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The Artificial Intelligence Application and Its Influence on the Marketing Innovation: Mediation of The Marketing knowledge Management An applied study on The Egyptian Public Commercial Banks

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Abstract: The immense artificial intelligence (AI) applications have effectively developed knowledge management and innovation processes in the marketing field, as institutions seek to benefit from AI applications to enhance marketing strategies and innovate solutions more effectively. This study aims to show the existence of an impact of marketing knowledge management (MKM) as a mediating variable in the relationship between AI applications and marketing innovation (MI) in banking institutions. The study discussed the presentation of AI applications through the dimensions of the technology acceptance model (TAM) for Egyptian public commercial banks employees as the study population. A sample of 162 employees responded to this study, and the study concluded that the implementation of AI technologies enhances the efficiency and effectiveness of MKM practices within these banking institutions. Potentially improving the processes of gathering, processing, and utilizing marketing information. While the implementation of AI applications does not directly enhance MI, there must be an intermediary role for MKM.

Keywords: artificial intelligence (AI), marketing knowledge management (MKM), marketing innovation (MI), technology acceptance model (TAM), banking sector.

I. INTRODUCTION

Globalization and economic changes have driven individuals and organizations to look for innovative methods to enhance their competitive advantages [1]. Artificial intelligence (AI) is considered the most influential technology on organizations, especially concerning their marketing activities. Organizations have been able to leverage AI to reach customers, understand their behavior, and predict their future behavior, thereby better meeting their desires than their competitors [2]. AI applications have revolutionized the marketing field by providing unprecedented opportunities for both practice and academic research. The rapid advancement in AI technologies, such as natural language processing, machine learning, and statistical algorithms, has enabled marketers to gain deeper insights into consumer behavior, optimize marketing strategies, and enhance customer relationships [3].

Thus, AI helps in designing and implementing marketing strategies, making them more adaptable and responsive to market changes [4], as the process of integrating AI applications into the marketing mix enhances innovation and provides competitive advantages [5]. In this context, we find that the rapid and continuous development of information systems technology increases organizations' ability to create, possess, and disseminate knowledge effectively. Additionally, AI applications enable us to acquire, possess, and store vast amounts of knowledge, and thus, AI applications facilitate knowledge management (KM) processes [6].

Marketing knowledge, including knowledge of customers and competitors, is of great importance for product innovation [7]. Innovation has become a strategic necessity for organizations today to face intense competition in the market [8]. Therefore, the organizations can increase innovation rate within their organization if they devote more attention to KM [9].

To align with banks' Strategies which is geared towards boosting digital transformation, AI, and Omni-channel marketing, and promoting the customers' digital experience in various banking aspects. Therefore, this study aims to explore the possibility of using AI applications to improve marketing knowledge management (MKM) processes in order to enhance marketing innovation (MI). This study investigates the following research questions:

- RQ1: There is the impact of the AI application on the MI?
- RQ2: There is the impact of the AI application on the MKM?
- RQ3: There is the impact of the MKM on the MI?
- RQ4: There is the impact of the AI application on the MI through the mediation of the MKM?

II. LITERATURE REVIEW

1. THE ARTIFICIAL INTELLIGENCE APPLICATION

The rapid developments in computer science and its software applications in recent years have surpassed those in other scientific fields. These advancements in software are referred to as AI, which is considered a modern technology that has gained widespread attention in both academic and practical fields [10] AI refers to systems or devices that simulate human intelligence to perform tasks and can improve themselves based on the information they collect. It is more about the ability to think and analyze data than it is about a specific form or function. AI relates to the design of computer systems and software that aim to mimic human behavior. As [11] points out, this software is among the most intelligent in the field of computing, encompassing two main directions: the first involves expanding the scope of information processing, and the second embodies enhancing the level of understanding of information. While [12] sees the goal of these applications as enhancing the skills of workers rather than replacing them, they serve as a link between complex applications, workers, computers, knowledge, and the physical world. Amongst their most prominent tasks are enabling applications to distribute and retrieve data, data mining, product design, manufacturing processes, and scheduling. Study [13] sees that AI systems rely on human experiences and knowledge, in addition to selecting appropriate logical models. He considers that current systems represent a continuation and expansion of human experiences.

The importance of applying AI in the banking sector has increased recently, as [14] pointed out the influence of AI on commercial banking operations, through various applications such as chatbots, risk assessment, anti-money laundering, and fraud detection. Furthermore [15] focused on the application of blockchain and AI in bank risk management, highlighting the importance of AI in enhancing risk assessment processes. Additionally, [16]

examined the innovative application of AI technology in the domain of banking credit risk management, highlighting the capacity of AI to refine credit decision-making processes via deep learning and comprehensive big data analytics.

In general, the increasing importance of AI in the banking industry is highlighted, as it is used in various areas such as risk management, customer service, and decision-making processes. The use of AI in banks is evolving with a focus on improving operational efficiency and customer experience. Here are the most prominent applications of AI in the field of bank management:

- Chatbots: They answer customer inquiries and provide support.
- Biometric identity verification systems: They use fingerprints or facial recognition to secure transactions.
- Recommendation engines: They provide personalized recommendations to customers regarding investment products and loans.
- Fraud detection systems: They continuously monitor financial transactions to detect any suspicious activities.

In this context, the variables related to the orientation towards AI applications will be addressed, based on the Technology Acceptance Model (TAM) developed by [17] this model is considered one of the most widely used and applied models in the field of modern technology. The model assumes that individuals' acceptance of new technology is determined by two main factors: perceived usefulness and perceived ease of use. The model also emphasizes that these two factors are influenced by several external factors. The main objective of the model is to explain user behavior towards information and to predict the intention to use and the actual use of technological innovations.

The TAM is predicated on the premise that an individual's perception of new technology as being facile and advantageous correlates directly with an increasingly favorable disposition towards it [18] thereby enhancing their inclination or motivation to engage with it. "Davis" elucidated the motivational factors influencing user engagement with information systems in the foundational model, delineating three critical components: perceived usefulness, perceived ease of use, and attitude towards utilization, while positing that the user's attitude serves as the principal determinant of both the actual engagement and non-engagement with the technology.

Subsequently, "Davis" refined the theoretical framework, positing that the perceived usefulness exerts a direct influence on the actual utilization of the system, and that the attributes of the system have a direct effect on the user's disposition independent of any actual dependence on the system. The model subsequently progressed to incorporate behavioral intention to use as a variable that is directly influenced by perceived usefulness and serves as a mediator between actual use and attitude towards usage. He then conducted an empirical assessment of the second iteration of the model, demonstrating its efficacy [17] Figure [3] illustrates the TAM according to "Davis's" modification:

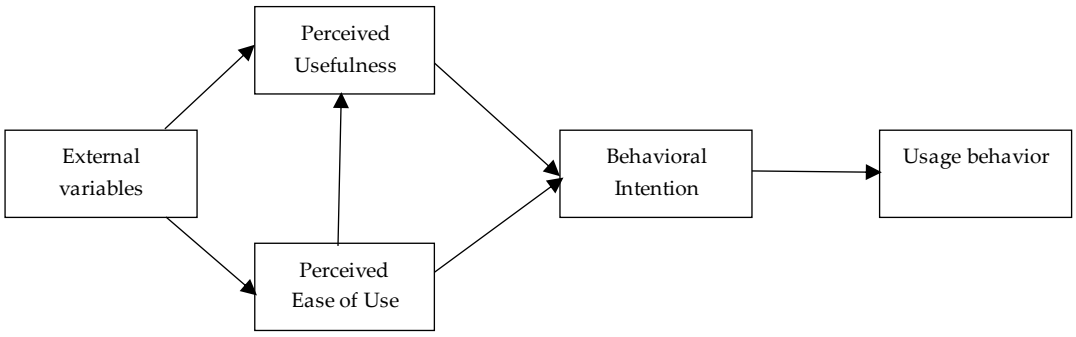

FIGURE 1. Tam according to Davis's *source: according to the latest modification of the Davis model

The following sections elaborate on these critical components.

Perceived Ease of Use (PEU): PEU denotes the extent to which an individual perceives that the utilization of a specific technology is devoid of effort. Research demonstrates that an elevated level of PEU correlates with an increased perceived of usefulness, which subsequently augments user acceptance [19, 20] For example, within an

investigation concerning QRIS, it was revealed that the students' perception of ease of use markedly affected their acceptance of the technology [19].

Perceived Usefulness (PU): PU is defined as the extent to which an individual perceives that the utilization of a particular technology will augment their occupational performance or enhance their routine activities. Empirical evidence indicates that a robust perception of usefulness is positively associated with behavioral intention in the use of the technology [21, 20]. Within the domain of Enterprise Resource Planning (ERP) solutions, organizations that customized their systems to align with specific requirements have reported elevated acceptance rates attributable to the perceived usefulness of the technology [21].

Behavioral Intention: The attitudes of users towards technological systems, influenced by (PEU) and (PU), exert a direct effect on their behavioral intentions regarding the utilization of the technology. Favorable attitudes correlate with an increased probability of actual system utilization, as evidenced by numerous empirical investigations [19, 20]. Although (TAM) offers a comprehensive framework for understanding technology acceptance, it is imperative to take into account external factors, such as cultural influences and organizational contexts, which can also exert considerable influence on user acceptance [22, 23].

2. THE MARKETING KNOWLEDGE MANAGEMENT

Knowledge encompasses a vast array of concepts; however, within the realm of organizational frameworks, it pertains to the comprehension exhibited by employees regarding their products, markets, policies, users, environmental factors, operational procedures, values, achievements, and errors [24]. When effectively administered, knowledge has the potential to enhance organizational learning and facilitate successful operational processes within institutions [25]. According to [26], knowledge is regarded as a crucial strategic asset within organizations, as it integrates employees, technology, and human resources to generate sustainable value for the organization. Study [27] contend that knowledge constitutes a synthesis of information amalgamated with experience, contextualization, cognitive processes, interpretation, and diverse perspectives, thereby engendering a heightened level of comprehension. Work [28] characterizes knowledge as the amalgamation of insights, understanding, and practical competencies possessed by individuals, while also serving as the fundamental resource that empowers individuals to engage in intelligent work practices.

Organizations must discover efficient methods to boost their performance in the face of globalization, rapid technological advancement, and a changing market environment [29]. Knowledge management is seen as a panacea for businesses looking to become more efficient and competitive. Unquestionably, the modern world has entered the information age, which makes turning organizational data into knowledge crucial. Furthermore, knowledge management has become a strategic asset for businesses due to the growing emphasis on managing and applying knowledge to improve organizational performance, efficiency, and competitive capabilities [30]. Knowledge management, according to [31], is "an administrative process for creating, sharing, and using organizational information and knowledge." According to [32] it as a process that includes knowledge creation (knowledge generation), acquisition, encoding, storage, transfer (knowledge conversion), distribution, integration, and application.

According to [33], marketing knowledge is "market information" that must be processed through organizational memory, shared knowledge, learning, dissemination, interpretation, and acquisition. Additionally, MKM is considered a vital and important part of total knowledge management within an organization, which focuses on applying various knowledge management processes to bridge the gap between the organization and its customers, allowing it to achieve its goals effectively. Based on [34] MKM is the organization’s employment of various knowledge management processes, including knowledge diagnosis, generation, storage, distribution, and application in its marketing environment, in order to make marketing decisions. The following are the dimensions of MKM and uses of AI:

- Knowledge Creation: The phenomenon of knowledge creation encompasses the formulation of novel concepts and resolutions from the ground up, and at times, it culminates in the reconfiguration and reassembly of pre-existing knowledge. This capacity facilitates the organization's adaptation to evolving contexts. Consequently, knowledge creation may manifest as the acquisition of knowledge through the exploration or procurement of information [35]. AI helps us drive predictive analytics through self-learning analytics capabilities, recognize

previously unknown patterns, analyze organizational data and discover relationships, develop new declarative insights.

- Knowledge Storage and Retrieval: Both [35] emphasized that this process is primarily concerned with the extraction of knowledge, its clarification, and the systematic documentation thereof for prospective utilization, frequently achieved through the establishment of knowledge repositories. Furthermore, [3] observed that a fundamental function of knowledge management is to develop and sustain an organizational memory that monitors both generated and acquired knowledge assets. The implementation of effective storage and retrieval strategies constitutes one of the critical mechanisms for the preservation of organizational memory. AI assists in the aggregation, categorization, structuring, preservation, and retrieval of coherent information. It systematically analyzes and filters diverse content and communication modalities. It enables the repurposing of knowledge by both collaborative teams and individual practitioners.
- Knowledge Sharing: As articulated by [35], the effective dissemination of knowledge within an organization is essential for its successful utilization in the realms of problem-solving and decision-making. Nevertheless, the process of knowledge sharing frequently encounters obstacles related to temporal, spatial, and functional dimensions. Consequently, the phenomenon of knowledge sharing within numerous organizations is often characterized by its localized and fragmented nature. AI facilitates the connection of individuals engaged in analogous issues by enhancing weak ties and know-who relationships. This, in turn, promotes collaborative intelligence and the cultivation of shared organizational memory. Furthermore, it engenders a holistic understanding of knowledge sources and potential bottlenecks. Ultimately, it aims to establish more coordinated and interconnected systems that transcend organizational silos.
- Knowledge Application: [36] posited that the application of knowledge encompasses the actualization of knowledge after its retrieval or dissemination. This frequently necessitates the restructuring of existing knowledge assets into viable solutions or the creation of novel products and services tailored for a specific context. In numerous instances, the application of knowledge is contingent upon a process of reinvention, which "is not merely about altering others' concepts". This endeavor mandates proficient selection, analysis, and integration of pertinent external knowledge. AI facilitates the enhancement of context-specific knowledge application by conducting searches and organizing knowledge repositories. It provides more organic and intuitive system interfaces (e.g., voice-activated assistants). Furthermore, it fosters equitable access to knowledge.

3. THE MARKETING INNOVATION

MI is a crucial element for enhancing the competitive ability of organizations in the rapidly evolving current environment. This includes the implementation of innovative methodologies, tools, and techniques that improve marketing processes and elevate customer engagement [37]. Its significance lies in bolstering an organization's capacity to adapt to evolving competitive dynamics. Consequently, organizations that adeptly perceive environmental shifts and discern the factors influencing organizational innovation can enhance their ability to forecast future trends within their competitive landscape. This capability not only heightens the potential for identifying market opportunities but also aids in pinpointing strengths and weaknesses, thereby offering strategic insights into market positioning [38]. Innovation in services can be classified into:

- Service innovation: [39] the production of new service products with the aim of changing the functional and physical components and performance components of the service through improvements and further development or the production of completely new substitutes.
- Process innovation: [40] Any change in the production and delivery process of a service through improvements and developments in production, distribution, management and organizational methods. This includes: Innovation in procedural processes, i.e. all the processes that an organization performs before and around interacting with a customer Innovation in the delivery process, i.e. the interaction between the service provider and the customer.

- Innovation in marketing methods, [41] including: innovation in communicating the benefits of service products to customers, innovation in customer experience, i.e. how to provide and use customer experience in marketing, and innovation in communication, i.e. how the company's products are connected to customers. Customers can.
- Business model innovation: [42] the creation of new business concepts that embody the three previous types of innovation, such as: a new service, a new process or a new market, and therefore represents a new business model.

Knowledge management plays a vital role in enhancing the effectiveness of MI through the process of collecting, organizing, and distributing knowledge within the organization, aiming to improve performance and decision-making, [43] specifically in the following aspects:

- Providing a knowledge base: Knowledge management collects information related to products, customers, markets, competitors, and current trends. This comprehensive knowledge base is the foundation for innovation.
- Enhancing collaboration and communication: By facilitating knowledge exchange among employees in different departments, knowledge management encourages collaboration and the generation of new ideas.
- Accelerating the decision-making process: With access to accurate and complete information, marketers can make quick and informed decisions, thus speeding up the process of launching new products.
- Analyzing data and extracting insights: Knowledge management tools assist in analyzing large amounts of data and extracting valuable insights that help understand customer needs and identify new innovation opportunities.

In summary, knowledge management is the cornerstone of MI. It provides the tools and environment necessary to generate new ideas and transform them into successful products and services.

Technological advancements, particularly the integration of AI and data science, profoundly influence MI within the banking sector. These technological enhancements allow banks to significantly improve customer experiences and optimize marketing strategies, thereby fostering better financial stability and securing a competitive edge in the industry [44]. The following areas demonstrate the advantages of using AI to promote innovation in banking marketing: Data analytics: the process of analyzing vast volumes of data using AI to gain a deeper understanding of consumer behavior; Chatbots: utilizing chatbots to offer 24/7 automated customer support; Fraud detection is the process of identifying and stopping fraudulent conduct using AI.

III. DEVELOPMENT OF HYPOTHESIS

1. THE APPLICATION ARTIFICIAL INTELLIGENCE AND THE MARKETING KNOWLEDGE MANAGEMENT

Recent literature has shown a keen interest in exploring the impact of AI applications on MKM. [35] endeavors to elucidate the prospects inherent in the adoption of nascent systems facilitated by AI within the domain of knowledge management (KM). To achieve this objective, we clarify the prospective contributions of AI in bolstering the essential facets of KM: the generation, preservation and retrieval, dissemination, and application of knowledge. Subsequently, we offer pragmatic approaches to cultivate the collaboration between human agents and AI in enhancing organizational KM endeavors, and we delineate various implications for the advancement and governance of AI systems predicated on the elements of personnel, infrastructure, and processes. Study [45] investigates the feasibility and potential benefits of employing AI in marketing management, with a particular focus on pricing strategies for products launched on e-commerce platforms. Additionally, [46] highlight the growing importance of researching how AI can be integrated into strategic marketing decisions. This marks a shift in AI application towards more strategic areas. Furthermore, [47] explores the impact of knowledge management and data mining on marketing decision-making, emphasizing the importance of leveraging data and insights to improve marketing strategies. Work [48] examines the potential role that AI plays in shaping marketing strategies, highlighting its significance in strategic decision-making. Study [49] introduces an Integrated AI Framework designed to improve knowledge creation and facilitate rational decision-making in B2B marketing, ultimately

aiming to enhance firm performance. This underscores the growing interest in leveraging AI for marketing strategies. [50] AI greatly enhances MKM by transforming the ways in which knowledge is developed, stored, shared, and applied. AI tools optimize data analysis, resulting in more informed decision-making and encouraging innovation. Consequently, this improves an organization's capability to implement marketing strategies efficiently and respond to changes in the market. Finally, [51] identified that both AI and Knowledge Management (KM) are inextricably interconnected with the fundamental characteristics of knowledge and learning; furthermore, contemporary advancements in AI possess the potential to establish novel frameworks for the reformation of KM within organizational contexts. In summary, the literature indicates that AI applications could substantially influence MKM, especially in strategic decision-making. Additional research is necessary to fully understand AI's potential in refining marketing strategies and boosting organizations performance. Based on literature review just mentioned the following hypothesis is developed:

- H1: There is a positive significant effect of the application AI in MKM processes.
- H1.1: There is a positive significant effect of the application AI in Marketing Knowledge Generation Process.
- H1.2: There is a positive significant effect of the application AI in marketing knowledge storage process.
- H1.3: There is a positive significant effect of the application AI in marketing knowledge sharing process.
- H1.4: There is a positive significant effect of the application AI in marketing knowledge application process.

2. THE APPLICATION ARTIFICIAL INTELLIGENCE AND THE MARKETING INNOVATION

The impact of AI applications on innovation in marketing has been a topic of great interest in recent years. Numerous scholarly investigations have examined the impact of AI across various sectors, illuminating the prospective transformations and advancements that AI may introduce. For instance, [52] examined the role of AI in audit services and its impact on the audit industry. The study emphasized how the deployment of financial robots by leading accounting firms has spurred innovation in both business models and auditors' work processes. In a similar manner, [34] examined the evolution of various application scenarios in the finance sector, focusing on intelligent marketing, and pinpointed areas with significant growth potential. Additionally, the role of AI in MI was explored in relation to emerging technologies like virtual reality (VR) and augmented reality (AR). Study [48] explores how digitalization and AI applications affects the financial performance of banks. It emphasizes the influence of technological change and financial innovation on transforming the financial sector. Additionally, [53] examined MI within the context of the new retail model, using Luckin Coffee as a case study. The analysis highlighted how AI and big data are revolutionizing traditional marketing methods, offering fresh concepts for businesses to revamp their strategies. The studies highlight the need to align AI applications with broader organizational objectives. In summary, the reviewed literature indicates that AI has the potential to greatly influence MI across different industries. By utilizing AI technologies like machine learning and data analytics, organizations can refine their marketing strategies, boost customer engagement, and promote business growth. Based on literature review just mentioned the following hypothesis is developed:

- H2: There is a positive significant effect of the application AI in MI.

3. THE MARKETING KNOWLEDGE MANAGEMENT AND THE MARKETING INNOVATION

The influence of MKM on the advancement of MI constitutes a significant domain of inquiry that has garnered considerable scholarly interest in contemporary discourse. Study [54] conducted an investigation into the mediating function of marketing dynamic capability within the context of the association between customer knowledge management and the performance of product innovation, underscoring the critical importance of dynamic capabilities in facilitating innovation. Additionally, [25] investigated the influence of MKM on the performance of banks, specifically through the lens of Fintech innovation within Jordanian commercial banking institutions, underscoring the intermediary function of Fintech innovation in the augmentation of bank performance. [55] accentuates the pivotal significance of integrating knowledge and promoting innovation to attain a novel product advantage within the high-technology industry. This highlights the necessity of leveraging knowledge to drive innovation and establish a competitive superiority. Furthermore, [56] investigate the notion of dynamic marketing capabilities within enterprises that are grounded in scientific research, highlighting the advantages of market intelligence in fostering technological advancements. This accentuates the significance of

market intelligence in propelling innovation within organizations. In an investigation conducted by [57], the contingent value of knowledge in the realm of innovation for new products was scrutinized within the context of China's high-technology sector. The results underscored the significant influence of knowledge-driven innovation on the creativity of new products, thereby highlighting the critical role of knowledge management in facilitating advancements in MI. Overall, the extant literature indicates that the domain of MKM is instrumental in facilitating MI. Through the strategic utilization of knowledge integration, dynamic marketing capabilities, and the management of customer knowledge, organizations can significantly improve their innovation performance and secure a competitive advantage within the marketplace [32, 56, 54]. These observations highlight the critical importance of knowledge-based capabilities in influencing marketing strategies and promoting innovation across diverse industries. In light of the aforementioned literature review, the following hypothesis has been formulated:

- H3: There is a positive significant effect of MKM in MI.
- H3.1: There is a positive significant effect of Marketing Knowledge Generation Process in MI.
- H3.2: There is a positive significant effect of marketing knowledge storage process in MI.
- H3.3: There is a positive significant effect of Marketing knowledge sharing process in MI.
- H3.4: There is a positive significant effect of marketing knowledge application process in MI.

4. THE APPLICATION ARTIFICIAL INTELLIGENCE, THE MARKETING KNOWLEDGE MANAGEMENT, AND THE MARKETING INNOVATION

The influence of AI on the advancement of MI, facilitated by the intermediary role of MKM, has emerged as a subject of scholarly interest in recent years. Work [58] investigates the potential contributions of (AI) to knowledge-driven marketing within business-to-business contexts. They elucidate the fundamental components of (AI) systems and their intricate interconnections. Work [45] elucidates the practicality and advantages associated with the implementation of AI methodologies within the domain of marketing management, particularly in the context of e-commerce environments. They employ fuzzy association rule mining and fuzzy logic methodologies to develop adaptable pricing strategies for products introduced on e-commerce platforms. Study [48] investigates the crucial role of AI in shaping marketing strategies. They detail how AI significantly impacts the management of strategic marketing decisions and its effect on the organizational structure of companies. Overall, the scholarly literature indicates that AI possesses the capacity to transform MI through the effective utilization of knowledge management methodologies. Through the implementation of AI technologies within marketing frameworks, organizations can secure a competitive advantage and respond adeptly to the continuously changing digital environment. In consideration of the previously discussed body of literature, the following hypothesis has been articulated:

- H4: MKM processes mediate the relationship between the application AI and MI.

From the above, researchers can formulate the proposed study model through the following Figure [25], which shows the relationships between the study variables.

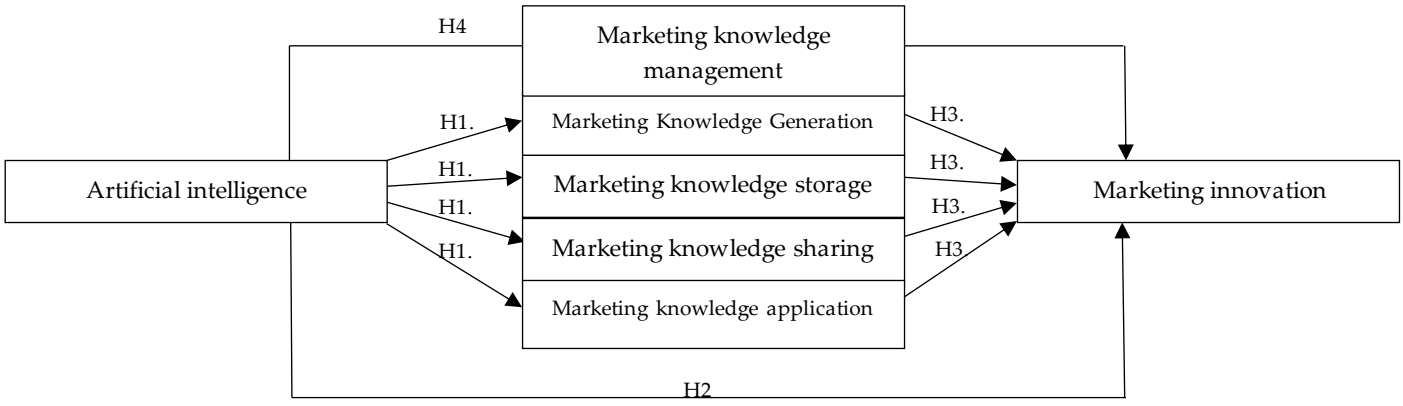

FIGURE 2. The proposed study model.

IV. RESEARCH METHODOLOGY

This quantitative study employed a multi-stage analytical approach. The first step involved assessing the reliability of the research instrument. Subsequently, Partial Least Squares Structural Equation Modeling (PLS-SEM) was conducted using SmartPLS software to evaluate the validity of each item. The hypothesized relationships were then tested using the Structural Equation Modeling (SEM) framework. Data was collected from 162 members through an online survey utilizing a five-point Likert scale. The questionnaire was designed based on previous research in AI, MKM, and MI. The independent variable (AI) was operationalized into three dimensions: ease of use (EOU), perceived benefit (PB), and intention to use (ITU). MKM, the mediating variable, consisted of four dimensions: knowledge generation (MK-G), knowledge sharing (MK-Sh), knowledge storage (MK-St), and knowledge application (MK-A). The dependent variable (MI) was measured across twelve statements.

1. DATA PRELIMINARY EXAMINATION:

Pearson correlation analysis was employed to examine the relationships between variables. Correlation coefficients can range from -1 to +1, with values closer to -1 or +1 indicating stronger relationships. In this study, the correlation coefficients were within acceptable ranges, providing insights into the strength and direction of the relationships between the variables. As shown in Table 1, the skewness and kurtosis values for all constructs were within acceptable limits, indicating that the data is normally distributed. Table 2 presents the results of Harman's single-factor test, used to assess common method bias. The total variance explained by the first factor was 31.09%, well below the 50% threshold, suggesting that common method bias is not a significant issue in this study. The Pearson correlation analysis, summarized in Table 3, reveals the strength and direction of the relationships between variables. Values between 0 and 0.3 indicate weak correlations, 0.3 and 0.7 moderate correlations, and above 0.7 strong correlations.

Table 1. Normality diagnostics for all variables.

Variables	Mean	SD	Skewness		Kurtosis	
			Statistic	Std. Error	Statistic	Std. Error
EOU	4.0756	.49382	-.365	.191	1.094	.379
PB	4.3247	.50538	-.714	.191	1.309	.379
ITU	4.1358	.57382	-.125	.191	-.270	.379
AI	4.1787	.40916	-.038	.191	.412	.379
KG	4.1929	.55747	-.869	.191	1.965	.379
KMSt	4.0139	.66070	-.825	.191	1.255	.379
KMSh	4.1127	.53746	-.213	.191	.091	.379
KMA	4.0154	.59416	-.544	.191	1.020	.379
MKM	4.0837	.49582	-.648	.191	1.686	.379
MI	3.9214	.66361	-1.069	.191	2.403	.379

Table 2. Results of Harman's single-factor test

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	12.098	31.019	31.019	12.098	31.019	31.019
2	3.134	8.035	39.054			
3	1.728	4.431	43.485			
4	1.708	4.380	47.865			
5	1.450	3.717	51.582			

Table 3. Correlations.

Var	EOU	PB	ITU	AI	KG	KMSt	KMSh	KMA	MKM	MII
EOU	1									
PB	.291**	1								
ITU	.492**	.438**	1							
AI	**.752****	**.733****	**.846****	1						
KG	.289**	.208**	.289**	.337**	1					
KMSt	0.136	.191*	.257**	.254**	.654**	1				
KMSh	.244**	.288**	.335**	.373**	.594**	.597**	1			
KMA	.295**	.164*	.235**	.296**	.602**	.658**	.576**	1		
MKM	.281**	.249**	.328**	**.369****	**.840****	**.876****	**.809****	**.844****	1	
MI	.297**	.205**	.368**	**.376****	.643**	.657**	.590**	**.672****	.761**	1

**P < 0.05; **P < 0.01; ***P < 0.00.*

V. ASSESSING THE MEASUREMENT MODEL

Before testing hypotheses to predict relationships between latent variables (inner model), it is essential to validate the measurement model (outer model). This involves assessing the reliability and validity of the constructs. Reliability ensures the consistency and accuracy of measurement; A reliable instrument produces consistent results across multiple administrations. While validity guarantees that the instrument measures what it intends to. Table 4 presents the results of the reliability and validity assessment for the measurement model. Overall, the model demonstrates satisfactory levels of both reliability and validity. The CR values range from 0.7368 to 0.9336, with most constructs exceeding the recommended threshold of 0.7, indicating strong internal consistency. The AVE values for all constructs are greater than 0.4, suggesting that the constructs are sufficiently distinct and that a substantial portion of their variance is explained by their respective indicators.

Additionally, the factor loadings for most items exceed the recommended threshold of 0.5, further supporting convergent validity. MI demonstrates particularly strong measurement properties, with a high CR (0.9336) and consistently strong factor loadings across items

Table 4: Results of the convergent validity and reliability analysis of the scale.

Variables	Dimensions	Items	Factor Loading	CR	AVE
Artificial intelligence	EOU	q1	0.732	0.7368	0.414
		q2	0.618		
		q3	0.575		
		q4	0.637		
		q5	0.693		
	PB	q6	0.649	0.8477	0.528
		q7	0.769		
		q8	0.753		
		q9	0.761		
Marketing Knowledge Management	ITU	q10	0.855	0.8291	0.708
		q11	0.828		
	KM-G	q12	0.749	0.8491	0.549
		q13	0.764		
		q14	0.776		
		q16	0.672		

Marketing Innovation	KM-St	q17	0.681	0.82	0.589
		q18	0.819		
		q19	0.817		
		q20	0.745		
	Km-Sh	q22	0.665	0.7946	0.564
		q23	0.777		
		q24	0.805		
	KM-A	q25	0.761	0.851	0.585
		q26	0.828		
		q27	0.793		
	MI	q28	0.672	0.9336	0.561
		q30	0.734		
		q31	0.702		
		q33	0.743		
		q34	0.737		
		q35	0.772		
		q36	0.793		
		q37	0.790		
		q38	0.707		
		q39	0.762		
		q40	0.765		
		q41	0.730		
		$\overline{AVE}$			0.492

As shown in Table 5, the diagonal elements represent the square root of the AVE for each construct. To satisfy the Fornell-Larcker criterion, the value in each diagonal cell should be greater than all the values in its corresponding row and column. For example, the square root of the AVE for the EOU construct is 0.6432, which is higher than its correlations with the other constructs in the same row and column. This pattern holds true for all the constructs, indicating that the measurement model demonstrates satisfactory discriminant validity. Overall, the results in Table 5 provide evidence that the constructs are well-differentiated and measure unique aspects of the phenomenon under study, supporting the validity of the measurement model.

Table 5. Fornell-Larcker criterion.

	EOU	ITU	PB	KM-A	KM-G	KM-Sh	KM-St	MI
EOU	0.6432							
ITU	0.3022	0.7265						
PB	0.5016	0.4406	0.8415					
KM-A	0.3043	0.1751	0.2363	0.7654				
KM-G	0.2593	0.1955	0.2721	0.6466	0.7415			
KM-Sh	0.2165	0.2469	0.3371	0.5964	0.5971	0.7515		
KM-St	0.1394	0.1938	0.2551	0.6634	0.7038	0.6341	0.7677	
MI	0.3004	0.2118	0.3692	0.6757	0.6976	0.5985	0.6638	0.7492

VI. RESULTS

After establishing the reliability and validity of the measurement model, the next step is to evaluate the structural model. This involves examining the relationships between the latent constructs to test the hypothesized theoretical framework.

The present study investigates the impact of AI on MI through the mediating role of MKM practices within the context of Egyptian public commercial banks. The analysis of the data presented in Tables 6 and 7 offers critical insights into the relationships between these constructs. The primary hypotheses examined in this research provide a structured framework for understanding how AI influences marketing strategies and operations. The results indicate a statistically significant and positive relationship between AI and MKM processes (H1), as evidenced by a strong beta coefficient of 0.3615 and a t-value of 3.5876. This finding suggests that the implementation of AI technologies enhances the efficiency and effectiveness of knowledge management practices within these banking institutions, potentially improving the processes of gathering, processing, and utilizing marketing information.

Table 6. Sem model estimations for main hypothesis testing.

Structure		Beta	t-value	P. value	95% CI		Decision
					LL	UL	
EOU--->	AI	0.707	12.026	**0.000**	0.568	0.804	**H1: Accepted*** **
PB--->		0.832	24.565	**0.000**	0.758	0.887	
ITU--->		0.779	25.276	**0.000**	0.717	0.835	
AI--->	MKM	0.3615	3.5876	**0.0004**	0.1540	0.5508	
	MI	0.0911	1.1849	**0.2366**	-0.0372	0.2540	**H2: Non-Accepted**
KM-G--->	MKM	0.864	31.160	0.000	0.803	0.911	H3 and H4: Accepted***
KM-St--->		0.878	32.905	0.000	0.814	0.923	
KM-Sh--->		0.802	23.848	0.000	0.737	0.865	
KM-A--->		0.856	36.847	0.000	0.804	0.897	
MKM --->	MI	0.741	10.577	0.000	0.577	0.847	

In contrast, the direct impact of AI on MI (H2) was found to be non-significant, with a p-value of 0.236. This indicates that while AI may contribute to the broader marketing landscape, its direct influence on innovation in marketing strategies is not statistically supported in the current study context. This result could imply that other underlying factors or processes may mediate or moderate the relationship between AI and MI, warranting further investigation.

Conversely, the findings for H3 reveal a robust and positive impact of MKM processes on MI. Each dimension of MKM (KM-G, KM-St, KM-Sh, and KM-A) presents strong evidence of facilitating MI, as indicated by the significant p-values and beta coefficients reported in Tables 6 and 7. This emphasizes the vital role of effective knowledge management practices in fostering innovation within marketing strategies. The acceptance of hypotheses H3 and H4 suggests a clear mediating function of MKM in the relationship between AI and MI, implying that while AI enhances MKM, it is the effective management of marketing knowledge that ultimately drives innovation.

Furthermore, the sub-hypotheses analysis unveils that each dimension of MKM significantly contributes to MI, with KM-G (knowledge generation) demonstrating the most pronounced influence. This divergence among the MKM dimensions indicates that the various facets of MKM may have unique roles and impacts on innovation outcomes. For instance, discovery-oriented knowledge (KM-G) may be crucial for generating innovative marketing solutions, while strategic and analytical dimensions (KM-St, KM-Sh, KM-A) may support more operational aspects of MI.

Table 7: SEM model estimations for sub-hypothesis testing.

Structure		Beta	t-value	P. value	95% CI		Decision
					LL	UL	
AI--->	KM-G	0.304	0.320	0.007	0.094	0.529	H1.1 Accepted***
	KM-St	0.250	0.263	0.012	0.058	0.453	H1.2 Accepted***
	KM-Sh	0.338	0.345	0.000	0.164	0.509	H1.3 Accepted***
	KM-A	0.292	0.298	0.002	0.099	0.463	H1.4 Accepted***
KM-G--->	MI	0.320	0.311	0.000	0.146	0.445	H3.1 Accepted***
KM-St--->		0.171	0.175	0.044	0.000	0.339	H3.2 Accepted***
KM-Sh--->		0.132	0.139	0.032	0.020	0.259	H3.3 Accepted***
KM-A--->		0.279	0.278	0.001	0.118	0.419	H3.4 Accepted***

In conclusion, the present study highlights the importance of MKM as a mediating factor that captures AI's potential in realizing innovation in marketing practices, despite the lack of a direct significant relationship between AI and MI. These insights underline the necessity for banks to focus on enhancing their knowledge management practices to fully leverage AI technologies, ultimately driving MI within the rapidly evolving financial landscape in Egypt.

Table 8 presents the R-Square and Adjusted R-Square values for the key relationships in the model. For the main hypothesis (Model-1), the R-Square value for the MKM->MI path is 0.606, indicating that MKM explains 60.6% of the variance in MI. This suggests a strong explanatory power of the MKM construct in predicting MI. In the sub-hypothesis model (Model-2), the R-Square values for the paths from the various MKM dimensions (KM-G, KM-St, KM-Sh, KM-A) to MI range from 0.607 to 0.597, also indicating strong explanatory power of these MKM facets in accounting for the variance in MI. The effect size (f^2) values for these paths are all classified as "strong" according to the guidelines provided. Table 9 further supplements the evaluation of the model's fit. The R-Square value for the AI->MKM path in the main hypothesis model is 0.130, suggesting a moderate level of explanation of MKM by AI. The R-Square value for the AI->MI path is 0.016, indicating a weak explanatory power of AI on MI when the mediating role of MKM is not considered.

Table 8. R square and associated r square adjusted.

Independent	Track Mediation	Dependent	R Square	R Square Adjusted	Effect Size
			Model-1: Main Hypothesis.		
AI-->	MKM-->	MI	0.606	0.601	Strong
			Model-2: Sub Hypothesis		
	KM-G--> KM-St-->	MI	0.607	0.597	Strong

KM-Sh-->			
KM-A-->			

Table 9. F Square.

Track		F Square	Effect Size
Model-1: Main Hypothesis			
AI--->	MKM	0.150	Medium
	MI	0.018	Small
MKM--->	MI	1.211	Very Large
Model-2: Sub Hypothesis			
KM-A--->	MI	0.093	Medium
KM-G--->		0.110	Medium
KM-Sh--->		0.024	Medium
KM-St--->		0.029	Medium

Since the model involves only one independent variable, the Variance Inflation Factor (VIF) is not relevant for assessing multicollinearity. The Stone-Geisser Q^2 values reported in Table 10 are all greater than 0, suggesting that the model has predictive relevance for the endogenous constructs. The GoF index can be calculated as follows:

$$GOF = \sqrt{\overline{R^2} \times \overline{AVE}} = \sqrt{0.6 \times 0.492} = 0.543 \qquad (1)$$

The Goodness-of-Fit (GoF) index of 0.543 exceeds the recommended threshold of 0.36, indicating a satisfactory overall model fit.

Table 10. Predictive relevance.

Dependent Variable	SSO	SSE	Q^2 (=1-SSE/SSO)
Model-1: Main Hypothesis			
MI	1782	1196.493	0.329
Model-2: Sub Hypothesis			
	1782	1198.674	0.327

In summary, the tables (from 8 to 10) presented provide robust empirical evidence supporting the hypothesized relationships in your research model. The high R-Square and effect size values, along with the predictive relevance of the model, highlight the importance of MKM as a mediating factor in the relationship between AI and MI within the context of Egyptian public commercial banks. These findings underscore the necessity for banks to focus on enhancing their MKM practices to fully leverage the potential of AI technologies and drive innovation in the rapidly evolving financial landscape.

VII. DISCUSSION

This research elucidates the significance of MKM processes in relation to the influence of AI applications on MI within the banking sector. Drawing from the preceding findings, the following conclusions become evident:

The utilization of AI applications significantly augments the efficiency and effectiveness of MKM practices in banking institutions [35]. AI technologies facilitate the automated extraction and categorization of information from diverse sources, including emails, documents, and customer interactions. This automation mitigates manual labor and ensures that knowledge is captured promptly. Furthermore, it enhances the procedures for searching and retrieving information through AI-driven search engines, yielding more precise and relevant results, thereby improving knowledge accessibility and minimizing the time spent on searches [51]. Additionally, it promotes

knowledge sharing among employees while ensuring they receive the most relevant information in a timely manner by analyzing user behavior and preferences through AI algorithms.

AI has a substantial impact on market innovation in the banking industry through a number of indirect mechanisms, even if this study found that the direct impact of AI applications on MI in the banking industry has decreased. This is demonstrated by improved data analysis skills, as AI methods like machine learning and predictive analytics allow banks to quickly examine enormous datasets, spot consumer trends and preferences, and raise customer happiness and engagement levels. Additionally, by enabling customized product recommendations and dynamic pricing models that cater to each customer's demands, AI makes it easier to personalize consumer interactions [59]. Despite the significant advantages of AI in MI, worries about algorithmic bias and data privacy are still very real. Thus, resolving these problems calls for a methodical approach to the application of AI. According to [59] and what was revealed by the previous results this explains the importance of the intermediary role of effective management of marketing knowledge in the relationship between AI and MI.

This study, on the other hand, shows how MKM techniques can significantly boost innovation in the banking services industry [43]. By compiling data about goods, consumers, markets, rivals, and current trends, extensive knowledge bases serve as the cornerstone of the innovation process. Additionally, it facilitates knowledge sharing between staff members in other departments, which improves communication and teamwork and fosters the generation of new ideas. Additionally, having access to thorough and accurate information helps marketers make prompt judgments, which expedites the introduction of new items. Last but not least, knowledge management technologies facilitate the analysis of enormous volumes of data and the extraction of insightful information that helps comprehend client wants and spot new areas for innovation.

VIII. LIMITATIONS AND FUTURE SCOPE OF THE STUDY

Examining the impact of AI on the fields of MKM and MI within the banking sector represents an important area of research, especially in light of the rapidly advancing pace of technological progress. However, these studies face a range of limitations and challenges that warrant careful examination. Relying on surveys as a methodological tool for data collection presents difficulties in accurate collection and measurement, as well as in the quantitative assessment of the precise impact of AI on knowledge management and innovation.

Furthermore, the wide array of banking products and services and their heterogeneity, along with the diversity of customer profiles, complicates this analysis. The nature of big and complex data in the banking sector requires advanced processing. In addition, different models of AI require accurate and comprehensive data to function effectively.

On another front, the prevailing organizational culture within banking institutions poses significant challenges regarding the adoption of contemporary technologies, coupled with various legislative and governmental constraints regulating the banking sector, particularly concerning the protection of personal information and compliance with privacy-related regulations.

Finally, ethical aspects and social implications associated with the deployment of AI applications must be comprehensively considered, including issues such as bias, accountability, data ownership, and intellectual property rights.

Studying the impact of AI on knowledge management and MI within the banking sector represents a promising area for scientific exploration. However, researchers should acknowledge the existing challenges and limitations in this field and focus on developing advanced research methodologies capable of addressing the complexities associated with the subject in their future studies. This may encompass the examination of the extensive societal implications associated with the implementation of AI in the domains of knowledge management and innovation. Moreover, these investigative endeavors could be broadened to encompass the function of AI in supplementary domains, including customer relationship management and the customization of products and services. Empirical research could be undertaken at the level of singular institutions, across the entire industry, or among various sectors, incorporating comparative analyses between public and private organizations, as well as studies that juxtapose institutions engaged in the provision of goods versus those involved in service delivery. Investigating the ramifications of AI applications on the financial and economic facets of the banking industry.

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Author Contributions

The authors contributed to the development and planning of the study.

Conflicts of Interest

The authors declare no conflicts of interest.

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