

## Metacognitive Awareness and AI Model Effectiveness in Financial Planning: An Applied Study on Smart Financial App Users in Financial Institutions

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**Abstract:** This research aims to study the relationship between Metacognitive Financial Awareness and the effectiveness of artificial intelligence models in financial planning, through an applied study on users of smart financial applications in financial institutions. The research problem lies in the absence of prior studies that determine the impact of integrating metacognitive awareness with artificial intelligence algorithms on the accuracy of financial transactions and strategic financial decisions.

The study adopted the descriptive-analytical method, whereby a questionnaire distributed to a random sample of employees in financial institutions, and the data were analyzed using descriptive statistics and the T-test to examine the three research hypotheses. The results revealed a strong statistically significant relationship ( $T=71.39, P<0.05$ ) between the level of Metacognitive Financial Awareness and artificial intelligence models in financial planning, with a mean score of (4.170). The findings further confirmed that integrating metacognitive awareness with artificial intelligence algorithms enhances the accuracy of financial transactions, with a correlation coefficient of ( $T=72.95$ ) and a mean score of (4.150).

The research concluded that users with high metacognitive awareness interact cautiously and consciously with artificial intelligence models, thereby enhancing the quality of financial decisions and reducing financial errors. The study recommended the necessity of developing training programs to enhance metacognitive financial awareness among employees in financial institutions, and integrating metacognitive awareness mechanisms into the design of financial artificial intelligence algorithms.

**Key words:** Financial Awareness, Artificial Intelligence, Financial Planning, Smart Financial Applications, Financial Transactions, Financial Institutions, Artificial Intelligence Algorithms.



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## Introduction

Over the past two decades, the world has witnessed a fundamental transformation in the field of Financial Technology (FinTech), where artificial intelligence technologies have become an integral component of the global financial ecosystem. Artificial intelligence is no longer merely an auxiliary tool for executing computational operations or automating routine tasks; rather, it has evolved into a principal agent in the strategic financial decision-making process, through its capacity to analyze big data, forecast future trends, and provide intelligent financial recommendations.

In this context, artificial intelligence technology emerges as one of the most significant innovations that has brought about a qualitative transformation in the financial sector, particularly in financial and banking institutions, where it has contributed to improving the efficiency of financial operations, mitigating risks, and enhancing transparency and security in financial transactions. However, the increasing reliance on artificial intelligence models in financial planning has raised fundamental questions about the role of the human element in this process, specifically regarding the importance of "Metacognitive Financial Awareness" as a pivotal factor in enhancing the effectiveness of these models.

This research seeks to achieve three primary objectives: first, to examine the relationship between users' level of meta cognitive financial awareness and artificial intelligence models in financial planning; second, to measure the impact of integrating metacognitive financial awareness with artificial intelligence algorithms on the accuracy of financial transactions; and third, to analyze the effect of metacognitive financial awareness on personal and institutional financial performance when using artificial intelligence models. Accordingly, through this research, we aspire to provide a scholarly contribution that assists financial institutions in adopting more conscious and critical practices when engaging with artificial intelligence technologies, thereby ensuring the achievement of optimal equilibrium between technological efficiency and human financial acumen.

## Chapter One

### Research Methodology

#### 1-1 Research Significance:

The significance of this research stems from the prominent position occupied by the topic of artificial intelligence, as well as from its role in bridging the gap between technology and financial matters, and in developing financial technological systems and applications through applied metacognitive awareness in the financial field. This is achieved by improving user experiences in smart financial applications and by enhancing and advancing the artificial intelligence models utilized within institutions.

#### 2-1 Research Objective

This research aims to study the relationship between metacognitive awareness and the effectiveness of artificial intelligence models in financial planning. This was accomplished by conducting a field study to measure the extent of meta cognitive financial awareness's impact on the accuracy and effectiveness of financial transactions in Iraqi financial institutions, reducing financial errors and decision-making biases, increasing the level of trust and reliability in AI-generated recommendations, enhancing transparency and user engagement with smart financial applications, and increasing the capacity of financial institution employees and users to adapt to AI-driven financial planning tools and future technological innovations. Based on the results of this research, financial institutions are recommended to develop training programs that enhance

metacognitive financial awareness among users and integrate metacognitive mechanisms into the design of AI financial algorithms to improve the performance of their financial planning operations.

### **1-3 Research Problem:**

The problem of this research lies in the absence of prior studies that precisely determine the impact of applying artificial intelligence models in financial planning and financial transactions in Iraqi financial institutions. Consequently, this research necessitates conducting an exploratory study to assess the impact of these models on financial transactions in financial institutions through understanding complex financial behavior in terms of application. The reliance has been on historical data and routine patterns without considering the AI-supported metacognitive processes that influence financial operations and decisions in these institutions. This research seeks to integrate metacognitive awareness into artificial intelligence algorithms to improve and enhance the accuracy of these financial operations and strengthen long-term financial commitments.

### **1-4 Research Hypotheses:**

This research based on the following hypotheses:

**H<sub>01</sub>:** There is a statistically significant relationship between the level of users' metacognitive financial awareness in financial institutions and artificial intelligence models in financial planning.

**H<sub>02</sub>:** There is a statistically significant relationship between developing metacognitive financial awareness and improving the accuracy of financial transactions through its integration with artificial intelligence algorithms.

**H<sub>03</sub>:** There is a statistically significant relationship between developing metacognitive financial awareness and the use of artificial intelligence models in personal financial performance.

### **1-5 Research Sources:**

In light of the research problem and to achieve its objectives, several sources were utilized, including:

**Secondary Data:** Books, research studies, and previous literature that addressed the same topic were consulted, which contributed to building the theoretical framework of the research.

**Primary Data:** These are the data relied upon in the applied aspect and for hypothesis testing, obtained through the development of a questionnaire that included a set of questions and statements designed to verify the aforementioned hypotheses.

### **1-6 Study Sample**

The researchers selected a group of employees working in financial institutions using a random sampling method, as illustrated in the subsequent tables presented in the applied section of the study.

### **1-7 Research Method**

The researcher employed the descriptive method due to its suitability for the nature of the study, as it is based on examining phenomena as they exist in reality and expressing them in quantitative terms that indicate their magnitude and extent. This approach relies on collecting facts and data, classifying them, processing them, and analyzing them sufficiently and accurately by administering a questionnaire to specialists, and then analyzing these data using the questionnaire as a research instrument, which consisted of a set of items designed to elicit information in order to gather data from the individuals under study.

## 1-8 Reasons for Choosing the Topic

This topic was chosen in response to the urgent need of financial institutions to employ modern technologies that contribute to improving metacognitive awareness in financial transactions through the use of artificial intelligence technology, which offers the potential to achieve this objective.

## 1-9 Literature Review

### 1. Self-Awareness for Financial Abilities

**Sunderaraman, P. et al. (2020), "Self-awareness for financial decision-making abilities in healthy adults", PLoS ONE.**

This study serves as an important foundation for developing measures of "metacognitive financial awareness" and linking them to decision quality. The study aimed to utilize a performance measure for financial decisions combined with self-confidence judgments to assess metacognitive awareness and how it can be leveraged in financial decision-making, as well as how this awareness relates to the accuracy of actual decisions made. The results demonstrated that overconfidence in financial capabilities is associated with decreased decision accuracy, reflecting a deficiency in metacognitive financial awareness among certain users.

### 2. Metamemory and Financial Decision-Making

**Yu, L. et al. (2022), "Metamemory and financial decision making in older adults without dementia", Neuropsychology.**

This study establishes that the strength or weakness of metacognitive awareness is an important indicator in financial decision-making. It focused on the concept of metamemory (awareness of one's own memory) and how deficits in this awareness affect the ability to make sound financial decisions among older adults. The study measured the strength of an individual's perception of their memory compared to actual performance on memory tests in relation to financial decision-making. One of the most significant findings of this study is that increased metacognitive awareness deficits among decision-makers lead to a noticeable decline in financial decision quality.

### 3. AI-Based Smart Financial Applications

**Gupta, A. & Verma, R. (2024), "AI-driven Personal Finance Apps: Assessing the Impact on Financial Decision-Making and Marketing Strategies", International Journal of Research Publication and Reviews.**

This study examined the impact of AI-based personal financial management applications on individuals' financial behavior. It also highlighted concerns related to data privacy and the reliability of recommendations, which opens opportunities for integrating metacognitive awareness when evaluating the extent of reliance on these models in financial planning. The study employed a field questionnaire to measure the extent of application usage, the level of improvement in budgeting and expenditure control, and the degree of user satisfaction with the resulting financial decisions.

## 2- Chapter Two: Theoretical Framework

### 2-1-Metacognitive Awareness in the Financial Context

#### Definition of Metacognitive Awareness

Metacognitive awareness is defined in the financial context as an individual's financial thinking, along with their ability to monitor, evaluate, and modify this thinking during financial decision-making. This awareness represents a higher-order supervisory layer above basic cognitive

processes such as consumption, investment, preparing computational transactions, risk assessment, and evaluating alternatives (Papaleontiou-Louca, 2008, p. 15). It is also defined as a person's awareness of their financial processes and the quality of their financial judgments, taking measures to monitor these judgments and correct errors before making final financial decisions, which include risk pricing, return estimation, and contract comprehension (Gunstone & Mitchell, 2005, p. 133). AlSedah (2017, p. 40) defined it as a field of study that depicts machine learning skills similar to human capabilities, which has the ability to respond to certain methods also known as artificial intelligence, which is the translation of complex mental processes performed by the human mind through their conversion into computer software in order to solve these complex problems using modern technologies.

## **2-2- The Concept of Metacognitive Financial Awareness**

Metacognitive financial awareness transcends knowledge of basic financial fundamentals such as budgeting, saving, investment, and other financial transactions, to encompass the ability to make financial decisions that accommodate economic influences, and to evaluate and analyze the financial positions of personal and institutional accounts, thereby making financial decisions based on critical thinking and conscious analysis of psychological, social, and economic factors (Tanner & Kimberly, 2012, p. 11).

Thus, the importance of metacognitive financial awareness lies in achieving financial and economic stability by reducing exposure to financial risks and avoiding these risks as much as possible, thereby facilitating sound financial decision-making based on intelligent competence to achieve a financial culture supported by successful economic development and growth. Accordingly, metacognitive financial awareness constitutes the cornerstone for making strategic and sustainable financial decisions, and enhances individuals' capacity to manage their resources effectively in a complex and dynamic financial environment.

## **2-3- Dimensions of Metacognitive Financial Awareness**

The dimensions of metacognitive financial awareness are diverse and include advanced financial knowledge, which covers areas such as financial market analysis, tax planning, investments, and risk management through the ability to engage in strategic planning and develop long-term financial plans. It also encompasses making decisions based on a future-oriented vision and scenario analysis to support financial self-awareness and the ability to recognize one's personal financial behavior and understand the motives and psychological factors that influence financial decisions in response to financial challenges, adapting to economic changes, and dealing effectively with financial crises.

## **2-4- Metacognitive Thinking Strategies in Financial Planning**

Metacognitive thinking strategies in financial planning defined as a set of deliberate practices that individuals use to monitor, organize, and evaluate their financial thinking, through:

1-Making financial decisions and setting financial goals.

2-Making saving, investment, and spending decisions.

These strategic decisions enhance the quality of financial decisions because they link awareness of one's capabilities and their limits with regulating actual financial behavior in reality, thereby reinforcing what known as financial self-awareness through a person's recognition of their level of competence in making financial decisions, the boundaries of their knowledge, and their areas of weakness. There are several types of metacognitive strategies in financial planning, some of which are discussed below.

**Table 1. Metacognitive Strategies in Financial Planning**

	Type	Strategy Type
1	Planning Strategies	Financial Planning Strategies
2	Monitoring Strategies	Financial Monitoring Strategies
3	Evaluation and Self-Regulation Strategies	Financial Evaluation and Self-Regulation Strategies

**Source: Prepared by the researcher**

### Chapter Three

#### 3-Applied Aspect

The applied aspect of this research was represented by the analysis of the questionnaire distributed to the study population, consisting of employees working in financial institutions. Through this instrument, the research sample was surveyed with the aim of verifying the research hypotheses. Descriptive statistics were used to analyze the data by calculating percentages and the arithmetic mean, in addition to using the T-test to examine the field research hypotheses, along with inferential statistics.

#### 3-1 Reliability and Validity of the Study Instrument

To verify the reliability of the research instrument used and the consistency of the study, which reflects the stability of the measurement tool, the reliability coefficient was calculated and its value was 0.801 according to Cronbach's alpha coefficient. This represents a high level that confirms the reliability of the research instrument; therefore, it is suitable for statistical analysis and its results can be relied upon to a high degree.

#### 3-2 Results of Testing the First Hypothesis

**The research is based on the following hypotheses:**

**H<sub>01</sub>:** There is a statistically significant relationship between the level of users' metacognitive financial awareness in financial institutions and artificial intelligence models in financial planning.

**H<sub>02</sub>:** There is a statistically significant relationship between developing metacognitive financial awareness and improving the accuracy of financial transactions through its integration with artificial intelligence algorithms.

**H<sub>03</sub>:** There is a statistically significant relationship between developing metacognitive financial awareness and the use of artificial intelligence models in personal financial performance.

#### 3-3-First Domain: Metacognitive Financial Awareness

To verify the first hypothesis, it was tested through a set of questions directed to relevant stakeholders via a questionnaire distributed to specialists regarding decisions and the level of users' metacognitive awareness in financial institutions and artificial intelligence models in financial planning.

As illustrated below:

	There is a statistically significant relationship between the level of users' metacognitive financial awareness in financial institutions and artificial intelligence models in financial planning	Standard Translations	Standard Deviation	T-value
1	I plan how to learn new financial concepts before starting to use them practically	4,423	0,213	65,87

2	I recognize the strengths and weaknesses in my financial knowledge before making .important investment decisions	4,298	0,317	73.67
3	I evaluate my financial decisions after .making them to learn from my mistakes	3,984	0,454	73,33
4	I plan how to learn new financial concepts .before starting to use them practically	4,126	0,650	56.45
5	The smart application's recommendations are accurate and align with the institution's .financial situation	3,981	0,486	66,98
6	The model helps me reduce errors in managing my budget	4,834	0,587	77.12
7	I trust the model's predictions regarding cash flows or future savings.	4,572	0,657	55.65
8	I use artificial intelligence tools (such as smart applications or robo-advisors) in .institutional financial planning	3,653	0.659	83,12
9	My ability to monitor my financial thinking increases the effectiveness of AI-proposed .plans	4,512	0,324	61,45
10	I compare AI results with my personal analysis before making final financial .decisions	3,319	0.450	55.98
<b>Overall Mean</b>		<b>4.170</b>	<b>0,480</b>	<b>66.96</b>

From the table above, which includes the data analysis for testing the first hypothesis and encompasses the analysis of research sample responses, it can be concluded that the arithmetic mean of the sample's responses ranges between (4.834), which represents the upper limit, and (3.319), which represents the lower limit. The lower arithmetic mean reflects that users with high metacognitive awareness interact more cautiously with artificial intelligence models, indicating a gap between the system's theoretical capability and its actual utilization. Furthermore, the overall arithmetic mean for all questions was (4.170), which is a high value with a standard deviation of (0.480). All these figures confirm that adopting artificial intelligence models in financial institutions contributes to facilitating financial services.

Regarding the use of the T-test for the first statistical hypothesis questions, as illustrated in the table below:

Weighted Average	Standard Deviation	Sig.	T-value
Sum	0.612	0.00	71.39

In light of the empirical evidence presented in the aforementioned table, the calculated T-statistic of 71.39 demonstrates statistical significance at  $p < 0.001$  ( $p = 0.00$ ), substantially below the conventional alpha threshold of 0.05. This finding indicates strong positive consensus among respondents and provides robust empirical support for the first research hypothesis, namely: "A statistically significant positive correlation exists between users' metacognitive financial awareness levels within financial institutions and the operational effectiveness of artificial intelligence-based models in strategic financial planning."

### 3-4-Results of Testing the Second Hypothesis

#### Alternative Hypothesis (H<sub>2</sub>):

There is a statistically significant relationship between the development of metacognitive financial awareness and the improvement of financial transaction accuracy through its integration with artificial intelligence algorithms.

This hypothesis was tested using the questions directed to the study sample, and the percentages shown below were obtained, which relate to measuring the contribution of the outcomes resulting from enhancing metacognitive financial awareness and improving the accuracy of financial transactions through its integration with AI algorithms. The statistical results were as follows:

There is a statistically significant relationship between the development of metacognitive financial awareness and the improvement of financial transaction accuracy through its integration with artificial intelligence algorithms		Standard Translations	Standard Deviation	T-value
1	My transactions have become faster and more accurate, with a reduced rate of cancellations and adjustments.	3,678	0,213	55.76
2	The algorithms improve the accuracy of my financial calculations (invoices, transfers, .investments)	3,987	0,317	88.72
3	I now reduce transaction losses thanks to early AI-driven alerts.	4,984	0,454	76.81
4	My transactions fully comply with financial regulations with the support of automated analytics.	3,438	0,650	80.78
5	The integration between my awareness and AI algorithms ensures 100% accuracy in financial reports.	4,981	0,486	66.77
6	Developing my metacognitive financial awareness enhances transaction accuracy when intelligent algorithms are integrated	4,834	0,587	95.12
7	AI feedback improves my ability to avoid transaction errors.	4,112	0,657	74.88
8	My self-monitoring of transactions improves with algorithmic support, which reduces errors.	3,653	0.659	63.41
9	Developing metacognitive awareness transforms artificial intelligence into a highly precise tool for every financial transaction.	4,512	0,324	91.14
10	My self-monitoring of transactions improves with algorithmic support, thereby reducing errors	3,319	0.450	69.64
<b>Overall Mean</b>		<b>4.150</b>	<b>0.480</b>	<b>76.30</b>

Regarding the use of the T-test for the first statistical hypothesis questions, as illustrated in the table below:

Weighted Average	Standard Deviation	Sig.	T-value
Sum	0.551	0.00	72.95

In light of the table above, it appears that the T-value reached 72.95 with a significance level of 0.00, which is lower than 0.05, indicating that the respondents' views were positive. This provides confirmation for the second hypothesis, which stated that there is a statistically significant relationship between the development of metacognitive financial awareness and the improvement of financial transaction accuracy through its integration with artificial intelligence algorithms.

The results also confirmed the existence of a statistically significant relationship between adopting metacognitive financial awareness and enhancing the accuracy of financial transactions by integrating AI algorithms, in a way that strengthens and upgrades financial services.

#### 4-3 Results of Testing the Third Hypothesis

H<sub>03</sub>: There is a statistically significant relationship between the development of metacognitive financial awareness and the use of artificial intelligence models in personal financial performance.

This hypothesis was tested through questions directed to the study sample, and the percentages mentioned below were obtained, which relate to the existence of a statistically significant relationship between developing metacognitive financial awareness and using artificial intelligence models in personal financial performance. The statistical results were as follows:

There is a statistically significant relationship between the development of metacognitive financial awareness and the use of artificial intelligence models ...in personal financial performance		Standard Translations	Standard Deviation	T-value
1	I possess the ability to continuously monitor and evaluate my financial decisions before and after they are made.	2,413	0,193	76.66
2	I review and refine my financial strategies based .on an analysis of my past mistakes	3,538	0,378	55.11
3	Our institution uses artificial intelligence technologies in financial data analysis and .decision-making	3,184	0,694	58.72
4	The artificial intelligence models used contribute to improving the accuracy of financial forecasts and financial reports.	3,236	0,810	86.81
5	AI algorithms are applied regularly in auditing .and financial control processes	4,221	0,616	80.78
6	The use of smart models increases the accuracy .of results	3,894	0,621	66.77
7	Using artificial intelligence models helps develop my capacity for precise thinking in making financial decisions.	3,912	0,759	55.12
8	I am able to consciously evaluate and review the outputs of AI-based financial models before approving them.	4,693	0.539	74.88
9	The integration between metacognitive financial awareness and the use of artificial intelligence has improved the efficiency of the institution's financial indicators.	4,912	0,421	83.11
10	The development of metacognitive financial awareness, in parallel with the implementation of AI models, has contributed to reducing financial errors and enhancing the quality of institutional	3,919	3.951	68.94

.performance				
11	I am able to identify the strengths and weaknesses in my own financial planning and analysis methods.	4.118	0,546	79.94
<b>Overall Mean</b>		<b>3.822</b>	<b>0.866</b>	<b>70.63</b>

Regarding the use of the T-test for the first statistical hypothesis questions, as illustrated in the table below:

Weighted Average	Standard Deviation	Sig.	T-value
Sum	0.866	0.00	70.63

In light of the table above, it is evident that the T-value reached 70.63 with a significance level of 0.00, which is less than 0.05, indicating that the respondents' views were positive. This confirms their support for the second hypothesis, which stated that there is a statistically significant relationship between the development of metacognitive financial awareness and the use of artificial intelligence models in personal financial performance.

## Chapter Four

### 4- Conclusions and Recommendations

#### 1-4 Scientific Conclusions

1. There is a positive relationship between metacognitive awareness and artificial intelligence, as evidenced by a strong statistically significant relationship ( $T = 71.39$ ) between users' level of metacognitive financial awareness and artificial intelligence models in financial planning, with an arithmetic mean of 4.170 ( $T = 71.39$ ).
2. There is a gap between the system's theoretical capabilities and its actual utilization, as reflected by the decline of some arithmetic means to 3.319, which indicates that users with high metacognitive awareness interact more cautiously with AI models.
3. Planning, monitoring, and metacognitive thinking strategies play a pivotal role in improving the quality of financial decisions when integrated with artificial intelligence technologies.
4. There is an actual gap between financial planning practices and the effective use of artificial intelligence. Despite the positive results, the level of AI tool utilization in institutional financial planning recorded a relatively moderate mean of 3.653, indicating a need for further awareness and adoption.
5. A tangible improvement was observed between metacognitive financial awareness and the use of artificial intelligence, which led to a noticeable enhancement in the efficiency of institutional financial indicators, with a mean of 3.919.
6. Financial errors are reduced and the accuracy of forecasts is increased through the use of AI models supported by metacognitive awareness.

#### 4-2 Scientific Recommendations

1. There is a need to design comprehensive training programs for employees in financial institutions to enhance metacognitive financial awareness and practically and systematically link it to artificial intelligence applications, through the development of specialized training programs.
2. It is recommended to promote critical thinking and self-review of decisions by developing AI algorithms that incorporate mechanisms to strengthen users' metacognitive awareness.

3. Mechanisms for monitoring and evaluation should be strengthened by developing self-monitoring and self-assessment tools that enable users to review their financial decisions before and after they are made using AI tools.
4. The gap between theory and practice should be addressed by working to reduce the disparity between the theoretical capabilities of AI systems and their actual use, through improving and developing the metacognitive awareness of practitioners in this field.
5. It is necessary to conduct periodic field studies to measure the evolution of the relationship between metacognitive awareness and AI models in financial institutions.
6. Scientific research should be expanded by conducting further studies on the impact of psychological, social, and economic factors on the relationship between metacognitive financial awareness and artificial intelligence in different contexts.

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