Nag, T. (2018) assessed the top 20 listed companies of India and China and identified that for Indian companies, CEO duality has favourable influence on economic performance and in case of Chinese firm; higher percentage of independent directors. Auditors' quality and board size have no effect on ROE.

* **Assistant Professor, Department of Business Administration, Maharaja Surajmal Institute, GGSIPU, New Delhi, India**

Publications

JIMS 8i

Introduction to Virtual Reality and Augmented Reality: Concepts, Applications, Implications and Challenges

ABSTRACT

This research paper provides an in-depth introduction to the concepts, applications, and implications of Virtual Reality (VR) and Augmented Reality (AR) technologies. It explores the fundamental principles that underlie VR and AR, their historical development, and the technological components that enable their immersive experiences. The paper delves into the diverse range of applications across industries, highlighting their impact on fields such as entertainment, education, healthcare, business, and beyond. Additionally, the ethical, social, and psychological implications of these technologies are discussed, along with potential future trends and challenges

KEYWORDS

Virtual Reality (VR), Augmented Reality (AR), 3D Visuals,Mixed Reality (MR)

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Original Article

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AI-Powered Talent Management: Revolutionizing Recruitment, Retention, and Employee Development

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ABSTRACT

Amidst the current practice of human resource management, strategic implementation of Artificial Intelligence (AI) is reconstructing the conventional talent management. The following paper aims at focusing on the possibilities that can be brought by AI in improving the practices of personnel acquisition, staff loyalty, and personnel training of organizations. This paper seeks to argue that AI analysis can be used to filter and match the right candidates with specified positions without any prejudice. Additionally, AI technologies help in training; providing tailored employee development programs to the various employees as a result of accumulated data, after which they are helped to improve their skills throughout their employment tenure. The paper also addresses the prospects of the use of AI in enhancing staff satisfaction and reducing high turnover rates by estimating possible turnover and ranking those employees in need of increased attention. This study, therefore, presents a synthesis of literature and case findings on the opportunities and risks linked with integrating AI in talent management. Consequently, the findings raise awareness about the importance of a purposeful AI implementation in organizations where employees are willing to enact the ethically sound and institutionally endorsed AI strategy that facilitates a more efficient, adaptive, and self-governed workforce.

Keywords - Artificial Intelligence, Talent Management, Recruitment, Employee Retention, Employee Development

Introduction

More and more it has become understood that talent management is one of the main determinants for competitive advantage in contemporary fast-changing business world. Categorical strategies for recruitment, retention, and human capital growth are measured insufficient to correspond to the present multifarious staff populace. However, with the arrival of artificial intelligence (AI), there is also an unmatched opportunity of improving the identified processes to be more effective and fair, oriented toward achieving the organization's objectives.

Machine learning techniques, neural networks, NLP as well as data analysis are now the core drivers of change in

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CERTIFICATE OF PARTICIPATION

This certificate is awarded to ***Dr. Mamta Gupta*** of ***Maharaja Surajmal Institute, New Delhi, India*** for contributing his/her paper titled ***"Influence of Green Supply Chain Management Practices on Organization Performance:An Interpretive Structural Modeling Approach"*** in 3rd International Conference "EFFECTIVE LEADERSHIP TECHNIQUES IN TURBULENT TIMES: RECOVERY, RESILIENCE AND ADAPTATION OF SUSTAINABLE BUSINESS MODELS" held on Tuesday 5th December. 2023

Prof. S. Priyadarshnie	**Prof. Payal Pahwa**	**Sh. Vinod Vats**
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Examining the Psychological Implications of E-Training and Development on Professional Performance

Sona Vikas
The NorthCap University
Gurugram

Ashish Mathur
Jai Narain Vyas University,
Jodhpur

Mannat Singh
Guru Gobind Singh Indraprastha
University, Delhi

Technological advancements have brought about a revolution in education, just as they have in almost every other aspect of human existence. The use of technology-based training is increasing, potentially as a supplement or alternative to conventional ways of education. The objective of the current research was to ascertain whether there existed a correlation between electronic training (e-training) and enhanced productivity in the workplace. Assessing a company's level of expertise by conducting a training needs analysis. In this manner, the firm can enhance performance, enhance the quality of its products or services, and increase customer satisfaction by providing training to its employees. This study demonstrates that all facets of E-training and development have a substantial impact on E-training. The efficacy of an organization's E-training and development endeavors hinges upon the caliber of its foundational infrastructure, its online training methodologies, and the overall efficiency of its training system.

Keywords: Electronic training, efficacy, Enhance Job performance.

The phrases training, education, development, and learning are frequently used interchangeably; however, their definitions might significantly differ depending on the specific situation. Employees must possess a comprehensive comprehension of the organization's objectives, thereby necessitating the establishment and delineation of these goals. Employee training is specifically focused on the acquisition of skills specifically required for a profile through training while on the job, while education is more closely related to a formal academic background. Some say that in the modern and constantly changing workplace, both skills are necessary to fully unlock an employee's potential.

According to Hughey and Mussnug (1997), practical experience is a crucial component of every training plan. According to Overman (1994), individuals tend to disregard what they hear but instead focus on what they remember and the experiences they encounter. Professional development encompasses a wider scope of activities than only learning and training, despite the fact that it does entail these components. According to the CIPD, the term "development" was initially introduced in the 1950s and currently carries a similar meaning to "training" (2007). Kitson (2003) advises against integrating training and development in this manner. According to him, "training" refers to a "learning activity focused on immediately improving one's performance in their current job or role," rather than "education." Development, on the other hand, refers to deliberate educational endeavors aimed at achieving future outcomes, such as preparing for a specific occupation or profession. According to these findings, the concept of "learning" should include both "training" as well as "growth."

Well-designed training programmes can significantly enhance a company's financial performance. Furthermore, it has been discovered to avert lethal errors in high-risk situations involving human-machine interaction. According to a study conducted by Senders and Moray (1991), human error is responsible for a significant proportion, ranging from 30 to 80 percent, of serious occurrences.

While searching for a more exact description, alternative words such as "virtual learning" and "online learning" The word "E-learning"

Mannat Singh

A STUDY OF PERCEPTION OF PARENTAL ATTITUDE AND PERSONALITY DISPOSITION IN STUDENT DRUG ABUSERS: A LONGITUDINAL STUDY

Mannat Singh[*] and Anu Singh Lather[**]

ABSTRACT

This paper makes an attempt at understanding the relationship between the personality of an individual with the perception of that individual of parental attitude among two major groups, namely, drug abusers and non-abusers. This study is a longitudinal study which has been conducted, as an extension of an already existing research of the year 1985. The study conducted in the year 1985 was replicated to understand the evolution that may have taken place in terms of personality disposition as well as perception of parental attitude among the two groups. Personality dispositions comprise of anxiety, hysteria, mania, paranoia, psychopathic deviation, repressor sensitizer, Schizophrenia, and K (Lie). Perception of parental attitude comprise of Parental Identification, Rule Enforcement, Sex-role Enforcement, Achievement Standards, Family Harmony, Mother Positivity, Mother Democracy, Father Positivity, and Father Democracy. Both the phases of study include only male respondents. In 1985, total number of respondents were about 310, out of which 150 were abusers and 150 were non abusers. In the second phase of study, 100 respondents were interviewed, out of which 50 were abusers and 50 were non abusers. The first scale that has been used to understand personality disposition is, Multi Phasic Personality Questionnaire which was created by Murthy, Laxminarayan, Satyavathi (1964). Scale used to understand the perception of the groups about the Parental Attitude is a Questionnaire by Spence and Helmreich which was created in the year 1979. This is a quantitative study which was analyzed by using statistical tools such as ANOVA

KEYWORDS: Drug Abuse, Parental Attitude, and Personality Disposition, Students

Introduction

Humans are known to consume psychoactive plantation which can be dated back to about a millennium by ancient agricultural societies for re creational purposes. Humans tend to explore with alteration of experiences in their lives. Humans may do it for different reasons which could vary from recreational uses, to social engagement, to medicinal purposes. We have seen that early men used to use the bush Kaishe which is known to make people go "mad" temporarily. However, we may not have much evidence to indicate that early men frantically used plantations for such experiences. We do however, have evidences regarding existence of cannabis in Europe in 5700 BC and in Asia in around 8100 BC. Greeks have been known to use cannabis in 450 BC. Existence and usage of opium has been dated back to 5100 BC. Tea is known to have been discovered and used in 2373 BCE. Coffee was first created in 800 AD. Various narcotic drugs such as 'hyoscyamus' and hemilock' are known to be used. (Crocq, 2007)

The drug problem, however, has forced itself rather dramatically into the public eyes due to its overly rampant usage across the globe. "About 11.8 million people die due to usage of drugs which include smoking, alcohol and other drugs. And 11.4 million people die

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Mannat Singh

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Mental Hygiene and Health

Dr Vanita Anand[1], Dr Promila Dabas[2], Dr Vipasha Rana[3]

ABSTRACT

The World Health Organization defines Health as an all round well being of an individual in terms of physical, social and mental aspects and not just the absence of illness or disease.

Mental Health includes rehabilitating mentally sick, preventing all forms of mental disorders, reducing stress in day to day life and attaining a state of attainment of well being that helps the individual work optimally as per his/her mental potential.

In the recent years, a lot of importance and stress is laid upon the importance of mental health in facilitating attainment of global development goals, as it has been included in the Sustainable Development Goals.

In simple words, mental hygiene is a set of healthy habits that aim to keep us mentally healthy.

First of all, one needs to differentiate mental hygiene and mental health. Mental hygiene is a means to attain mental health. Mental Hygiene is "means" and Mental health is "end".

American Psychiatric Association (APA) defines mental hygiene as scientific approach that helps prevent mental illness and restore mental health by curing mental illness

The key here is prevention and preservation. Mental hygiene mainly concerns itself with positive activities and programmes that help preserve mental health and prevent metal illness.

MENTAL HYGIENE AIMS TO:

Realisation of potentialities: Providing opportunities where one's inherent potential is realised to ensure prevention of frustration.

Positive attitude: Mental hygiene promotes positive attitude towards life and work and encourages a person to utilise their potential and solve the problems of life with an attitude of hope.

Harmonious development: It is not just emotional health but the all round development of all aspects of one's personality such as physical well being, emotional maturity, social adjustment etc

Effective Adjustment: Mental hygiene helps one to adjust well in all areas of life be it home, school, work, society, relationships etc. It focuses on effective conflict management and problem solving approach.

STRATEGIES TO PRACTICE MENTAL HYGIENE

Realistic Approach: A realistic approach towards one's strengths and weaknesses can help one avoid many disappointments and frustrations in life. A knowledge of our abilities, aptitudes help us keep realistic in our expectations from ourselves resulting in right decisions and consequently minimising failures.

Emotional Maturity and control: Emotional maturity and a control over one's behaviour and impulses is essential for a healthy adjustment. This helps keeping calm and composed while responding to tough situations.

Self esteem: Awareness of self, knowing one's values, beliefs and feelings, and having positive self esteem are essential contributors to mental health.

Positive Thoughts: The quality of thoughts determine one's mental health as negative thoughts such as hatred, fear, jealousy, anger etc evokes negative emotions and consequent behaviour and reactions. However, positive thoughts such as joy, hope, compassion, love etc evoke optimism and empathy. Such emotions add positive energy in one's behaviour to cope with daily life problems and challenges.

LIFESTYLE FOR GOOD HEALTH INCLUDING MENTAL HEALTH ACCORDING TO AYURVEDA:

Ayurveda, the science of Indian medicine, talks about importance of four major areas that contribute to good health.deals with four aspects of lifestyle which can ensure good health in us.

Ahara

Achara

Vihara

Vichara

Ahara (Food): A person is what they eat. Our overall health, mental as well as physical, is majorly impacted by what we eat. Eating food that is good for mood, is rich in vitamins and minerals, including whole foods in diet, staying hydrated,

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Future of Digital Commerce with Online Network for Digital Commerce

Abstract: *Open Network for Digital Commerce (ONDC) is a revolutionizing and ground-breaking initiative first announced in 2020 that is aimed to forever change the world of digital commerce by using new concepts like openness and inclusivity. It is designed to provide safe and secure interoperable digital transactions that go beyond geographical boundaries, enabling users to participate in businesses of all sizes and economies. It also provides standard formats and APIs to ensure cross-compatibility between different platforms, marketplaces, and logistics support. ONDC also puts a great amount of care and emphasis on data privacy, security, robust transactions, and encryption and also encourages user empowerment and allows an individual to manage their data and information to produce maximum trust and transparency between participants.*

This platform also aims to bring new opportunities by supporting merchants of all levels despite their scale and size and helping them get on online platforms. It will allow both consumers and sellers to engage and trade online regardless of the platform they are using. It is an initiative provided by the Department for Promotion of Industry and Internal Trade (DPIIT) under the Ministry of Commerce and Industry. It was implemented and registered as a non-profit company on December 31, 2021.

Keywords: *Digital Commerce, Open commerce, ONDC, Online Networks, Digital Market, Open Trade, Commerce Evolution*

I. INTRODUCTION

To understand Open Network for Digital Commerce (ONDC), this paper first focuses on a glimpse of its core – Digital commerce. Digital commerce can also be referred to as E-commerce which is a process where companies and individuals can buy or sell goods and services digitally (over the Internet). It can be operated in different types of target markets and can be achieved through computers, mobile phones, or any other smart devices with access to the Internet. Almost anything can be bought or sold through Digital commerce, and it is also an alternate or substitute for old Commerce models such as stores (and may include old models like B2B, B2C, C2C, and C2B). The roots of Commerce go back to the early 1960s, and back then, Electronic Data Interchange (EDI) was used as a standard for transactions, but as time passed, it revolutionized and gained popularity as it is today [1].

It is very important for business and trade providing various features and advantages over old commerce models. First of all, it provides global reach to everyone in the world who can access the internet, which removes any geographical barrier for trade and commerce. It also makes services accessible to everyone in the world and very convenient & time saving without actually having to go visit the place. It saves money and enhances the customer experience and satisfaction which in turn results in giving a boost to commerce and trade.

ONDC is a global initiative that aims to promote an open network for commerce or exchange of goods and

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Study of EKC Hypothesis and Long Run and Short Run Linkages between CO_2 Emission, GDP, Coal Consumption, power Consumption and Renewable Energy in India

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Abstract-In this paper we used most recent and robust econometric technique for estimation of cointegration to provide decisive proof on the linkage between CO_2 emission, electric power consumption, electricity production from coal source, renewable energy consumption and economic growth in India from 1971-2014. Furthermore, the study also explored the Granger causality among the variables. The empirical result suggest that the variables are cointegrated and hence suggest the existence of long term relationship between the variables. Granger Causality test reveals strong evidence of bi-directional causality from CO_2 emission and renewable energy consumption as well as unidirectional causality from GDP, electricity production from coal source, electric power consumption to carbon emission. The implication of the results is further discussed.

Keywords- ARDL Error Correction Model, Environment Pollution, Johansen Cointegration, Granger Causality, EKC hypothesis.

I. INTRODUCTION

Coping with the development goals, countries generally face dilemma in choosing between policies favouring economic growth over environmental sustainability. It is prominent in developing economies like China and India, where energy usage has increased over the years as does the economic growth. This study focusses on India which is the fast growing economy in the world and tries to find the conclusive evidence how the policies can be amended to go with the sustainable development. Energy is an important factor contributing towards economic development. In India coal is the prominent source for energy and in terms of total energy it is nearly 75% in 2015. Any effort made to lessen it may have unswerving effect on the economic growth. However, renewable energy percentage to total energy usage is merely 5.3% , though we have observed its increasing trends in the past years. Figure 1 shows the increasing trend of these variables in the past forty four years. This study comes up at specific time when India has recorded 7.4% annual growth in GDP and the consumption of coal is ever increasing and making it one of the third largest consumer of energy in the world. In contrary, the pressure on countries to reduce CO_2 is ever increasing after signing of the Kyoto protocol by United Nations Climate Change, (United Nation Climate Change : Kyoto Protocol - Targets for the first commitment period) and Paris Climate Agreement signed in

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COMPARISON OF VARIOUS YOUTUBE TRANSCRIPT SUMMARIZER TECHNIQUES

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ABSTRACT

In this paper we aim to create a hassle-free user experience through which a user can summarize any youtube video and save it and use it again at any given point in time. In this paper we will compare the existing youtube transcript summarizer techniques. In any instance, there is a staggering number of video recordings that are available on the internet, and also more are being created at the same time as well. That effort can be in vain if we find it hard to find time to watch longer-than-expected movies, and if useful information can't be extracted from them. Automatically summarizing movie transcripts like this can quickly identify important patterns in your videos, saving time and effort by not having to review the entire content. This work uses a flask server for text transcription. Then natural language processing (NLP) is used to summarize the transcript. About the front end, it is built using react. The website has all the necessary features which a user may require such as saving the notes for review, and a folder structure to organize similar notes. Also, we have compared the different algorithms usedto summarize text on the server as well based on some metrics such as time taken, cosine values, and more.

Keywords: Summarization, Natural Language Processing, Hugging-Face Transformers, LSA Algorithm, Text Rank Algorithm

1. INTRODUCTION

About 500 hrs of video content is being shared on youtube at any passing minute. The number of active YouTube users is about 2.5 billion users in 2022 and is growing rapidly year by year. According to a Google survey, nearly a third of YouTube viewers in India watch videos on their mobile phones and spend more than 48 hours a month on the website [1]. That is all fine if you are using youtube for entertainment purposes but it gets tricky if you want to learn something or just get an overview of a topic very quickly but the content available is in hours. That's the exact problem that can be solved using automatic summarization tools [2]. Searching for videos that contain the information you're looking for can be thwarting and long-delayed. For example, there are several videos on the Internet talking about a specific topic, but it is difficult to know what the speaker is trying to convey to the audience without watching the entire video. That's why an automatic summarization tool is the need of the hour. The tool we have used uses NLP (natural language processing). In natural language processing, there are two types of summarizations: abstractive and extractive. In extractive summarization we take sentencesas it is from the original text which seems relevant and more important, no modification is done. But, in abstractive summarization, it tries to guess the meaning of the sentences and creates its own words and sentences for the important information. We are using the abstractive summarization method in this work. To implement these algorithms, we use python as our primary language. Python has various packages that are very useful [3]. Access to YouTube content is now simplified through APIs in Python libraries such as B.Video transcripts, etc. We use this to our advantage to directly access video transcripts, aggregate them and display them to the user. There is also another algorithm that is already modeled in python known as the hugging face transformer. That too is also used in this work for comparison.

2. METHODOLOGY

As a videotape summarization system, it brings powerful expertise. Algorithms based on machine learning models require high processing power. Recapturing a videotape based on cut lines is the easiest way to summarize a videotape. It's easier and faster to work with text than it is to train colorful videos. Machine Learning models can be used to achieve this.

YouTube Video:

The variety of YouTube videos includes short films, music and audio clips, spot movies, images, audio recordings, commercial film camps, live channels, vlogs and other content from popular YouTubers. Over 1 billion hours of videotapes are watched on YouTube every day. Therefore, YouTube videos were considered as data for the proposed algorithmsto add videotapes. The YouTube Paraphrase API retrieves slogans from a specific videotape using links [5]. Video downloading process is not convenient and requires a lot data and storage. For this, you must first copy the url of the video and paste the url to the YouTube video downloader website. This loading system takes time. Pytube is a very lightweight and powerful Python library used to seamlessly download videos.

DRIVER DROWSINESS DETECTION SYSTEM

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Abstract - Driving requires constant attention and focus, but factors like long hours on the road, monotonous scenery, and sleep deprivation can lead to driver drowsiness, a significant cause of road accidents worldwide. To tackle this critical issue, the Driver Drowsiness Detection System has been developed.
The Driver Drowsiness Detection System is a crucial component for ensuring road safety by addressing driver fatigue and drowsiness. This project utilizes Python, OpenCV, Imutils, and Dlib libraries to develop a robust system capable of monitoring the driver's facial features, detecting signs of drowsiness, and taking proactive measures to prevent potential accidents.
The system employs real-time facial recognition and tracking to monitor the driver's face. It accurately detects the driver's eyes and mouth and calculates their aspect ratios to assess the driver's level of drowsiness. When significant signs of drowsiness are detected, the system triggers an alarm to alert the driver and prompt necessary action.
In the event of three consecutive alarms, the system initiates a series of precautionary measures. These include automatically reducing the vehicle's speed, activating parking lights to signal potential distress, and transmitting the driver's location to their last dialed contact. The Driver Drowsiness Detection System serves as a crucial tool in preventing road accidents caused by driver fatigue and drowsiness. By providing timely alerts and taking proactive safety measures, this system aims to reduce the risk of accidents and ultimately save lives on the road.

Index Terms - drowsiness detection, yawn detection, facial landmarks, OpenCV, Dlib, shape predictor

I. INTRODUCTION

The problem of driver drowsiness detection is a critical safety concern in the automotive industry. Drowsiness or fatigue can cause a driver to lose focus and attention, leading to accidents and fatalities. The goal of the driver drowsiness detection system is to identify when a driver is experiencing drowsiness or fatigue and alert them before they become a hazard to themselves or others road. The system aims to detect the driver's eyes and monitor their level of drowsiness based on various factors such as eye closure, and facial expressions. The system will use computer vision techniques to analyze the driver's face and eyes in real-time, using cameras installed in the vehicle. The system will process the video feed from the cameras using OpenCV, a computer vision library, to detect and track the driver's face and eyes. Dlib, a facial recognition library, will be used to extract 68 facial landmarks from the driver's face, which will help in detecting the eyes and other facial features. The system will use deep learning algorithms to analyze the facial landmarks and determine the level of drowsiness. [1][2]

The system will use this knowledge to classify the driver's level of drowsiness into different categories, such as active, sleeping, drowsy. Once the system detects a high level of drowsiness, it will alert the driver using a warning sound, visual alert, or vibration. The driver drowsiness detection system will be designed to be non-intrusive and unobtrusive, with minimal impact on the driver's privacy and comfort. The system will be designed to work in various conditions and will be able to handle different facial expressions, head positions, and eye wear.the driver drowsiness detection system aims to address the problem of drowsy driving by using computer vision and deep learning techniques to detect the driver's eyes and monitor their level of drowsiness. The system will provide real-time alerts to the driver, helping them stay safe and alert while driving.

II. OBJECTIVE

The primary objective of the driver drowsiness detection system project is to develop a robust and efficient solution using facial recognition and computer vision technologies to monitor the driver's facial features, specifically the eyes and mouth, calculate their respective aspect ratios, and subsequently determine the level of drowsiness exhibited by the driver. Upon detecting signs of drowsiness, the system will promptly alert the driver using an alarm. In the event of three consecutive alarms the system will autonomously trigger safety measures, including the reduction of vehicle speed, activation of parking lights to alert rear drivers, and the transmission of a location message to the last dialed contact of the driver. Through the implementation of these features, the project aims to enhance road safety, mitigate the risks associated with driver fatigue, and prevent accidents, ultimately improving overall driving safety and experience. [3][4]

III. WORKING

(1) Facial Recognition and Feature Detection:

Utilization of Python, OpenCV, Imutils, and Dlib libraries to record the driver's face and accurately detect the eyes and mouth of the driver in real-time. Implementation of pre-trained models for precise detection and tracking of the driver's facial landmarks.

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Analysis of Network and Content Delivery Services In AWS

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ABSTRACT :

This paper conducts a detailed examination of Amazon Web Services (AWS) networking systems as well as content distribution services like Virtual Private Cloud (VPC), CloudFront, Route 53, API Gateway, Direct Connect, App Mesh, Global Accelerator, Cloud Map, Route 53 Application Recovery Controller, and Private 5G.The study investigates the applicability, possible restrictions, and perspective features of technologies for ensuring highly available, high-speed and globally distributed cloud applications.

The ways in which every service operates, what they look like on the inside and how people use them in reality are looked at to identify positives and negatives. Moreover, any upcoming developments about this service would take into account technical aspects like edge computing, having more than one provider thus multi-cloud, ways to manage sophisticated traffic, improve safety and meet standard requirements and easier supervision and automation systems. By presenting a comprehensive analysis, this research serves as a valuable resource for organizations leveraging AWS's network and content delivery offerings in the cloud computing landscape.

Keywords: Optimization, Performance, Traffic, Network, Content

Introduction:

When it comes to cloud computing, AWS is an abstract dado service provider with a broader bundle and suite of related solutions that are used for efficient modern applications development and deployment support. Within which, it promotes high bandwidth delivery and performance across multiple devices and locations throughout the world as well as storage safety measures of crucial data that can be secured from unauthorized use or leakage.

The research paper looks at the services intricacies of these services, such as their functionalities, likely restrictions and possible future aspects Virtual Private Cloud (VPC), Amazon CloudFront, Route 53, API Gateway, Direct Connect, AWS App Mesh, Global Accelerator, Cloud Map, Route 53 Application Recovery Controller, and AWS Private 5G are among the services that are included in the paper.

The article, after all, pointed out what makes each service unique with regards to addressing certain content delivery and networking issues. The latter topic could not be exhaustively discussed without mentioning its technologies, architecture or even real life examples. Consequently, these findings can help any organization that wants to make use of such servicesin gaining some ideas of where they should start from.

Additionally, the research paper critically evaluates the potential shortcomings and limitations of these services, identifying areas where improvements or enhancements could be made to better address evolving customer needs and emerging technological trends.

Also, future prospects of AWS network and content delivery services are highlighted in regards to advances in edge computing, multi-cloud integration, advanced traffic management, better security and compliance controls, and simplified management and automation.

This paper provides valuable insights into AWS' networking and CDN services, making it an important source of information for institutions that are looking forward to building highly available applications worldwide with high speed in a cloud environment. Meanwhile, it gives some recommendations on how to enable businesses to remain competitive as they decide on various issues especially within the cloud computing space.

AWS Network and Content Delivery Services:

1. Virtual Private Cloud (VPC):

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SCOPE OF SNBL PLATFORMS AND THEIR ROLE IN ESCALATING THE FINANCIAL INDEPENDENCE OF ITS USERS

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Abstract: *This research paper aims to explore the global and domestic scope of "Save Now, Buy Later" (SNBL) apps/platforms and their role in enhancing the financial independence of individuals who adopt these services. SNBL apps have gained significant popularity in recent years, offering consumers the ability to save towards a purchase and defer the payment to a later date. The study investigates the impact of SNBL platforms on consumer behaviour, financial decision-making and overall financial independence. Additionally, it analyses the potential benefits and risks associated with these platforms, taking into account both global and domestic perspectives. The research employs a mixed-method approach, combining qualitative interviews with SNBL users and quantitative analysis of relevant data and financial indicators. The findings provide valuable insights for policymakers, financial institutions, and consumers, contributing to a comprehensive understanding of the SNBL phenomenon and its implications for personal financial management.*

Keywords: Save Now, Buy Later, SNBL, financial independence, consumer behaviour, financial decision-making, financial management, global perspective, domestic perspective.

I. INTRODUCTION

1. In recent years, the rise of digital technology and the transformation of consumer behaviour have paved the way for innovative financial solutions that cater to the changing needs and preferences of individuals. One such solution that has gained considerable traction is the concept of "Save Now, Buy Later" (SNBL) apps/platforms. SNBL platforms offer consumers an opportunity to save money towards a desired purchase and defer the payment to a later date, enabling them to achieve their financial goals while maintaining financial flexibility. These platforms have become increasingly popular among individuals seeking convenient and structured ways to make purchases without relying on traditional credit or loans. The widespread adoption of SNBL platforms can be attributed to various factors. Firstly, the convenience and accessibility of these apps/platforms have significantly contributed to their popularity. With just a few taps on a smartphone, users can set saving goals, contribute funds, and monitor their progress, making the process of saving for a purchase both efficient and user-friendly. Secondly, SNBL platforms align with the changing consumer mindset, particularly among younger generations, who value experiences and delayed gratification over immediate ownership. The ability to save towards a desired item and defer payment allows individuals to exercise financial discipline while still enjoying the benefits of their purchase. Lastly, the COVID-19 pandemic and its economic repercussions have further

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emphasised the importance of responsible spending and savings, making SNBL platforms particularly appealing as individuals strive to maintain financial stability and independence.

2. **Research Objectives:** The objectives of this research paper are:
   a. Understanding the global and domestic impact of SNBL apps/platforms on financial independence.
   b. It explores how SNBL platforms affect consumer behaviour, financial decision-making and overall financial independence.
   c. The study examines the benefits and risks associated with SNBL platforms from both global and domestic perspectives.
   d. A mixed-methods approach, combining qualitative surveys and quantitative analysis, is used to gather data.

II. LITERATURE REVIEW

1. **Fagereng, A., Holm, M., & Natvik, G. J. (2017).** Saving and portfolio allocation before and after job loss. The Quarterly Journal of Economics, 132(4), 2020-2096.

   The stated study investigates the relationship between job loss, saving behaviour, and portfolio allocation. Their study explores how individuals adjust their saving and investment strategies in response to income shocks, shedding light on the role of delayed consumption during economic uncertainty.

   Using detailed administrative data from Norway, the authors conduct empirical analysis, comparing the saving behaviour and investment choices of individuals who experienced job loss to those who did not. They find that individuals tend to increase saving rates before job loss, suggesting precautionary saving. Additionally, those who lose their jobs shift towards safer assets in their investment portfolios.

   This research provides valuable insights into saving behaviour and investment decisions during income shocks. It demonstrates individuals' preference for delayed consumption as they save more before job loss and choose safer investments to protect their financial well-being. The study's findings are significant for policymakers and individuals, informing the design of policies promoting delayed consumption, financial resilience, and economic stability.

   In summary, Fagereng, Holm, and Natvik's study contributes to understanding how job loss affects saving behaviour and investment choices. Their findings highlight the prevalence of delayed consumption as individuals respond to income shocks through precautionary saving and adjustments in portfolio allocation towards safer assets. This research has implications for individual financial planning, social safety net design, and policies promoting long-term financial well-being.

2. **Ameriks, J., Caplin, A., Leahy, J., & Tyler, T. (2020).** Measuring self-control problems. The Quarterly Journal of Economics, 135(2), 1033-1080.

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Ameriks et al.'s (2020) paper explores measuring self-control problems and their impact on saving behaviour. The authors propose a framework for assessing self-control abilities and examine the influence of self-control on long-term financial planning.

Using behavioural experiments and surveys, the study measures self-control problems and explores their effect on saving decisions. It emphasizes the importance of framing, reflection, and communication in shaping saving behaviour and retirement preparedness.

The findings provide insights into self-control complexities and their implications for saving behaviour. The research informs policymakers, financial institutions, and individuals about the challenges of self-control and suggests strategies to promote better saving habits.

In summary, Ameriks et al.'s study offers a comprehensive approach to measuring self-control problems and understanding their impact on saving behaviour. It informs interventions to improve financial decision-making and long-term well-being.

3. **Consumerism and Financial Challenges:** Consumerism and the associated financial challenges have become pervasive in modern society. Increasingly, individuals find it challenging to manage their personal finances amidst the temptation of instant gratification and the pressure to keep up with societal expectations. This has led to financial stress, debt accumulation, and a lack of financial independence. Several studies have highlighted the negative consequences of consumerism on personal finance management and emphasised the need for innovative solutions.

4. **The Rise of "Save Now, Buy Later" Approach:** In response to the financial challenges posed by consumerism, the "Save Now, Buy Later" approach has gained momentum. This approach encourages individuals to prioritize saving money before making purchases, thereby fostering responsible financial behaviour and long-term financial stability (Oberholzer-Gee & Thierer, 2018). The emergence of digital platforms and apps tailored to support this approach has further facilitated its adoption.

5. **Role of Apps/Platforms in Personal Finance Management:** Apps and platforms designed to support the "Save Now, Buy Later" approach have revolutionised personal finance management. These tools offer a range of features such as automated savings, goal tracking, budgeting assistance, and financial education resources. Studies have shown that these apps can effectively help individuals track their expenses, save money, and make informed financial decisions.

6. **Empowerment and Financial Independence:** Financial independence is a crucial aspect of personal well-being, enabling individuals to have control over their financial decisions and secure their future. "Save Now, Buy Later" apps/platforms play a pivotal role in empowering individuals to achieve financial independence by providing tools for effective money management, fostering saving habits, and promoting financial literacy. Research suggests that individuals who adopt these

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platforms experience increased confidence in their financial abilities and exhibit improved financial behaviour.

Overall, the reviewed literature highlights the negative effects of consumerism on personal finance management while emphasizing the potential of "Save Now, Buy Later" apps/platforms in mitigating these challenges. These platforms offer individuals the tools and resources needed to develop responsible financial habits, accumulate savings, and achieve financial independence.

III. GLOBAL PERSPECTIVE OF SNBL APPS/ PLATFORMS

3.1. **Overview of Global Market:** In recent years, the global market for "Save Now, Buy Later" apps/platforms has witnessed substantial growth. These platforms have gained popularity among individuals aiming to enhance their personal finance management and attain financial independence. Market research reports reveal a growing demand for these apps/platforms in multiple regions, displaying their potential to influence individuals' financial behaviours and objectives.

Prominent examples of such apps/platforms include, YUH, and Revolut, a well-known player in the market, offers convenient "Save now, Buy Later" options that allow users to save and achieve their short term and long term buying goals. YUH is another emerging platform that provides users with the ability to save money towards specific goals while also offering attractive cashback rewards. Revolut, a leading fintech company, offers a range of financial services, including budgeting tools, savings options, and simplified investment solutions.

These examples illustrate the variety of "Save Now, Buy Later" apps/platforms available globally, each having their own unique features and benefits. The increasing demand for these platforms indicates the potential impact they can have on individuals' financial behaviours, encouraging responsible spending, better saving habits, and overall financial well-being.

3.2. **Leading "Save Now, Buy Later" Apps/Platforms:** In the global market for "Save Now, Buy Later" apps/platforms, there are several prominent leaders that have made a significant impact. One such example is Accrue, a notable platform that has gained recognition for its comprehensive set of features. Accrue offers users automated savings tools, budgeting capabilities, and personalised financial insights to assist them in effectively managing their finances. By providing automated savings features, Accrue enables users to set aside funds towards their savings goals effortlessly. Its budgeting tools empower users to track their expenses, establish budgets, and gain better control over their financial activities. Additionally, Accrue's personalised financial insights offer users valuable guidance and recommendations tailored to their individual financial circumstances.

Another example of a prominent player in the "Save Now, Buy Later" landscape is the Neobank YUH. YUH combines various financial services, including savings options and budgeting features, within a modern and user-friendly interface. With YUH, users can set savings goals, track their progress, and earn attractive cashback rewards. The platform emphasises responsible spending and saving habits, providing users with a range of tools to enhance their financial well-being. YUH's

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ISSN : 2454 – 308X | Volume : 09 , Issue : 04 | July - September 2023
DOI : 10.36676/irt.2023-v9i4-003

combination of social savings features and educational resources also encourages a sense of community and financial empowerment among its user base.

These examples, including Accrue and YUH, represent the diverse range of "Save Now, Buy Later" apps/platforms available globally. They have successfully attracted substantial user bases and have received positive reviews for their effectiveness in promoting financial independence, responsible spending, and improved financial management.

3.3. **Features and Functionalities:** "Save Now, Buy Later" apps/platforms offer a range of features and functionalities to support individuals in their financial management journey. These include automated savings, goal setting and tracking, expense categorisation, personalised budgeting recommendations, and financial education resources. These features aim to simplify the savings process, provide insights into spending habits, and empower users to make informed financial decisions.

3.4. **User Adoption and Engagement**: The global adoption of "Save Now, Buy Later" apps/platforms has witnessed a steady increase as users recognise their benefits in achieving financial goals, building emergency funds, and reducing debt. These platforms have gained significant traction across various demographics, appealing to individuals seeking effective financial management solutions.

The convenience of automated savings and goal-setting features has contributed to the adoption of these platforms. Users appreciate the ability to set up automatic transfers and effortlessly allocate a portion of their income towards savings. This streamlined approach eliminates the need for manual intervention, making it easier for users to save consistently.

Users' engagement levels on these platforms have been promising, with individuals actively utilising the provided tools and resources. The goal setting and tracking features motivate users to stay focused on their financial objectives and measure their progress over time. Categorising expenses and gaining insights into spending habits empowers the users to make informed decisions and identify areas for adjustment.

The personalised budgeting recommendations further enhance user engagement. By analysing users' financial information, these platforms provide tailored suggestions on optimising spending, reducing unnecessary expenses, and allocating funds towards savings or debt repayment. This personalised approach resonates with users, helping them make practical adjustments to their financial plans.

The availability of financial education resources is also a significant factor in user engagement. Platforms offering articles, videos, tutorials, and interactive tools improve users' financial literacy, equipping them with knowledge and skills for sound decision-making. By empowering users with educational content, these platforms foster confidence and competence in managing finances effectively.

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DOI : 10.36676/irt.2023-v9i4-003

IV. DOMESTIC PERSPECTIVE OF SNBL APPS/ PLATFORMS

4.1. Current Landscape in the Domestic Market: Within the domestic market segment seeking credible means to stabilise finances towards achieving self-reliance– "Save Now, Buy Later" apps/platforms flourish with increasing significance. With mounting demand reported within contemporary consumers' attitudes towards more effective personal finance planning– evidenced by surveys conducted- need persists for reliable personal finance solutions, encouraging an enlarging demographic, and embracing new habits resulting in inevitable impact on daily spending habits leading towards achieving greater independence from financial anxiety thus popularising its use among society today moreover amplified prevalence amongst Generation-Z amidst various other advantages including convenience it brings forth.

4.2. Key Players and Competition: In the domestic market for "Save Now, Buy Later" apps/platforms, Multiple Fintech Solutions have emerged to cater to the specific needs and preferences of users. These solutions include both local and international providers, offering a range of tailored features. For instance, Multipl Fintech Solutions offers localised savings options and financial education resources through their platform, empowering users to manage their finances effectively. The presence of diverse players like Multipl Fintech Solutions highlights the competitive landscape within the domestic market.

4.3. User Demographics and Adoption Patterns: The adoption of "Save Now, Buy Later" apps/platforms within the domestic market shows variations across different user demographics. Studies indicate that younger generations, such as millennials and Generation Z, exhibit higher rates of adoption. This can be attributed to their familiarity with digital technologies and their desire for enhanced financial management. Nevertheless, as awareness and accessibility of these platforms continue to expand, there is also a growing interest among other age groups.

4.4. Impact on Personal Finance Behaviour: The impact of "Save Now, Buy Later" apps/platforms on personal finance behavior domestically has been significant. Studies demonstrate that individuals who utilize these platforms experience positive transformations in their saving habits, a decrease in impulsive spending, and improved financial discipline. By offering users various tools and insights, these platforms empower individuals to gain a better understanding of their financial situation and make informed decisions about their finances.

V. ENHANCING FINANCIAL INDEPENDENCE THROUGH "SAVE NOW, BUY LATER" APPS/PLATFORMS

5.1. Savings Strategies and Tools: "Save Now, Buy Later" apps/platforms offer individuals a range of savings strategies and tools to enhance their financial independence. These platforms often provide automated savings features, allowing users to set up recurring transfers from their checking accounts to designated savings accounts. By automating savings, individuals can develop a consistent saving habit and build emergency funds or work towards specific financial goals.

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ISSN : 2454 – 308X | Volume : 09 , Issue : 04 | July - September 2023
DOI : 10.36676/irt.2023-v9i4-003

Additionally, these apps may incorporate features such as round-up savings, where the spare change from transactions is automatically transferred into savings, further facilitating savings accumulation.

5.2. Budgeting and Expense Tracking: Effective budgeting and expense tracking are crucial elements of financial independence. "Save Now, Buy Later" apps/platforms provide tools that enable users to track their expenses, categorise spending, and set budget limits for different expense categories. These platforms often offer visual representations of spending patterns and provide real-time notifications and alerts when users exceed their budget limits. By offering insights into spending habits and encouraging conscious spending decisions, these apps/platforms empower individuals to take control of their finances and align their expenses with their financial goals.

5.3. Investment and Wealth Accumulation: Some "Save Now, Buy Later" apps/platforms expand their services beyond savings and budgeting to include investment and wealth accumulation features. These platforms may provide users with access to investment options such as robo-advisors or low-cost index funds, enabling them to grow their wealth over time. By integrating investment opportunities within the app, individuals can leverage the power of compound interest and diversify their financial portfolio, ultimately fostering long-term financial independence.

5.4. Education and Financial Literacy: Promoting financial education and literacy is a fundamental aspect of empowering individuals to achieve financial independence. "Save Now, Buy Later" apps/platforms often-incorporate educational resources such as articles, videos, or tutorials on topics like budgeting, debt management, and investment strategies. These resources aim to enhance users' financial knowledge and equip them with the necessary skills to make informed financial decisions. By providing accessible and user-friendly financial education, these platforms contribute to individuals' financial independence and their ability to navigate the complexities of personal finance.

5.5. Psychological and Behavioural Aspects: "Save Now, Buy Later" apps/platforms also consider the psychological and behavioural aspects of financial decision-making. Some platforms utilize gamification elements, such as challenges, rewards, or progress tracking, to motivate users and reinforce positive financial behaviours. Additionally, personalised nudges and reminders can encourage individuals to save, budget wisely, and resist impulsive spending. By addressing psychological and behavioural barriers, these apps/platforms support individuals in cultivating healthy financial habits and fostering their financial independence.

VI. COMPANIES INVOLVED IN THE "SAVE NOW, BUY LATER" APPS/PLATFORMS SEGMENT

6.1. Key Players in the Market: The "Save Now, Buy Later" apps/platforms segment is experiencing active participation from several notable players in the global market. These companies are at the

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ISSN : 2454 – 308X | Volume : 09 , Issue : 04 | July - September 2023
DOI : 10.36676/irt.2023-v9i4-003

forefront of offering innovative solutions that empower individuals to effectively manage their personal finances. Among the prominent companies operating in this segment are:

a. **Revolut:** A renowned as a leading fintech company, Revolut provides a wide range of financial services. Its "Save" feature allows users to set savings goals, automate savings transfers, and track their progress.

b. **Yuh:** It is a digital banking platform that seamlessly integrates banking services with personal finance management tools. The platform's unique "Save" feature enables users to save money by rounding up transactions and automatically allocating the spare change to their savings.

c. **Qapital Fintech:** It offers a comprehensive savings and investing platform designed to help users achieve their financial goals. The app also encompasses various features, including goal-based savings, automatic savings rules, and personalised savings challenges.

d. **Multipl Fintech:** An Indian Company, provides a robust "Save Now, Buy Later" platform that empowers users to save money for future purchases. They offer personalised savings plans tailored to individuals' needs and collaborate with e-commerce platforms to provide exclusive offers.

e. **Tortoise SNBL platform:** It is a notable player in the "Save Now, Buy Later" segment. This platform offers innovative features and functionalities to simplify savings and promote responsible financial management habits. Users can automate savings, set goals, and receive personalised recommendations to optimize their savings

f. **Hubble SNBL platform**: It is another prominent player in the market, offering a comprehensive platform for saving and financial management. Their platform emphasises goal-setting, automated savings, and expense tracking, empowering users to make informed financial decisions and work towards their financial aspirations.

These key players in the "Save Now, Buy Later" apps/platforms market continually strive to enhance their offerings and provide users with user-friendly and feature-rich solutions to support their financial management efforts.

6.2. Market Share and Competition: The "Save Now, Buy Later" (SNBL) apps/platforms segment is highly competitive, with various companies competing for market share and user adoption. Companies such as Revolut, Yuh, Qapital Fintech, and Multipl Fintech compete in this space, each bringing its unique value proposition to attract and retain users. These companies continuously strive to innovate, enhance their product offerings, and expand their customer base. Market share in the SNBL segment may vary across different regions, depending on factors such as brand recognition, user experience, platform features, and partnerships with financial institutions and e-commerce platforms.

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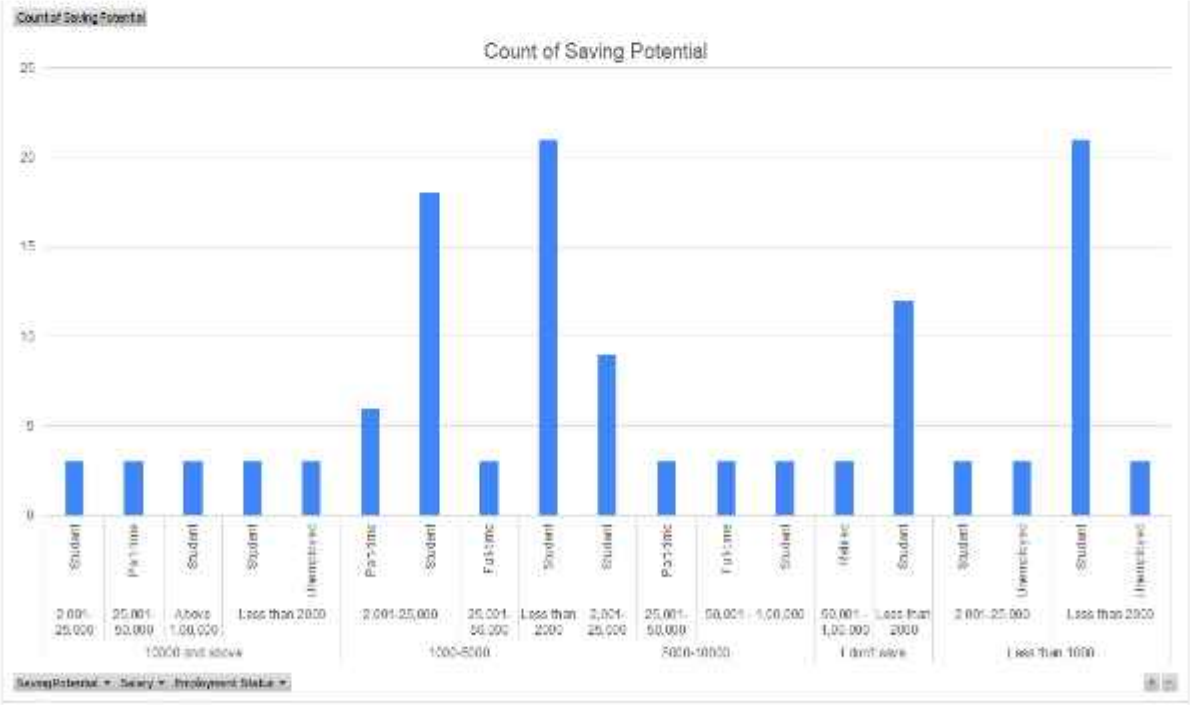
ISSN : 2454 – 308X | Volume : 09 , Issue : 04 | July - September 2023
DOI : 10.36676/irt.2023-v9i4-003

6.3. Business Models and Revenue Generation Strategies: Companies in the SNBL apps/platforms segment employ different business models and revenue generation strategies. These models and strategies may include transaction-based fees, revenue sharing through partnerships with financial institutions, or monetisation of user data through personalised offers and targeted advertisements. Each company may adopt a specific approach based on its target market, user base, and value proposition. The chosen business model and revenue strategy should align with the company's goals and sustainability while delivering value to users.

6.4. Innovations and Differentiating Factors: Innovation plays a crucial role in the success of companies operating in the SNBL apps/platforms segment. Key players such as Revolut, Yuh, Qapital, and Multipl continually strive to innovate and differentiate themselves from their competitors. These companies introduce new features, enhance user experience, integrate with other financial services, leverage data analytics, and employ artificial intelligence to offer personalised recommendations and savings strategies. Innovations may include unique savings mechanisms, interactive interfaces, seamless integrations with e-commerce platforms, and tailored financial education resources. By constantly innovating, these companies aim to provide value-added services that set them apart from the competition and attract a larger user base.

VII. ANALYSIS AND INTERPRETATION



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ISSN : 2454 – 308X | Volume : 09 , Issue : 04 | July - September 2023
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A survey was conducted among a specific demographic: individuals within the age group of 18-24. According to the results, a significant proportion (61%) of the 126 people surveyed exhibited a willingness and capability to invest and save up to Rs. 5000. They expressed interest in doing so regularly and consistently if provided with a streamlined medium, which is where the SNBL platform comes into the picture.

The complexity and potential downsides of BNPL methods- including the requirement of owning a credit card, meeting monthly payment deadlines, paying interests, dealing with the implications of EMIs (Equated Monthly Instalments), and the risk of damaging one's credit score have been highlighted as deterring factors. In contrast, the SNBL platform appears to offer a simplified, user-friendly alternative that eliminates these challenges.

Proof:

High Willingness to Save and invest: 61% of those surveyed expressed a keen interest in saving and investing, indicating a substantial potential user base for SNBL platforms. Their readiness to set aside up to Rs. 5000 monthly reveals a level of financial discipline and awareness that would likely translate into effective use of a convenient investment platform like SNBL.

Lack of Suitable Investment Mediums: The respondents' desire for a streamlined investment medium implies that current options, including BNPL, are not fulfilling their needs. This gap in the market gives SNBL an opportunity to introduce an alternative that better aligns with the preferences of this demographic.

Complications of BNPL: The complexities associated with BNPL- such as credit card requirements, the need to manage EMIs and interests, the pressure of meeting payment deadlines, and the threat to credit scores - serve as strong disincentives. If SNBL can indeed eliminate these obstacles, it would likely find favour among consumers eager for a more straightforward and less risk-laden approach to finance.

Preference for SNBL over BNPL: The above points collectively suggest a clear preference for SNBL over BNPL among the surveyed demographic. The simplicity, ease-of-use, and lower risk profile of SNBL, combined with the group's high readiness to save and invest, provide strong evidence in support of the hypothesis that SNBL will soon replace BNPL.

VIII. CHALLENGES AND OPPORTUNITIES

8.1. Privacy and Security Concerns: As "Save Now, Buy Later" apps/platforms handle sensitive financial information, privacy and security concerns are significant challenges to address. Users may worry about the safety of their personal and financial data, potential data breaches, and unauthorised access. Ensuring robust security measures, implementing encryption protocols, and

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ISSN : 2454 – 308X | Volume : 09 , Issue : 04 | July - September 2023
DOI : 10.36676/irt.2023-v9i4-003

complying with relevant data protection regulations are crucial for building trust and mitigating privacy risks.

8.2. **Regulatory Landscape:** The regulatory landscape surrounding "Save Now, Buy Later" apps/platforms varies across different jurisdictions, posing challenges and opportunities for these platforms. Compliance with financial regulations, consumer protection laws, and data privacy regulations is essential. Adapting to evolving regulatory requirements, obtaining necessary licenses, and maintaining transparency in operations are crucial to building credibility and fostering user trust.

8.3. **Technological Advancements and Future Developments:** The field of financial technology continues to evolve rapidly, presenting both challenges and opportunities for "Save Now, Buy later" apps/platforms. Advancements in artificial intelligence, machine learning, and data analytics offer opportunities for enhanced user experience, personalised financial advice, and improved savings strategies. However, staying up to date with technological advancements and adapting platforms to new trends can be challenging for app developers and providers.

8.4. **Collaboration with Financial Institutions:** Collaboration with traditional financial institutions presents both challenges and opportunities for "Save Now, Buy Later" apps/platforms. While partnerships with banks and financial institutions can enhance the credibility and reach of these platforms, navigating complex partnerships, ensuring data integration, and addressing potential conflicts of interest require careful consideration.

8.5. **Scalability and Accessibility**: Scaling up operations and expanding user bases while maintaining a user-friendly and accessible interface can be challenging for "Save Now, Buy Later" apps/platforms. Ensuring seamless performance, managing increasing volumes of user data, and catering to diverse user needs and preferences are critical for sustained growth and success.

8.6. **Increasing awareness**: One of the challenges faced by SNBL platforms is increasing awareness among the population. The emerging nature of these platforms and their unique features contribute to a lack of familiarity. Overcoming this hurdle requires effective marketing strategies, partnerships with financial influencers, and collaborations with existing financial education initiatives. Leveraging existing customer bases and showcasing success stories can also aid in raising awareness.

IX. FURTHER SCOPE OF IMPROVEMENT AND INNOVATION IN THE "SAVE NOW, BUY LATER" SEGMENT

9.1. **Enhanced Integration with E-commerce Platforms:** Further improvement and innovation in the "Save Now, Buy Later" segment can involve enhanced integration with e-commerce platforms. By establishing seamless integration with popular online marketplaces, these apps/platforms can provide users with real-time price tracking, personalised offers, and convenient saving options specifically tailored to their desired purchases.

9.2. **Seamless Integration of Payment Solutions:** Another area of improvement is the seamless integration of payment solutions within "Save Now, Buy Later" apps/platforms. By providing a comprehensive payment ecosystem that allows users to make purchases directly through the app

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or link to their existing payment methods, the process of saving and buying can be further streamlined and simplified.

9.3. **Customisation and Personalisation Features:** To enhance user engagement and satisfaction, customisation and personalisation features can be developed within the "Save Now, Buy Later" apps/platforms. By offering personalised savings recommendations, tailored financial goals, and customised alerts based on user preferences and behaviour, these platforms can provide a more individualised experience.

9.4. **Integration of Artificial Intelligence and Machine Learning:** The integration of artificial intelligence (AI) and machine learning (ML) technologies holds immense potential for further improvement in the "Save Now, Buy Later" segment. AI and ML can be utilised to analyse user data, identify spending patterns, provide personalised financial advice, and optimize savings strategies based on individual goals and circumstances (Dasgupta & Srivastava, 2021).

9.5. **Gamification and Rewards Programs:** Incorporating gamification elements and rewards programs can contribute to increased user engagement and motivation within "Save Now, Buy Later" apps/platforms. By introducing challenges, milestones, and rewards for achieving savings goals or making responsible spending choices, these platforms can enhance user satisfaction and long-term adherence to financial plans.

X. POTENTIAL OF "SAVE NOW, BUY LATER" APPS/PLATFORMS TO REPLACE BNPL CONCEPT

10.1. **Comparison of "Save Now, Buy Later" and BNPL Approaches:** The emergence of "Save Now, Buy Later" apps/platforms has the potential to reshape the traditional Buy Now, Pay Later (BNPL) concept. While both approaches involve deferred payment, there are notable differences. The "Save Now, Buy Later" model encourages individuals to prioritise saving before making purchases, fostering responsible financial behaviour and long-term financial stability. In contrast, BNPL allows immediate purchases with deferred payment, potentially leading to impulsive spending and debt accumulation.

10.2. **Advantages of "Save Now, Buy Later" Apps/Platforms:** "Save Now, Buy Later" apps/platforms offer several advantages over BNPL models. Firstly, they promote financial discipline and encourage individuals to develop healthy saving habits, empowering them to achieve financial independence. Secondly, these platforms provide tools for effective money management, such as automated savings, goal tracking, and budgeting assistance. Thirdly, by promoting financial literacy and education, "Save Now, Buy Later" apps/platforms equip users with the necessary knowledge and skills to make informed financial decisions.

10.3. **Potential Disruption and Market Shift:** The rise of "Save Now, Buy Later" apps/platforms has the potential to disrupt the BNPL market and drive a shift in consumer preferences. As individuals become more conscious of their financial well-being and seek sustainable financial practices, they may gravitate towards platforms that prioritize savings and financial independence. This shift can reshape the financial landscape, with consumers adopting responsible spending habits and embracing a long-term perspective on their financial goals.

10.4. **Challenges in Replacing the BNPL Concept:** While "Save Now, Buy Later" apps/platforms have the potential to replace the BNPL concept, there are challenges to overcome. BNPL models have

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gained significant popularity and established a strong presence in the market. Overcoming consumer familiarity, addressing the convenience of immediate gratification, and building awareness and trust in the "Save Now, Buy Later" approach pose challenges to widespread adoption. Additionally, regulatory frameworks and industry collaborations will play a crucial role in supporting the transition from BNPL to "Save Now, Buy Later".

XI. CONCLUSION

The objective of this research was to understand the global and domestic scope of SNBL apps/platforms and their role in escalating the financial independence of SNBL-adapting citizens. Through a comprehensive literature review and analysis of key players, user adoption, features, and potential innovations, this research has shed light on the promising future of SNBL apps/platforms.

The global market for SNBL apps/platforms has witnessed significant growth, with leading players such as Revolut,Yuh, Qapital Fintech, and Multipl Fintech making a substantial impact. These platforms offer features such as automated savings, goal tracking, and personalised financial insights, empowering users to make informed financial decisions and achieve financial independence.

Comparatively, the BNPL concept, although popular, comes with potential drawbacks such as impulsive spending and debt accumulation. In contrast, SNBL apps/platforms prioritise responsible financial behaviour by encouraging individuals to save before making purchases, promoting long-term financial stability

The potential of SNBL apps/platforms to replace the BNPL concept is evident. These platforms offer several advantages over BNPL, including financial discipline, effective money management tools, and financial literacy promotion. As individuals become more conscious of their financial well-being, the market shift towards SNBL is already underway, with consumers embracing responsible spending habits and focusing on long-term financial goals.

While challenges such as consumer familiarity and regulatory frameworks need to be addressed, the momentum favours SNBL apps/platforms as the future of the buying concept. Their potential disruption and market shift, coupled with advancements in technology and the growing demand for financial independence, position SNBL apps/platforms as the preferred choice for individuals seeking a sustainable and responsible approach to their financial management.

In conclusion, this research suggests that SNBL apps/platforms will soon take over the BNPL concept and become the future of the buying concept. The advantages they offer, coupled with the changing consumer preferences and market dynamics, indicate a shift towards responsible and long-term financial practices. SNBL apps/platforms have the potential to empower individuals, promote financial independence, and reshape the financial landscape for the better.

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TWEET SENTIMENT ANALYSIS USING SVC, LOGISTIC REGRESSION AND BERNOULLI NB

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ABSTRACT

This research paper focuses on tweet sentiment analysis, the process of automatically categorizing tweets as positive, negative. It explores the techniques, challenges, and applications of analyzing sentiments expressed in short-form text on social media platforms like Twitter. By leveraging machine learning businesses can extract valuable insights from tweets to make informed decisions, enhance customer engagement, and manage online reputation effectively. This study aims to provide insights into tweet sentiment analysis methodologies and their implications for businesses and individuals in the dynamic realm of social media.

Keywords: Tweet , sentiment analysis, logistic regression, SVC, Bernoulli NB

Introduction

Social media platforms have become an integral part of modern communication, providing a vast and dynamic landscape for individuals and businesses to express opinions, share experiences, and engage with a global audience. The proliferation of user-generated content on these platforms has led to an exponential growth in the amount of data available for analysis, presenting both opportunities and challenges for organizations seeking to understand the sentiments and preferences of their target audience . Sentiment analysis, the process of extracting and categorizing the emotions and opinions expressed by users, has emerged as a crucial tool in this digital age. By analysing the sentiments expressed on social media, businesses can gain valuable insights into customer feedback, brand perception, and emerging trends, enabling them to make more informed decisions and enhance their overall strategy .This research paper delves into the multifaceted world of sentiment analysis on social media platforms, exploring the various techniques, challenges, and applications of this dynamic field. Through a comprehensive review of existing literature and a detailed discussion of the research findings, this paper aims to provide a holistic understanding of the significance of sentiment analysis in the context of social media and its implications for businesses and individuals navigating the digital landscape.

Research Objective

1. Explore the importance of sentiment analysis on social media platforms. This study aims to explore the importance of sentiment analysis in understanding user sentiment, monitoring brand awareness, and making informed decisions in the digital age.
2. Learn about the methods and tools used in sentiment analysis. The goal of this study is to explore a wide range of technologies , machine learning, and, and tools used for sentiment analysis on social media platforms.
3. Identify problems when interpreting user sentiment. The goal is to identify and analyze the challenges faced in accurately interpreting user sentiment in social media, including linguistic nuances, cultural differences, and understanding context.
4. Discuss ethical considerations when performing sentiment analysis. This study aims to ensure responsible and ethical use of sentiment analysis techniques by addressing ethical considerations associated with sentiment analysis, including user privacy, data security, and bias mitigation.
5. We highlight future research directions in sentiment analysis. The goal is to suggest potential future research directions, including advanced sentiment analysis techniques, multilingual sentiment analysis, and integration with other data.

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A Spatiotemporal Analysis of Punjab's Agricultural Diversification

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Abstract: The Indian state of Punjab is well known for its prosperous agrarian position. The number of different sorts of crops a farmer is cultivating on a specific plot of land is indicated by crop diversification. We have attempted to assess crop diversification for the various agro-climatic zones of Punjab in the this study. We measured the degree of agricultural diversification using the Herfindahl Index and the Entropy Index for the various years, and we then charted the pattern over time. The findings for both indexes show that farmers are shifting their focus away from other crops and towards wheat, paddy, and vegetables. This suggests monoculture, which suggests that farmers are switching from crop diversity to crop specialization. We have also made an effort to draw attention to the issue of the state's declining water level and deteriorating situation. Wheat, paddy, and vegetables are grown specifically because they use more water and have a negative impact on biodiversity in Punjab, where farmers are highly dependent on groundwater levels.

Keywords: Agriculture, Punjab, Crop-Diversification, Crop Choice, Climate

JEL Classification Number: Q22, Q150

1. Introduction

Agriculture has long been a significant part of the Indian economy. In terms of attaining economic growth in terms of eradicating poverty and ensuring food security, the agriculture sector serves as a pillar. Since independence, agriculture has a smaller percentage of India's GDP, although rural areas in India still rely on it for employment and a means of subsistence. Even during COVID-19, out of the other two sectors—manufacturing and services—agriculture was the one least affected by the epidemic and displayed positive development. In 2020–21, India produced 3087 lakh tonnes of food grains overall.

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India has seen rapid expansion in the agricultural sector as a result of the green revolution technologies in the 1960s and has achieved food grain self-sufficiency. The agriculture industry faces a difficulty in maintaining the food supply needed to feed the world's second-most populous nation. However, the increase in agricultural activity has also led to a number of environmental issues, such as biodiversity loss, land degradation, excessive irrigation, etc., that pose a threat to the agriculture sector's future at the regional level.

Crop diversification offers a wide range of crop options in a specific location and helps to increase productivity and reduce risk. Generally speaking, crop diversification is the process through which a farmer switches from historically low-yielding crops to high-yielding ones. Crop diversification may be caused by a number of factors. One of the causes could be the market price; farmers are more likely to choose to cultivate the crop that has higher market price. The elements affecting infrastructure, profitability, weather, governmental policies, etc., are what determine agricultural diversification.

1.1. Punjab: Rich Agrarian State in the Country

A state called Punjab is located in northern India and borders the states of Jammu & Kashmir, Rajasthan, and Haryana. Its square area is 50,362 km. The Himalayas and the Thar Desert have the biggest impacts on Punjab's climate. Sutlej, Ravi, and Beas rivers all pass through the state. Punjab typically receives 61.9 cm of rain per year, 75% of which falls during the monsoon season. The agriculture industry makes up a large portion of the state's economy and uses 85% of the state's total water use. Due to farmers' excessive usage of tube wells, the state is experiencing a ground water shortage.

The state's irrigation is carried out using a system of canals. However, due to increased pressure on groundwater resources, the state's surface water supplies are completely utilised but unable to meet the demand for water for irrigation in agriculture. The quantity and quality of surface water are declining as a result of climate change and global warming. Punjab has a net irrigation area of 11,69,000 hectares from canals and 29,07,000 hectares from tube wells. It suggests that farmers rely on the level of ground water for irrigation. The following fig 1 shows the exploitation of ground water in different regions of Punjab. Majority of the regions shows that there is an over-exploitation of ground water level that has deteriorated the ground water table and is negatively affecting the biodiversity.

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Understanding the Adoption of Mobile Wallets Amongst Rural Indian Women

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Abstract

Acknowledging the great paucity of studies concerning the mobile wallet adoption by the rural women in Indian context; this study intended to explore the mobile wallet (M-Wallet) adoption among Indian rural women along with understanding the factors affecting adoption, challenges and possibility of mobile wallet as a tool of women empowerment. This study adopted the embedded mix method design in which both qualitative and quantitative information were obtained concurrently, however the qualitative information was incorporated throughout the quantitative information. Using Census (2011) as frame of reference, data was collected from rural women of Delhi. Purposive and snowball sampling techniques were used for data collection. Data for qualitative phase was collected from 10 females; whereas for quantitative phase data was collected from 208 females. Qualitative data was analysed using thematic analysis whereas quantitative data was analysed with the help of SPSS employing one independent sample t-test and factor analysis. The study concluded that Paytm Google Pay and PhonePe were the most used mobile wallets amongst Indian rural women. Most common usage of mobile wallet by the Indian rural women included recharges and bill payments. Three factors namely the "perceived ease of use" "perceived usefulness" and "social norms" were identified as the facilitators or drivers. "Self-efficacy" was found essential for effectively using the mobile wallets; however rural Indian women considered themselves less confident possessing limited knowledge about the mobile wallets. "Perceived risk" was identified as a restraining factor impeding usage of mobile wallets. Lack of confidence, socio-cultural barriers, lack of financial resources and lack of awareness were highlighted as the major challenges faced by rural Indian women while using mobile wallets. Mobile wallets have the possibility to act as a tool of women empowerment by facilitating banking needs of the unbanked, fostering cooperation, self-dependence and promoting self-employment and business amongst the rural Indian women.

Keywords: Mobile Wallets, Indian Rural Women, Adoption and Challenges of M-Wallets

Introduction

India is betting big on being digital and has made significant strides towards the same through significant initiatives like Digital Kranti renamed as Digital India and demonetization. Today, India boasts of more than 1.2 billion internet subscribers and now stands at number 2, second only to China, according to the latest Statista report (Statista, 2023). Majority of the people in India access internet through mobiles; especially in the year 2023, around 1.05 billion people accessed internet through their mobile device; thereby mobile devices playing a significant role in India's digital progress (Basuroy, 2023). Availability of cheap and feature laden smartphone and new telecom spectrum licenses have spurred the growth of mobile device based internet accessibility. One of the most popular trends emerging really fast in past few years is the Cashless truncations. Virtual or cashless transactions are getting increasingly popular in every sphere and mobile wallets are acting as the most important mediums facilitating the virtual transactions. Mobile wallets are a sub-type of digital wallets with latter being a type of software used for making online transactions

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through devices like computer, tablet, laptop or smartphone. Mobile wallet represents a type of digital wallet, usually an app storing the details of customers cards namely the debit, credit, rewards, membership and gifts, facilitating them to make payments (Sardar, 2016). Mobile wallets carry out all the tasks of traditional wallets i.e. storing money and making payments; virtually, but in quick, secure and convenient manner. Mobile wallets can be used for various purposes like shopping, travel booking, taxi booking, and even it is acceptable for few other sites which offer food and other services. Mobile wallets can be categorized into many categories with open, semi-closed and closed being the most popular. Open wallets such as Apple Pay, PayPal, Google Pay etc. enable users to send, receive and withdraw money at ATMs (Painuly and Rathi, 2016). Semi-closed wallets like Paytm, Stripe, MobiKwik, Square, Oxigen, PayUMoney, and M-Pesa.offer comparatively constrained services in comparison to open wallets as they don't support cash withdrawal; however, users can receive money into their bank accounts and send others the money using the same platform. The third type of mobile wallet is the closed wallet like Starbucks Pay, Amazon Pay, Flipkart, MakeMyTrip, BookMyShow, etc., issued by the private organizations wherein customers can use these wallets to buy goods and services of the issuing company only. Key technological innovations such as near field communication, tokenization and point of sale system have furthered the usage of mobile wallets in India.

The concept of digital wallets gained immense popularity in India especially after the announcement of demonetization by Prime Minister Mr. Narendra Modi in the year 2016 (G Naga Sridhar, 2018). It was a move towards fostering cashless society which gave a boost to the digital payments sector and created huge opportunities for mobile wallets in India (Kapoor, Sindwani & Goel, 2020). Batra and Kalra (2016) in their research, however, deciphering the role of demonetization as a pivotal activity fostering the growth of mobile wallets in India commented that a specific section of the society was ready and quick to embrace the journey of digital citizen by using the mobile wallets; however, a large section of the society was not that eager to embrak upon that journey. Supporting the similar argument, D'souza and Bhadury (2017) remarked that the typical Indian was anxious about making the changeover to electronic payment methods notwithstanding their fame. The common Indian was curious to learn more regarding the payments and different hazards associated with these kinds of transactions; and because of this, most people avoided using digital wallets and instead favored using ATMs to get cash out. Kumar (2023) in his latest study confirming the rural urban digital divide in India asserts that urban India has been really quick in adopting the mobile wallets; but rural India is still lagging behind. Despite government's impetus for digitization and falling smartphone prices and their rising penetration in rural landscape, rural Indians prefer cash transactions.

Technology has always been forefront of banking and finance industry. There is a little doubt that mobile wallet, the contemporary technological innovation would also pave the path of financial inclusion and empowerment (Wewege & Thomsett, 2019). Also, marketers are enthusiastic to see the widespread adoption of mobile wallets in India, which are currently in the emerging state (Singh, Srivastava & Sinha, 2017). Mobile wallet market is likely to reach 5.7 trillion US $ by the year 2027 (Global Data, 2023). Mobile-wallets oriented research has gained momentum in past few years; yet research on mobile wallet is not in abundance. Understanding the adoption of mobile wallet is therefore necessary as the knowledge of the latter would unveil the significant implications for the financial institutions, financial intermediaries, policy makers and consumers. There are number of research suggesting the association among demographic and geographic factors such as age,

education, gender, income and urbanization with usage of technological developments including mobile wallets (Siddika & Sarwar,2023; Kittipipatputi,2019; Badran, 2017). At the same time, plenty of research indicate that these innovations and developments have not penetrated to the last mile populations, especially the rural women (Grameen Foundation Report, 2013). Hence, their adoption of mobile wallets is not likely to be understood with the help of findings of existing studies. So, this study understands the adoption of mobile wallets amongst rural Indian women along with understanding the sources of information for mobile wallet, purpose of using and factors affecting the mobile wallets. Inclusion of women in financial system is of utmost important. McKinsey study highlights that successful integration of women in financial system would increase the world's GDP by 12 trillion US dollar by 2025 (Sepashvili, 2019). However, gender disparity is prominent in ownership of digital devices wherein women, especially the South Asian women are far less likely to own a mobile phone and use mobile wallets (Paul & Dutta, 2023). Apart from dealing with the challenges of low income and education, rural Indian women are also subjected to the significant socio-cultural barriers in rural settings in India (Thamminaina, Kanungo & Mohanty, 2020). The study also intends to explore the challenges faced by Indian rural women while using mobile wallets and probability of the latter acting as the tool of women empowerment for Indian rural women.

Literature Review

Literature is abuzz with enthusiastic statistics validating the widespread and popular use of mobile wallets. There are no dearth of studies explaining the motivating factors accounting for the greater usage of mobile wallets (George & Sunny,2023; Kaur et al. 2020; Aydin & Burnaz, 2016). Ease to use, benefit, trust and self-efficacy are the leading factors motivating people to use mobile wallets (Ahuja & Joshi, 2018). Even though the demand for digital wallets is rising, people still have doubts regarding the safety of the transactions and that is why people still prefer cash over digital wallets for monetary transactions (Arora & Yadav, 2018). Mew and Millan (2021) also commented that mobile wallets have to be secure and reliable as bot these traits positively affect the consumers' attitude which in-turn affect the adoption intentions of the consumers. Reddy et al. (2017) in their study also confirmed that convenience, multi-utility, direct operator billing, fast service, ease of use and promotions. Tang et al. (2019) examined the effects of external variables, convenience, compatibility and trust on perception of consumers of the usefulness and easiness of mobile payment system and to understand their satisfaction level with the system. They found that convenience, compatibility and perceived ease of use significantly affect the perceived usefulness and perceived ease of use. It was also found that perceived ease of use significantly affects perceived usefulness, and this perceived usefulness significantly affects the customer's satisfaction with mobile payment system. Chauhan, Shingari and Shingari (2017) in their study referring to mobile wallets in India purported that these are the youngsters who are leading the digital wallet consumption revolution. Despite of the security issues, the prefer using this mode because of the convenience, availability, ease of use and quick service that it provides. Parashar and Rasiwala (2018) analyzed the awareness of consumers (Gen Y and Gen Z) towards digital wallets and found that social media plays a significant role in creating awareness towards digital wallets. One can observe clear paucity of research if one wishes to focus the lens on rural women, that too in Indian context. Existing research does not offer much if one intends to see whether similar factors affecting the adoption of mobile wallets for Indian rural women.

Discussing the role of rural women and mobile

wallet usage globally, Obopay (2018) study purported that despite having lack of financial resources, women are usually proactive home money managers. Mobile money options, with their secure and simple transaction methods, can assist address women's desire for a versatile financial instrument. Their pace, effectiveness, and low cost have shown to be successful financial integration strategies. Nevertheless, there remain a lot of restrictions that prohibit women from adopting mobile monetary solutions. These difficulties can be divided into three categories: a lack of access to tools like mobile phones, illiteracy, and a shortage of conviction. The study offered a global perspective; so, it remained to be seen whether results would hold true for Indian context or not. However, Puri (2019) and Joshi, Gupta and Rangaswamy (2023) conducted studies in Indian context and found similar challenges affecting Indian women using digital and e-wallets; but their respondents were largely the working women in urban settings.

There are few studies that explore the role of mobile wallets as a tool of empowerment for Indian rural women. Studies conducted in different context indicate that usage of digital wallets empower women to have an equal say in family monetary choices that eventually improves the whole family's quality of life (Care, 2020). Another study conducted by Bhattacharjee (2023) in developing countries' context claimed that around 40% women in developing countries do not have a formal bank account and more than 1 billion women don't have any access to financial services; and in such conditions, mobile wallets can offer banking services to the unbanked. However, these findings might not replicate well in Indian context as Indian women, especially from rural contexts are not independent in taking financial decisions. The major financial decisions of the household are either taken by the men of the family. In developing countries like India, women suffer from number of socio-cultural stereotypes, due to which their participation in financial and entrepreneurial ventures become highly restrained. Pekkari and Fransson (2022), however offered rather unclear results regarding the association of mobile wallet usage and women empowerment with Jordanian women respondents as they asserted that women might not get benefited more than taking little control of their expenses and finances. Gupta and Chaudhary (2023) offering a perspective of the formal banking constraints, argue that the latter struggles hard to meet the needs of underprivileged groups and under-served communities like women; and Fintech technologies, such as mobile wallets, have the potential to overcome this disparity and increase financial inclusivity if approached cautiously and with prudence. These companies might utilize technology to render financial services easier to access, inexpensive, and user-friendly, ultimately empowering women as well as underrepresented populations. This study has however, been conducted from the policy making perspective; it remains yet to be seen that such initiatives might actually empower women in India breaking all social and cultural stereotypes.

Review of literature highlighted a great paucity of studies concerning the mobile wallet adoption by the rural women in Indian context. Although there are few industry reports that detail about the digital services usage; of which a small segment of research while discussing about the digital wallet adoption deliberates upon the frequency of usage of such services. However, frequency of publication of such reports have also been irregular as such studies were mostly published after the demonetization and one can observe declining interest of the researchers in the recent years. This study reignites the interest in the area by discussing a comparatively less explored segment i.e. rural woman. Moreover, mere presenting a statistic about the usage of a particular digital channel or medium is not enough for an in-depth understanding of a research phenomenon. Hence, this report extends the contribution of the previous researchers by

elucidating the challenges, factors facilitating usage and probability of mobile wallets acting as a means of women empowerment.

Objectives and Methodology

The main objective of the study is to understand the adoption of mobile wallets by the Indian rural women by comprehending the awareness, purpose, and usage frequency of mobile wallets by the rural Indian women. Mobile wallets' use in India is increasing at a motivating pace, still there are people who do not use digital; wallets. Mobile wallets are increasingly becoming popular for their salient features like ease of use, convenience, and perceived usefulness. However, there are issues of trust, security, and privacy also there. This study aimed to understand the whether similar driving and restraining factors are affecting the adoption of mobile wallets among Indian rural women. Existing literature highlighted that women in India face different types of challenges like illiteracy, lack of information and socio-cultural barriers etc. while using the different financial innovations such as digital finance, e-banking etc. The study intended to unveil whether similar challenges are faced by the Indian rural women while using mobile wallets. Mobile wallets have been touted as one of the most promising tools of empowerment by facilitating the financial inclusion, kindling entrepreneurial mindset, and facilitating cooperation. This study was designed to understand whether mobile wallets might act as means of women empowerment. Specifically, the main objectives of the study were:

- To understand the adoption of mobile wallets by the Indian rural women.
- To understand the key factors affecting the adoption of mobile wallets amongst rural women.
- To understand the challenges faced by rural women while using mobile wallets.
- To understand whether mobile wallets can act as means of women empowerment amongst rural women.

The study adopted a mixed methodology. By combining both quantitative and qualitative information, mixed methods research provides for a more in-depth examination of the topic at hand. There are several types of mixed methods designs namely the parallel, embedded, sequential explanatory and sequential exploratory (Creswell & Clark, 2011). This study adopted the embedded design in which both qualitative and quantitative information were obtained concurrently, however the qualitative information was incorporated throughout the quantitative information (Creswell et al., 2003). Hence, this study primarily concentrated on the quantitative information but supported the results with qualitative information as well to understand in an in-depth manner. Data was collected from the villages of Delhi which were classified as rural area according to the Census 2011. The sampling unit for the study was a female above 18 years of age from the rural area of Delhi having basic knowledge about mobile wallets with a usage history of mobile wallets i.e. at least once in last three months. Purposive and snowball sampling techniques were used for data collection. Data for qualitative phase was collected from 10 females; whereas for quantitative phase data was collected from 208 females. Semi-structured questionnaire was used for qualitative phase whereas structured questionnaire was used for quantitative phase. Personal interview technique was used for qualitative phase whereas survey technique was employed for the quantitative phase. Qualitative data was analyzed using thematic analysis by identifying the codes, sub-themes and themes, Quantitative data was analyzed with the help of Statistical Package for Social Sciences (SPSS) version 23.0 employing one independent sample t-test and factor analysis. Table 1 gives the respondents profile of the study.

Table 1: Respondents' Profile

Sr. No.	Variable	Categories	Respondents (in %)
1	Age	18-30 years	30
		31-45 years	42
		46-60 years	17
		Above 60 years	11
2	Occupation	Student	21
		Service	10
		Self Employed	11
		Home Maker	58
3	Annual Family Income	Less Than or Equal To 5,00,000	39
		5,0,001-10,00,000	28
		10,00,001-15,00,000	23
		More than 15,00,000	10

Source: Authors' Own

This can be seen from the table that 42% of the sample was represented by the women belonging to 31-45 years of age group, followed by 18-30 years age group women representing 30% of the sample. 58% of the women were home makers whereas 21% of the sample was represented by the student respondents. 39% of the respondents corresponded to less than or equal to 5,00,000 Rs. annual family income category followed by 28% of the respondents belonging to 5,0,001-10,00,000 Rs. annual family income category.

4. Adoption of Mobile Wallets

This study was designed to understand the adoption of mobile wallets by the rural Indian women. Adoption of mobile wallets was understood in terms of type of mobile wallets used, years of experience, frequency of usage, sources of information, and purpose of using mobile wallets.

Table 2: Adoption of mobile wallet

1	Type of Mobile Wallet used	PayTm	80
		Google Pay	34
		BHIM	23
		Mobikwik	19
		PhonePe	29
		Others	12
2	Years of experience with mobile wallets	Less than 1 year	44
		1 to 3 years	36
		4 to 5 years	15
		More than 5 years	05
3	Frequency of usage	Less than 3 times in a month	55
		3-5 times in a month	35
		More than 5 time in a month	10
4	Source of information	Internet	62
		Magazine	5
		Television	34
		Radio	12
		Word of Mouth	93
5	Purpose of using mobile wallet	Recharges	90
		Bill payments	72
		Online shopping	25
		Money transfer	20

Source: Authors' Own

Table 2 shows that Paytm was the most used mobile wallet with 80% of the respondents using it, followed by the Google Pay and PhonePe used by 34% and 29% of the respondents. 44% of the respondents had a less than one year experience with mobile wallets whereas 36% of the respondents had 1to 3 years of experience. Majority of the respondents i.e. 55% respondents used mobile wallets less than 3 times a month. Word of mouth (WOM) served as the most prominent source of information about the mobile wallets wherein 93% of the respondents cited the same. Most common usage of mobile wallet emerged as the recharges, accepted by 90% of the respondents, followed by bill payments cited by 72% of the respondents.

Referring to the qualitative aspect of the research, it was found that most respondents identified the cue "Paytm" almost instantly; rather than acknowledging the service category namely the mobile wallets. Researchers had to give examples of various mobile wallets companies such as Paytm, Google Pay etc. to ensure that respondents understand the term mobile wallets easily. These observations indicate the strong brand equity of Paytm whereby the brand is overlapping with the service category for the rural women. Qualitative results also highlighted that the most common reason for increased usage of mobile wallets in recent years is the sheer popularity of mobile wallets and usage by the respondents' friend circle rather than the utility of the apps. Most of the respondents cited reasons like "everybody is using Paytm now a days", "my friends are using it, so I also thought of using them" etc. Only 1 respondent cited utility of the mobile wallets and ascribed the usefulness of the wallets for its increased usage. Interesting insights were obtained about the frequency and purpose of using mobile wallets wherein

respondents citing high frequency of usage of mobile wallets also quoted recharges and bill payments. Only 2 respondents in the qualitative phase cited purpose of using mobile wallets as online shopping and money transfer. Money transfer was also not more than Rs. 5000. The biggest source of information about the mobile wallets emerged as other people in the friend circle as all 10 respondents in qualitative phase accepted getting information about mobile wallets from friends only. Other sources were not mentioned in the qualitative aspect of the study.

4.1 **Factors affecting adoption of mobile wallets**

Responses of the respondents were recorded about salient features and beliefs of mobile wallets unveiled by previous studies through the review of literature. Reliability of the scale used for measuring perception was checked with the help of 'Cronbach's Alpha' whose value was found .882 which was more than .7 indicating the reliability of the scale. The study wished to explore the factors affecting adoption of mobile wallets, the most popular data reduction technique i.e. Factor Analysis, was used to get the results. Factor analysis is a statistical technique which is used to expose the underlying structure of a relatively large set of variables. The underlying variable is a latent variable in factor which is not directly observable.

Kaiser-Meyer-Olkin (KMO) Test was applied to see the overall suitability of the data for factor analysis. The test also assesses the sampling adequacy for each variable and complete model.

Table 3: KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.896
Bartlett's Test of Sphericity	Approx. Chi-Square	10182.071
	df	1225
	Sig.	.000

Source: Authors' Own

Table 4 details the descriptive statistics. The table gives the mean value, standard deviation and number of respondents who participated in the survey. It can be seen from the table that all major beliefs related to mobile wallets were rated more than mean value which was 3 as per the measurement tool, which meant that respondents favorably perceived mobile wallets appreciated its key traits such as being easy, convenient, and quick. Respondents also acknowledged the usefulness of the mobile wallets whereby they accepted that the latter facilitating cashless transactions, organization of cards, acceptance at all the places. Respondents also acknowledged that they could use mobile wallets without help. However, respondents remained concerned about the privacy and security issues while using mobile wallets. Table 4 also gives the communalities. Communality refers to the extent to which an item correlates with all other items. Communality values should be more than 0.5 to be considered for further analysis. This can be seen from the table that for all the variables, communalities value exceeded the minimum cut off value of .5. So, all the statements/variables were considered for further analysis.

Table 4: Descriptive & Communalities

Sr. No.	Variables/Statements	Mean	Std. Deviation	N	Communalities	
					Initial	Extraction
1.	Mobile wallets are easy to use.	4.35	0.595	208	1.000	.573
2.	Mobile wallets are convenient to use.	3.83	0.572	208	1.000	.553
3.	Special skills are not required to use digital wallets.	3.70	1.283	208	1.000	.680
4.	Mobile wallets facilitate cashless transactions.	4.05	0.407	208	1.000	.628
5.	Mobile wallets are less costly to get and operate.	4.21	1.106	208	1.000	.536
6.	Quick payments can be made with mobile wallets.	4.56	0.799	208	1.000	.634
7.	Mobile wallets offer discounts and cash backs.	4.31	1.304	208	1.000	.520
8.	Shopping becomes easy with mobile wallets.	3.73	0.536	208	1.000	.512
9.	I do not need to keep other cards with mobile wallets.	3.84	0.760	208	1.000	.640
10.	Mobile wallets have acceptance at almost all the places.	4.11	0.410	208	1.000	.486
11.	Many people use mobile wallets now a days.	4.26	0.346	208	1.000	.709
12.	I was motivated to use mobile channels after seeing others using it.	4.18	1.156	208	1.000	.671
13.	My friends advised me to use mobile wallets.	3.81	1.050	208	1.000	.501
14.	My family supports the use of mobile wallets.	3.93	0.928	208	1.000	.630
15.	I can use mobile wallets without help.	3.05	.505	208	1.000	.722
16.	I think I can use mobile wallets efficiently.	3.46	1.149	208	1.000	.591
17.	I have all the resources to use mobile wallets.	3.53	0.963	208	1.000	.664
18.	There remains a fear of sharing confidential information with mobile wallets.	4.26	0.679	208	1.000	.515
19.	There remains a risk of device getting stolen.	4.07	0.997	208	1.000	.588
20.	There is risk of malware/ virus with mobile wallets.	4.03	0.882	208	1.000	.682
21.	There remains a risk of money being lost.	4.22	0.876	208	1.000	.782

(Source: Authors' Own)

Table 5 presents the total variance explained. This can be seen from the table 5 that there were five factors which contributed towards the customer adoption. This can be seen from the table that these five factors taken together explained 70% of the variation in mobile wallet adoption.

Table 5: Total Variance Explained

Component	Initial Eigen values			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1.	22.167	35.423	35.423	22.167	35.423	35.423	18.388	33.787	33.578
2.	13.319	23.075	58.498	13.319	23.075	58.498	17.778	26.828	60.615
3.	3.084	5.693	64.191	3.084	5.693	64.191	5.137	3.988	64.603
4.	2.583	3.054	67.245	2.583	3.054	67.245	2.223	2.946	67.549
5.	1.818	2.881	70.126	1.818	2.881	70.126	1.436	2.577	70.126
6.	1.633	2. 245	72.371						
7.	1.534	2.201	74.572						
8.	1.415	2.198	76.77						
9.	1.294	1.882	77.952						
10.	1.202	1.871	79.633						
11.	1.136	1.869	81.502						
12.	1.060	1.859	83.361						
13.	.989	1.844	85.805						
14.	.939	1.832	87.537						
15.	.832	1.827	89.064						
16.	.825	1.823	90.887						
17.	.796	1.819	92.726						
18.	.760	1.815	94.561						
19.	.726	1.811	96.842						
20.	.720	1.809	98.651						
21.	.715	1.349	100						

(Source: Authors' Own)

Table 6 given below demonstrates the rotated component matrix. Principal component analysis method was used to extract the factors. Varimax with Kaiser Normalization was used as a rotation method. It can be seen from the table that total five factors were extracted which accounted for the adoption of mobile wallets.

Table 6: Rotated component matrix

Sr. No.	Variables/Statements	Component				
		1	2	3	4	5
1.	Mobile wallets are easy to use.	.739				
2.	Mobile wallets are convenient to use.	.792				
3.	Special skills are not required to use digital wallets.	.881				
4.	Mobile wallets facilitate cashless transactions.		.767			
5.	Mobile wallets are less costly to get and operate.		.855			
6.	Quick payments can be made with mobile wallets.		.741			
7.	Mobile wallets offer discounts and cash backs.		.841			
8.	Shopping becomes easy with mobile wallets.		.694			
9.	I do not need to keep other cards with mobile wallets.		.783			
10.	Mobile wallets have acceptance at almost all the places.		.797			
11.	Many people use mobile wallets now a days.			.841		
12.	I was motivated to use mobile channels after seeing others using it.			.749		
13.	My friends advised me to use mobile wallets.			.799		
14.	My family supports the use of mobile wallets.			.811		
15.	I can use mobile wallets without help.				.775	
16.	I think I can use mobile wallets efficiently.				.728	
17.	I have all the resources to use mobile wallets.				.698	
18.	There remains a fear of sharing confidential information with mobile wallets.					.784
19.	There remains a risk of device getting stolen.					.658
20.	There is risk of malware/ virus with mobile wallets.					.759
21.	There remains a risk of money being lost.					.776
Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization. a. Rotation converged in 8 iterations.						

(Source: Authors' Own)

First factor was composed of statements 1 to 3; and was named as "perceived ease of use" wherein respondents described mobile wallets as easy to use and convenient in nature. Second factor was composed of statements 4 to 10 and was named as "perceived usefulness" whereby respondents attributed certain benefits to the usage of mobile wallets such as facilitating cashless transactions, less costly to operate, making quacking payments, offering cashbacks, easy shopping, organization of cards and widespread acceptance. Third factor was named as "social norms" and was composed of statements 11 to 14. Respondents acknowledged using mobile wallets after observing others and accepted the support of their friends and family. Fourth factor was named as "self-efficacy" and was composed by the statements ranging from 15 to 17. Respondents claimed to use mobile wallets effectively without help. They also accepted having all the resources to use mobile wallets. The last factor was named as "perceived risk" and was composed by the statements ranging from 18 to 21. Respondents accepted being fearful while sharing personal information. They also remained apprehensive about the probability of device being stolen, exposed to risk of malware and financial fraud.

The qualitative phase of the research highlighted four most important factors affecting adoption. All the respondents unanimously accepted the benefits of the mobile wallets. They acknowledged its easy interface e.g. "just a click and that's it" as quoted by a respondent; and convenient nature. They also acknowledged its widespread usage especially by their family members, friends, and relatives. However, all the respondents also highlighted the "risky" nature of mobile wallets. Citing the commonly observable financial frauds, most of the respondents remained fearful about loosing money.

Citing the same, one of the respondents said, "I think mobile wallets are useful, but they are risky too… that's why I don't have much money in my wallet." Analyzing both the phases of research, it can be said that "self-efficacy" was only acknowledged in the quantitative phase. In qualitative phase, lack of self-confidence and knowledge were acknowledged by the respondents. They accepted using mobile wallets, but at the same time accepted not being truly confident and entirely knowledgeable about the mobile wallets. They further remarked that benefits of mobile wallets and their widespread popularity motivated them to use mobile wallets whereas lack of self-confidence and knowledge; and risky nature of mobile wallets acted as restraining forces.

Challenges faced by rural women while using mobile wallets

This study intended to understand the challenges of rural women using mobile wallets. Review of literature revealed the important challenges faced by rural women while using contemporary technologies like digital or mobile wallets. Several statements were phrased related to the important challenges as highlighted in literature and responses of the respondents were recorded. Reliability of the constructs was measured through Cronbach's Alpha whose value exceeded the cutoff value of 0.7, indicating the usage of internally consistent scale. Table 7 indicates the descriptive and inferential statistics along with reporting the reliability statistics.

Table 7: Descriptive and inferential statistics related to challenges

Challenge	Statements	Cronbach's Alpha	Mean Value	t-value	Sig. (2-tailed)
Lack of confidence	I fear while paying through mobile wallets, especially large amount.	.878	4.23	20.275	.000
	I think I am not as confident as handling cash while using mobile wallets.		4.12	24.463	.000
	Quite often, I think I will make mistake while paying through mobile wallets		3.98	23.383	.000
Socio-cultural barriers	Usually the financial payments, especially big ones are done by my husband, not by me in my family.	.887	3.87	24.792	.000
	Other members in the family encourage me to make utility payments through mobile wallets.		3.98	35.034	.000
	My family thinks that financial matters must be handled by men only.		4.13	30.360	.000
Lack of awareness	I am not fully aware of all the benefits of mobile wallets.	.789	3.76	35.034	.000
	There is a lot of confusion while choosing amongst the different mobile wallets.		4.06	37.138	.000
	Sometimes, I do not understand the exact reason of using digital wallets.		3.59	39.331	.000
	I do not have complete knowledge of mobile wallets.		3.55	29.202	.000

(Source: Authors' Own)

Table 7 indicates that all the statements rated more than the average value; indicating that respondents agreed with all the challenges highlighted in the literature. Lack of confidence, socio-cultural barriers and lack of awareness were highlighted as the major challenges faced by rural Indian women while using mobile wallets. Respondents remained fearful while paying through wallets, and indicated towards probability of making mistakes while using mobile wallets. They also acknowledged existence of socio-cultural barriers wherein they remained confined to making utility payments whereas men in the family handled large transfers. Lastly, they also remained unaware of all the benefits of mobile wallets and being confused about different mobile wallets. The significance of the results was assessed with the help of one independent sample t-test at 5% level of significance. All the statements were found associated with .000 sig. value; indicating towards the significant results.

Lack of confidence was quite visible in the qualitative phase of the research wherein most of the respondents accepted not being completely confident with mobile wallets. They accepted being fearful while making payments. Probed specifically, they remained fearful while paying for more than 5000 Rs. Socio-cultural barriers were also highlighted in the qualitative phase wherein most of the respondents accepted non-handling of the major financial decisions. Most of the women except the unmarried ones, acknowledged handling budget of their houses; acting as major outlet of household's monthly financial outflow concerning with grocery, bills, tuition fees etc.; but denied playing any big role in making big payments to the outside parties either via cash or through mobile wallets. One of the respondents claimed, "How much money I can handle and how do I handle is already decided in my family. I only make payments for grocery and electricity bills. I used to do it physically……. But recently I have switched to online payments. These payments are not more than 2 or 3 thousand." Many respondents cited lack of financial resources also. They accepted being dependent upon their husbands for the money; hence not having enough money. Asking more about the challenges of using mobile wallet, one of the respondents cited problem with the language. She was not comfortable with the English language and wanted the language of the wallet to be in Hindi. She was surprised to know that the app she was using was available in Hindi language also. This instance clearly indicated the lack of awareness. Enquired about all the features of the mobile wallets, most of the respondents denied knowing all the features of the mobile wallets; validating the lack of knowledge about the mobile wallets.

Mobile wallets as means of women empowerment amongst rural women

The study wished to explore the probability of mobile wallets acting as a means of women empowerment amongst rural women. The association was less explored in the existing literature; hence few statements related to financial inclusion, facilitating coopetition with others, self-dependence and promoting self-employment and business, representing women empowerment through mobile wallet were formulated and responses of the respondents were recorded. The results have been explained in table 8.

Table 8: Descriptive and inferential statistics of mobile wallet as means of empowerment

Statements related to women empowerment	Cronbach's Alpha	Mean Value	t-value with sig.
I think mobile wallets can be extremely useful for fulfilling the banking needs of unbanked women.	.875	4.34	27.014
I can help other women financially with the help of mobile wallets.		4.02	36.153
Utility payments can be easily made with the help of mobile wallets and that makes me feel independent.		4.09	27.661
Mobile wallets can be especially helpful for self-employed and business women in rural settings.		3.87	34.559

(Source: Authors' Own)

Cronbach's Alpha value was found more than .7; indicating the reliability of the scale used to measure women empowerment through mobile wallets. This can be seen from table 8 that all the stated were assigned values of more than the average value, suggesting that respondents believed that mobile wallets have the capability to help them financially, fulfilling the banking needs of unbanked. Mobile wallets were also believed to ease the utility payments, thereby furthering the feeling of independence. Respondents also believed that mobile wallets could be especially helpful for self-employed and business women in rural settings. The significance of the results was assessed with the help of one independent sample t-test at 5% level of significance. All the statements were found associated with .000 sig. value; indicating towards the significant results.

Qualitative phase of the research also pointed towards the similar direction as out of 10 respondents in the qualitative sample, only 2 had the bank account; but all the respondents had mobile wallets; validating the proposition that mobile wallets can fulfill the banking needs of the unbanked. All the respondents felt independent while using mobile wallets as the latter furthered the convenient and quick payments and transfers without overt dependence on anyone. Respondents also accepted helping their friends in need through money transfers via mobile wallets and paying for shopping, bills, recharges etc. the results indicated the gradually improving women's agency in financial decisions. However, respondents in the study also opined that financial independence is must to truly feel empowered. One respondent was employe with a government organization in the sample; still she accepted that her finances are also handled by her husband and she was not able to take financial decisions independently even after being financially independent.

Discussion and Implications

Paytm, Google Pay, and PhonePe were found the most used mobile wallets amongst Indian rural women. The fundings corroborate well with the latest Statista report wherein Paytm, Phonepe and Google Pay were the most used mobile wallets used by the Indians (Raynor de Best, 2023). Most common usage of mobile wallet by the Indian rural women included recharges and bill payments. The most common reason for increased usage of mobile wallets for Indian rural women was usage by the respondents' friend circle rather than the utility of the apps. These insights were not offered in the existing literature and hence these findings stayed unique to the study. The study identified that word of mouth acted as major source of information for rural Indian women about mobile wallets. The findings are in contrast with Parashar and Rasiwala (2017) wherein social media was highlighted as the major source of communication. The contrasting

finding could be attributed to the different sample composition of the researcher wherein Gen Y and Gen Z consumers including both men and women constitute the sample whereas in the present study only female respondents have been considered. The results imply that rural women trust more the informal and personal channel of communication rather than non-personal and formal channel of communication. This information might be used by the marketer to reach this market segment wherein they can identify the opinion leader in the women groups and try target the whole group through influencing the leader.

Results of the study identified five factors divided into drivers and constraints affecting the adoption of mobile wallet by rural Indian women. Three factors namely the "perceived ease of use" "perceived usefulness" and "social norms" were identified as the facilitators or drivers. "Self-efficacy" was found essential for effectively using the mobile wallets; however rural Indian women considered themselves less confident possessing limited knowledge about the mobile wallets. "Perceived risk" was also identified one of the most important factors affecting the adoption of mobile wallet wherein greater perceived risk was identified lowering the mobile wallet adoption intentions. The findings largely corroborate with previous findings highlighted by researchers like George and Sunny (2023), Kaur et al. (2020) Aydin and Burnaz,(2016) and Ahuja and Joshi (2018). The results imply that mobile wallet adoption among rural women can be enhanced not only by emphasizing upon the benefits and ease of mobile wallets; but also fostering confidence among women, facilitating knowledge and handling the privacy and security issues. Organizations can organize special training sessions for the rural women. Essential information must be shared with rural women in the vernacular language for easy understanding.

Lack of confidence, socio-cultural barriers, lack of financial resources and lack of awareness were highlighted as the major challenges faced by rural Indian women while using mobile wallets. These findings are not surprising at all as similar findings have also been reported by previous researchers like Obopay (2018), Puri (2019) and Joshi, Gupta and Rangaswamy (2023). Mobile apps need to build confidence among rural women by making their apps less intimidating, more accessible and friendly. They can also collaborate with Internet Saathi, a long-term initiative of Google and Tata group to facilitate digital literacy in rural areas.

The results indicated that mobile wallets have the possibility to act as a tool of women empowerment by facilitating banking needs of the unbanked, fostering cooperation, self-dependence and promoting self-employment and business amongst the rural Indian women. Association of digital wallets with women empowerment have been previously acknowledged by few existing studies such as Care (2020) Gupta and Chaudhary (2023) and Bhattacharjee (2023). The results imply that mobile wallets might work in collaboration with formal banking system to fulfil the needs of unbanked as formal banking system often find itself in fulfilling the needs of underprivileged segment and underserved communities including women. The results however, also imply that only facilitating access to banking services through mobile wallets to the unbanked is not enough; Formal needs of rural women must be understood formally. Similarly, it is easy to say that mere using and access to mobile wallets would further the independence feeling of the rural women. Indian culture's insistence on patriarchy must not be undermined and gender norms in the social setting must be appreciated and addressed. Indian rural women are not dependent upon their spouses while making financial decisions despite being financially independent; hence, training and education must be given to them in order to make them truly independent while making financial decisions. In order to facilitate the gender equality, government

and mobile wallet organizations might organize financial counselling sessions and gender dialogues programs.

Conclusion and limitation

The study intended to explore the mobile wallet adoption among Indian rural women along with understanding the factors affecting adoption, challenges and possibility of mobile wallet as a tool of women empowerment. The study concluded that Paytm Google Pay and PhonePe were the most used mobile wallets amongst Indian rural women. Most common usage of mobile wallet by the Indian rural women included recharges and bill payments. The most common reason for increased usage of mobile wallets for Indian rural women was usage by the respondents' friend circle rather than the utility of the apps. Word of mouth acted as major source of information for rural Indian women about mobile wallets. Three factors namely the "perceived ease of use" "perceived usefulness" and "social norms" were identified as the facilitators or drivers. "Self-efficacy" was found essential for effectively using the mobile wallets; however rural Indian women considered themselves less confident possessing limited knowledge about the mobile wallets. "Perceived risk" was also identified one of the most important factors affecting the adoption of mobile wallet. Lack of confidence, socio-cultural barriers, lack of financial resources and lack of awareness were highlighted as the major challenges faced by rural Indian women while using mobile wallets. Mobile wallets have the possibility to act as a tool of women empowerment by facilitating banking needs of the unbanked, fostering cooperation, self-dependence and promoting self-employment and business amongst the rural Indian women.

The study adopted the mixed methodology which is considered better than the sole qualitative or quantitative study; still the study was more focused on quantitative side. Qualitive results were embedded to further elaborate the quantitative results. Qualitative data was collected from only 10 respondents. Further researchers can balance both the aspects of the study. The study was confined to Delhi; which could restrict the generalization of the results. The various factors have been identified; but their quantitative effect on adoption intentions has not been identified.

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