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FINTECH ADOPTION AND RISK MANAGEMENT EFFECTIVENESS: THE MEDIATING ROLE OF DIGITAL FINANCIAL LITERACY IN THE SAUDI STOCK EXCHANGE

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Abstract

The present paper explored the impact of fintech adoption on the effectiveness of risk management with mediating variable being digital financial literacy in the Saudi Stock Exchange (Tadawul). The research design adopted by the researcher was a quantitative research design that utilized Partial Least Squares Structural Equation Modeling (PLS-SEM). Out of 370 active investors and financial professionals that work in Tadawul- listed institutions, data was gathered. The research paper investigated the effectiveness of fintech application, algorithm trading applications, mobile trading systems, digital payment systems, and robo-advisory services in improving the capacity to evaluate and respond to risk and performance in risk-controlling. To test the hypothesized relationships and verify the mediating effect of digital financial literacy, the structural equation modeling was used. The findings indicate that the effectiveness of risk management can be significantly enhanced through the adoption of fintech that will allow obtaining real-time data, automated data analysis, and greater transparency in investment choices. Moreover, digital financial literacy as an intermediating variable can convert the use of fintech into knowledgeable decision-making, successful interpretation of digital financial data, protection against financial and cyber risks. The results reveal that digitally literate investors can benefit more using fintech tools to detect, evaluate, and reduce market volatility and operational risks. The paper suggests that organizations and regulators in Tadawul should invest in the enhancement of digital financial literacy interventions, investor education, and risk awareness interventions driven by fintech. Digital financial competence will allow investors to optimize the use of fintech solutions, contribute to the sustainability of the increase in the effectiveness of financial stability and risk management throughout the Saudi capital market.

Keywords: Perceived Usefulness, Perceived Ease of Use, Security Perception, Risk Management Effectiveness, Digital Financial Literacy.

1. INTRODUCTION

The past ten years have seen a radical change of the Saudi financial ecosystem due to the booming development of financial technology applications in Saudi Stock Exchange (Tadawul), digital trading systems, mobile investment applications, robo-advisory platforms, blockchain-based trading, and algorithm-based decision-support systems have become widespread among investors and financial institutions.

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The technologies have transformed the usual way of investing by improving the visibility about transactions, making the analysis process more robust and minimizing the degree of uncertainty in operations (Al-Mutairi and Al-Dossary, 2023). The adoption of fintech has thus turned into a strategic need and not a technological choice, particularly as Saudi Arabia transitions to a digitally enabled financial market that is in line with the reforms of Vision 2030 and the international standards of capital-market modernization. With Fintech applications, the transactions are performed faster, the real-time monitoring is enhanced, the transparency is also improved, and the accuracy of data is enhanced, which leads to the better detection of financial and operational risks (Ahmad and Al-Mubarak, 2022). In the case of Tadawul investors, fintech also improves decision-making by offering real-time access to analytics, automatic notifications, portfolio overviews, and risk indicators. The features enhance the effectiveness of risk management through the minimization of information gaps, increasing the accuracy of forecasts, as well as facilitating the opportunity to control the risks more actively. Nevertheless, effectiveness of fintech will largely depend on the investment ability of the investor to comprehend and interpret digital financial data appropriately. Digital financial literacy (DFL) has thus become an essential need in the contemporary capital markets. It involves the capacity to assess online financial services, online market information interpretation, cybersecurity knowledge, and decision-making by using digital tools (Khan et al., 2024). Within the framework of Tadawul, the more DFL an investor is, the more he/she is likely to be able to use fintech tools effectively, preventing misinformation, risk-reduction mechanisms, and reacting to market changes more efficiently. DFL is the mechanism that transforms the fintech adoption into the significant risk-management results. Although the application of fintech tools in the Saudi market has increasingly become relevant, there is still a lack of empirical research examining the application of digital financial literacy as an intermediary variable between the adoption of fintech and effectiveness in risk management in the emerging stock markets. Majority of existing theorizing has been centered on technical effects of digital transformation or investment behavior, as opposed to literacy-based processes that render technological use to produce better risk outcomes (Mahdi and Al-Suwailem, 2024). Thus, the article fills an important gap by exploring the impact of fintech adoption on the effectiveness of risk management by providing the mediating role of digital financial literacy in the context of Tadawul (Al-Hawamdeh et al., 2024).

Research Objectives (ROs):

RO1: To test the effectiveness of risk management among Saudi Stock Exchange investors due to the adoption of fintech.

RO2: To determine the mediating effect of digital financial literacy in the connection between the adoption of fintech and risk management effectiveness.

This paper aims to add to the literature by illustrating the interaction of fintech adoption, digital-skill building, and financial-risk behavior to determine the institutional and investor resiliency. It offers novel theoretical and empirical findings on the way digital financial literacy changes the use of fintech into strategic risk-management skills in the rapidly-changing Saudi financial market.

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2. LITERATURE REVIEW AND HYPOTHESES DEVELOPMENT

2.1 Literature Review

Adoption of fintech has emerged as a core component of change in contemporary financial markets that have transformed the way investors collect, analyze risk, and make decisions under digital trading conditions. In the Saudi Stock Exchange (Tadawul), fintech solutions, including digital trading platforms, robo-advisory services, algorithmic trading, and blockchain-based payment networks, allow accessing information faster, increasing transparency, and improving the monitoring capabilities. These technologies offer a chance to make financial forecasting and identification of risks more accurate, however, they rely on the digital competencies and perceptions of usefulness, security, and perceptions of usability among the investors. The section analyzes the theoretical connections between the critical technological acceptance factors and the risk outcomes, where digital financial literacy becomes the key factor in enhancing technology-facilitated decision-making.

2.2 Hypotheses Development

2.2.1 Digital Financial Literacy and Risk Management Effectiveness

Digital financial literacy can be defined as how well the investor comprehends, analyzes and uses digital financial instruments to interpret market data, calculate risks and make sensible decisions. More digitally financially literate investors can find their way more easily through online platforms and can recognize misleading information and implement appropriate risk-reduction techniques. Within the setup of Tadawul, the improved digital competencies will enable investors to understand financial dashboards more effectively, identify any form of anomaly, and impose digital risk controls, which will lead to highly accurate and responsive risk management practices.

H1: Digital financial literacy has a positive and significant effect on risk management effectiveness.

2.2.2 Perceived Ease of Use and Digital Financial Literacy

Perceived ease of use describes how the investors think that fintech tools are easy, intuitive, and simple to use. Investors will have a stronger incentive to investigate the functionality of digital applications, use data analytics tools, and gain greater digital financial literacy by using them continuously when they are user-friendly. Easy-to-use in the context of the Saudi market where fintech use is growing at a brisk pace will simplify the process of learning and enhance the capacity of investors to read digital market signals.

H2: Perceived ease of use has a positive and significant effect on digital financial literacy.

2.2.3 Perceived Ease of Use and Risk Management Effectiveness

Fintech systems that are easy to use also help in enhancing risk management behaviors directly. The more investors are able to use trading platforms without technical complexity

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to monitor their portfolios, or to refer to risk indicators, then the more likely they will be able to implement digital risk controls effectively. The ease of use will minimize the occurrence of errors in the operation process, complicate the decision-making process and facilitate quick reaction to market fluctuations in Tadawul.

H3: Perceived ease of use has a positive and significant effect on risk management effectiveness.

2.2.4 Perceived Usefulness and Digital Financial Literacy

Perceived usefulness is the level of the perceived usefulness of the financial technology platforms to investors regarding performance of the investments, awareness of risk, or quality of the decision. Investors will use more of such tools when they perceive the tools to be useful in enhancing returns or managing risk. Regular and intentional use facilitates further knowledge of digital capabilities, analysis options as well as market signals, which eventually improves the digital financial literacy.

H4: Perceived usefulness has a positive and significant effect on digital financial literacy.

2.2.5 Perceived Usefulness and Risk Management Effectiveness

Investors can conduct more efficient and informed risk assessment with the help of fintech tools, which they find useful. Investors are more likely to use digital tools to reinforce their risk assessment capabilities when they understand the practical value of these tools, i. e. faster access to data, automated alerts, accurate analytical insights, etc. Perceived usefulness in the Tadawul setting helps investors to incorporate fintech into their day-to-day decision-making activities, enhancing the effectiveness of risk management.

H5: Perceived usefulness has a positive and significant effect on risk management effectiveness.

2.2.6 Security Perception and Digital Financial Literacy

Security perception is the extent of trust that investors place in the safety, privacy as well as cybersecurity of fintech platforms. When investors see fintech tools as safe, they are more willing to use them, explore the new capabilities, and understand how digital financial risks can be prevented successfully. Perceived security increases digital financial literacy thus increasing its active and broader adoption.

H6: Security perception has a positive and significant effect on digital financial literacy.

2.2.7 Security Perception and Risk Management Effectiveness

It is also a strong sense of security which is directly related to risk management effectiveness. The greater the confidence of the investor in cybersecurity and data protection tools installed on fintech platforms, the more they are ready to trade on the Internet, trust automated analytics, and use digital risk-management tools. Increased

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sense of security lowers the psychological obstacles related to the risks of digital investment and facilitates more regular and assured risk management procedures.

H7: Security perception has a positive and significant effect on risk management effectiveness.

2.2.8 Theoretical Foundation

The theoretical framework that drives the study is a synthesis of 2 incompatible theoretical views of the Resource-Based View (RBV) and Technology Acceptance Model (TAM). Collectively, these frames describe how the implementation of Fintechs helps to achieve a higher level of risk management through the creation of digital financial literacy in the Saudi Stock Exchange (Tadawul).

Resource-Based View (RBV) holds that valuable, rare, imperfectly imitable, and non-substitutable are the resources upon which the strategic advantage of the organization is constructed (Barney, 1991).

Fintech applications, including algorithmic trading systems, mobile trading applications, robo-advisory services, blockchain-based payment systems, and digital analytics dashboards, are among the strategic digital resources in digital financial markets. When properly leveraged, these fintech tools will enhance institutional responsiveness, increase forecasting capabilities, and organizational resilience to operational and financial uncertainties.

Digital financial literacy is also a feature that helps investors to turn fintech instruments into higher-quality decisions and risk-related management results, which confines to the value of RBV regarding strategic resource as knowledge.

The use of the Technology Acceptance Model (TAM) (Davis, 1989; Venkatesh and Bala, 2008) can also be seen as a complement to RBV since it can be applied to understand how perceptions of usefulness, ease of use, and security perception can influence the willingness of investors to use fintech systems. The use of fintech in Tadawul setting is determined by the perception held by investors that digital technologies are useful, easy to work with, and safe to use when making financial transactions.

These attitudes shape the levels of investor adoption of fintech solutions and, by implication, the establishment of online financial literacy. Constantly engaging with convenient, valuable, and secure fintech applications, investors develop more skills in the analysis of information and digital skills, which enhance their effectiveness in identifying, assessing, and reducing risks in investments. Integrating RBV and TAM will offer an in-depth explanation of how the effect of fintech adoption (technological acceptance) and digital financial literacy (a knowledge-based capability) together increase the effectiveness of risk management.

The conceptual model suggests then that fintech adoption is driven by the perceptions of investors on the fintech usefulness, usability, and security and that digital financial literacy contributed to the ultimate enhancement of risk management practices in the digital trading ecosystem of Tadawul.

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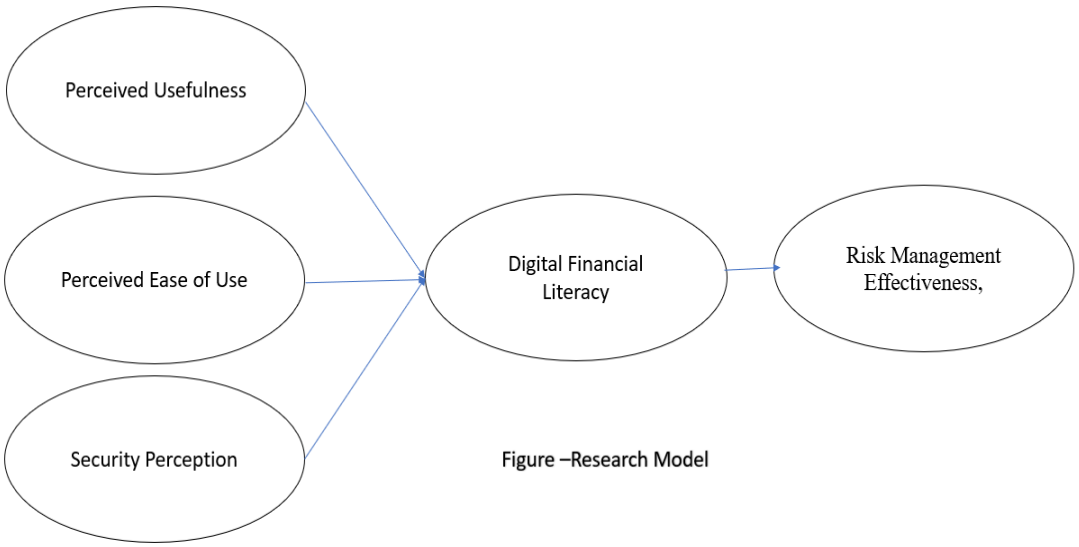

Figure –Research Model

The present research design was quantitative to examine the effectiveness of fintech adoption in risk management mediated by digital financial literacy in the Saudi Stock Exchange (Tadawul). It was chosen to use the quantitative method because it will allow testing the relationships between the latent constructs in a statistic manner and it will also allow to generalize the results to the population of investors and financial professionals whose work is under the influence of the same digital financial environment. The constructs, which were covered in the research model were the following: perceived ease of use, perceived usefulness, security perception, digital financial literacy, and risk management effectiveness. The surveys were conducted through a structured questionnaire that was used to collect data on 370 investors, financial analysts, technical employees, and risk experts in financial, investment, and brokerage firms listed in Tadawul. Stratified random sampling was employed in order to allow proportional representation of various job types and levels of the organization. The choice of the respondents was limited to those people who are directly engaged in digital trading, use fintech platforms, financial analysis, and make risk-related decisions. This guaranteed that the participants had the applicable experience in fintech systems and risk assessment. The questionnaire was developed according to the previous literature on validated measurement scales on the topic of fintech adoption, technology acceptance, digital literacy and risk management. The instrument included five major constructs:

1. Perceived ease of Use: This component is a measurement of how fintech-based applications (mobile trading, digital platforms, robo-advisory applications) are viewed to be easy and easy to use.
2. Perceived Usefulness: Determining the level of improvement of the fintech tools in investment decisions, efficiency, and consequences of risk.
3. Security Perception: Measuring the level of trust of the users in the privacy, cybersecurity and data protection capabilities of fintech applications.

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4. Digital Financial Literacy: Digital financial literacy measures how financial information is interpreted on a digital platform, how well the platform features are known, whether or not cyber risks are recognized, and whether or not the platform is being used efficiently.
5. Risk Management Effectiveness: Measuring the ability of the investor or institution to recognize, assess and manage both financial and operational risks by applying digital tools.

The rating was done on a five-point Likert scale (1 = Strongly Disagree to 5 = Strongly Agree) to ensure the extent of agreement with each indicator. The data were processed with the help of the Partial Least Squares Structural Equation Modeling (PLS-SEM) in SmartPLS 4 which is appropriate in case of complex models where the mediating variables are included along with reflective constructs. The analysis was divided into two significant phases of the measurement model and the structural model. Cronbach Alpha, Composite Reliability (CR) and Average Variance Extracted (AVE) were used to test the internal consistency and convergent validity. Discriminant validity was assessed through Fornell and Larcker criterion and HeterotraitMonomethod ratio of (HTMT) which verified that constructs were empirically different. The assessment of structural models was done by looking at the path coefficients (), t-values, p- values, and the coefficient of determination (R 2). The bootstrapping method with 5,000 resamples was used to test the mediation effects of digital financial literacy, which gave strong estimates of both direct and indirect and total effects. Before the actual data collection, the questionnaire was expertly reviewed by experts on the topic of fintech systems, digital finance, and risk management to achieve the content validity. To test the instruments, a pilot study was performed on 30 respondents and it was required to test the clarity of the instruments and their reliability. All constructs obtained Cronbachs Alpha of greater than 0.8 meaning high internal consistency. The ethical standards were observed strictly. The study purpose was explained to the participants, and the study was voluntary with guaranteed anonymity and confidentiality. Each of the procedures met institutional and international ethics requirements of social science research. This methodological framework gives a strong empirical basis of understanding the influence of the adoption of fintech based on the perceptions of ease of use, usefulness, and the perception of security on the risk management effectiveness due to the presence of digital financial literacy among institutions and investors operating within the digital financial landscape of the Saudi Stock Exchan.

4. DATA ANALYSIS

The analysis of the data was provided with the help of the Partial Least Squares Structural Equation Modeling (PLS-SEM), a type of variable-based data analysis in the SmartPLS 4 (Hair et al., 2017). The choice of PLS-SEM was that it is best applicable in complex research model, medium-sized sample, and non-normal data distribution. The given methodological approach is especially suitable in the case of predictive research, exploratory research, and mediating research, like the current one, which explores the

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impacts of fintech adoption on risk management effectiveness through the meditating effect of digital financial literacy between investors and financial professionals working in the Saudi Stock Exchange (Tadawul). PLS-SEM enables the measurement model, relationships among latent constructs, and their indicators and structural model, test the hypothesized relationships among constructs to be simultaneously assessed. SmartPLS uses an iterative least-squares algorithm, which makes the estimation of SmartPLS stable and accurate even in circumstances of model complexity and non-normal data. This renders PLS-SEM suitable in the context of the analysis of multidimensional constructs of fintech adoption and their contribution to digital literacy and outcomes related to risk.

4.1 Measurement Model Assessment

The initial measure evaluated the reliability and validity of the reflective measurement constructs. Cronbach Alpha and Composite Reliability (CR) were considered to evaluate the internal consistency, whereas Average Variance Extracted (AVE) was used to assess convergent validity. The FornellLarcker and the HeterotraitMonotrait (HTMT) ratios were used to measure discriminant validity which measures empirical differentiation of constructs. All indicators were within set threshold values, which proved the sufficiency of the measurement quality.

4.2 Structural Model Assessment

The assessment of the structural model where the proposed relationship among the constructs were assessed. Each direct effect, its magnitude and value were observed by analyzing path coefficients (-), t-statistics and p-values. In particular, the model tested the direct associations between the perceived ease of use and digital financial literacy, perceived usefulness and digital financial literacy, and security perception and digital financial literacy. Secondly, the impact of digital financial literacy on risk management effectiveness was also studied as well as every other direct relationship between the fintech adoption dimensions and risk management effectiveness. This analytical procedure offered an in-depth evaluation of the way every technological perception leads to the digital financial capacity and, eventually, to the actual risk management in the fintech-equipped environment of the Saudi Stock Exchange. The bootstrapping process of 5,000 resamples was used to have strong estimates of the significance of the direct and indirect effects, particularly the mediating effect of the digital financial literacy. This resampling method provided proper confidence levels and standard error estimation of structural path of the model. The adequacy of the models was also tested with the help of Standardized Root Mean Square Residual (SRMR) and Normed Fit Index (NFI), whereas R2 values were used to assess the power of the model- how much digital financial literacy and risk management effectiveness was explained by the fintech adoption constructs. The findings proved that the PLS-SEM was competent in recording the extent as well as the direction of the relationships in the conceptual model. The model identified that there were strong predictive relationships between the fintech adoption constructs and digital financial literacy, which in their turn had a significant impact on risk management in Tadawul. On the whole, the PLS-SEM process offered a thorough understanding of the direct and mediated impacts of the adoption variables of fintechs,

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which contributes to the further insight into investor behaviour and institutional resilience in the Saudi financial digital.

Table 1: Factor loadings

Constructs	Items	Factor Loadings	Cronbach's Alpha	CR	AVE
Digital Financial Literacy	DFL1	0.882	0.901	0.932	0.733
	DFL2	0.871			
	DFL3	0.843			
	DFL4	0.821			
Perceived Ease of Use	PEOU1	0.884	0.928	0.948	0.721
	PEOU2	0.843			
	PEOU3	0.873			
	PEOU4	0.812			
Perceived Usefulness	PU1	0.862	0.902	0.931	0.694
	PU2	0.846			
	PU3	0.901			
	PU4	0.811			
	PU5	0.822			
Risk Management Effectiveness	RME1	0.873	0.903	0.931	0.731
	RME2	0.846			
	RME3	0.892			
	RME4	0.837			
Security Perception	SP1	0.811	0.894	0.926	0.709
	SP2	0.899			
	SP3	0.871			
	SP4	0.832			
	SP5	0.804			

4.1 Measurement Model Analysis

The findings of the measurement models indicate that all the constructs have satisfactory reliability and validity, which results in the assumption that the measurement tool applied in this research approach is statistically sound. The factor loadings of all items were above the suggested value of 0.70 (Hair et al., 2017), which proves that the indicators were of good reliability in constructs. In particular, the loadings of the digital financial literacy items generated are in the range of 0.821-0.882 indicating a consistent depiction of the underlying construct. The perceived ease of use construct had loadings of between 0.812 and 0.884 thus indicating high internal homogeneity of items. Similarly, the perceived usefulness had strong factor loadings of between 0.811-0.901 and risk management effectiveness had between 0.837 and 0.892, which indicate adequate strengths of indicators. Security perception items were also performing well as was loaded between 0.804 and 0.899, which was exceeding minimum acceptable value. Cronbach Alpha and Composite Reliability (CR) were used to test internal consistency reliability. The constructs of all constructs all obtained the Cronbach alpha and CR value of more than 0.89 and 0.92 respectively, which is more than the conventional 0.70 mark (Nunnally and Bernstein, 1994). These findings imply that the items in every construct can be used to

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measure the same underlying concept. The convergence validity was also obtained with all the average variance extracted (AVE) being above the value of 0.50, the values were in the range of 0.694 to 0.733. This illustrates the fact that a significant percentage of the variance in each indicator is attributed to the respective latent variable. In general, the constructs (digital financial literacy, perceived ease of use, perceived usefulness, security perception, and risk management effectiveness) had good levels of reliability and convergent validity. These results prove that the measurement model is within the psychometric standards established and constitutes a strong basis of further structural analysis of assessing the relationships within the conceptual framework proposed.

Table 2: Values of HTMT

Constructs	DFL	PEOU	PU	SP	RME
Digital Financial Literacy (DFL)	—				
Perceived Ease of Use (PEOU)	0.412	—			
Perceived Usefulness (PU)	0.463	0.521	—		
Security Perception (SP)	0.498	0.574	0.612	—	
Risk Management Effectiveness (RME)	0.532	0.603	0.648	0.801	—

4.2 Discriminant Validity (HTMT Analysis)

The discriminant validity was assessed with the help of the Heterotrait Monotrait Ratio (HTMT) in accordance with the recommendations provided by Henseler, Ringle, and Sarstedt (2015). Table 2 indicates that all of the HTMT values fell below the conservative value of 0.85, which validates the fact that each of the latent constructs is empirically distinct. The values of the HTMT were 0.412-0.801 which means that there is enough discriminant validity among all the constructs used in the model.

In particular, the correlation between digital financial literacy and perceived ease of use (HTMT = 0.412) and perceived usefulness (HTMT = 0.463) is a weak-to-moderate association, which indicates that digital financial literacy and the above concepts are closely correlated but represent different conceptual areas.

The perceived ease of use and risk management effectiveness (HTMT = 0.603) and the perceived usefulness and security perception (HTMT = 0.612) had moderate correlations, which showed that the two constructs are conceptually relevant but statistically different. Security perception and risk management effectiveness had the highest correlation (HTMT = 0.801) although it is relatively large, but it was still lower than the acceptable upper limit.

It means that the image of platform security and the performance of risk management of investors are closely connected and do not exhibit the conceptual redundancy. The overall findings are that all constructs digital financial literacy, perceived ease of use, perceived usefulness, security perception and risk management effectiveness -are conceptually different and effectively measure various facets of the fintech adoption and risk management model. The high level of discriminant validity makes it possible to analyze the structural model further without the interference of the multicollinearity or overlap of constructs and, therefore, interpret the hypothesized relationships effectively.

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Table 3: Fronell-Larcker

Constructs	DFL	PEOU	PU	SP	RME
Digital Financial Literacy (DFL)	0.856				
Perceived Ease of Use (PEOU)	0.412	0.849			
Perceived Usefulness (PU)	0.463	0.521	0.833		
Security Perception (SP)	0.498	0.574	0.612	0.842	
Risk Management Effectiveness (RME)	0.532	0.603	0.648	0.682	0.855

4.3 Discriminant Validity (Fornell–Larcker Criterion)

Fornell Larcker criterion was also used to test the discriminate validity of the constructs further. Based on this criterion, the square root of the Average Variance Extracted (AVE) of each construct should exceed the correlation of the construct with other constructs in the model. This condition guarantees that every latent variable has more variance across its indicators than its indicators across other constructs hence confirming the discriminant validity. The diagonal values are the square root of AVE, where the off-diagonal values are inter-construct correlations as shown in Table 3. Digital financial literacy has a square root of AVE of 0.856, which exceeds its correlations with perceived ease of use (0.412), perceived usefulness (0.463), security perception (0.498) and risk management effectiveness (0.532), which validates some evident discriminant validity. Equally, perceived ease of use (>>AVE =.849) has an acceptable discriminant validity since all its correlations, with r = 0.412 to 0.603, are smaller than its diagonal. Construct perceived usefulness (0.833) also has discriminant validity since the correlation coefficients between the construct and the rest of the constructs (0.463 to 0.648) are less than its square root of AVE. The same trend is observed in the security perception construct, having a √AVE of 0.842 and surpassing all its inter-construct correlations (0.498 to 0.682). Lastly, risk management effectiveness (√AVE = 0.855) passes the requirement since all its correlations, including the largest level of correlation with security perception (0.682) are less than its diagonal value. In general, every construct, digital financial literacy, perceived ease of use, perceived usefulness, security perception and risk management effectiveness pass the Fornell-Larcker test. This goes to confirm that each of the constructs is conceptually and statistically different and validating that there is strong discriminant validity throughout the measurement model and that structural model analysis can be continued without fears of construct overlap and multicollinearity.

Table 4: R-Square Adjusted

	R-square	R-square adjusted
Digital Financial Literacy	0.432	0.426
Risk Management Effectiveness,	0.557	0.552

4.4 Coefficient of Determination (R^2 and Adjusted R^2 Analysis)

The value of the coefficient of determination (R 2) and adjusted R 2 were analyzed in order to determine the explanatory ability of the structural model. Table 4 indicates that the R 2 of the digitally financial literacy is 0.432 with the adjusted R 2 of 0.426, which implies that perceived ease of use, perceived usefulness, and security perception explain

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an approximation of 43 percent of the variance in the digitally financial literacy. As Chin (1998) states, R 2 of 0.33-0.67 indicates the presence of an average level of explanatory power, indicating that the relevance of views on fintech to the formation of the digital financial literacy of investors in the environment of the Saudi Stock Exchange has a significant meaning and a moderate strength. The R 2 value of risk management effectiveness is 0.557, and the adjusted R 2 is 0.552, indicating that the digital financial literacy and the fintech perception constructs explain about 55 percent of risk management effectiveness variance. According to the recommendations presented by Hair et al. (2017), such a degree of explanatory power is considered as the moderate-to-substantial. It means that the use of fintech not only directly but also indirectly through its mediating role through digital financial literacy has a high predictive effect on the degree to which investors cope with financial risks in a digital trading climate. In general, the results indicate that the specified model is substantially explaining, which proves the significance of the perceived ease of use, perceived usefulness, and security perception on influencing the digital financial literacy, which, in turn, can positively affect the efficacy of risk management among investors in Tadawul. Moreover, the fact that R 2 and adjusted R 2 are close to each other suggests that the model is stable, there are no significant issues with multicollinearity, and the framework has high structural integrity, which also confirms the theoretical soundness of the presented framework.

4.5 Results of Hypotheses Testing

The hypotheses of the structural model were tested with the help of the Partial Least Squares (PLS) Algorithm in the SmartPLS 4, which approximates the standardized path coefficients (). These coefficients are between -1 to +1 which is used to demonstrate the strength and direction of the relationships among the latent constructs. The proximity of values to zero implies weak or no relations, and the approach to + or -1 is strong impacts. A non-parametric bootstrapping analysis, using 5,000 sub samples, was used to measure the statistical significance of each of the hypothesized paths.

This procedure produced the estimates of standard error, t-value, and p-values of every structural relationship. Larger standard errors are indicative of more accuracy in the estimates of the parameters. The t-values and p-values 0.05 ($t > 1.96$) was then contrasted with the traditional 5 percent significance level ($p < 0.05$, $t > 1.96$) applied in the social science literature (Hair et al., 2017).

The relationships that passed these criteria were considered statistically significant. Under this approach, the research strictly tested the hypothesized associations between the fintech adoption constructs perceived ease of use, perceived usefulness, and security perception, and their impacts on digital financial literacy and effectiveness in risk management.

This strategy made the direct and indirect effects to be empirically validated within the conceptual model. The findings of these hypothesis tests are demonstrated in Figure 2 that provides the structural model and the estimated path coefficients of the significant level as well as the directional relationships among the constructs.

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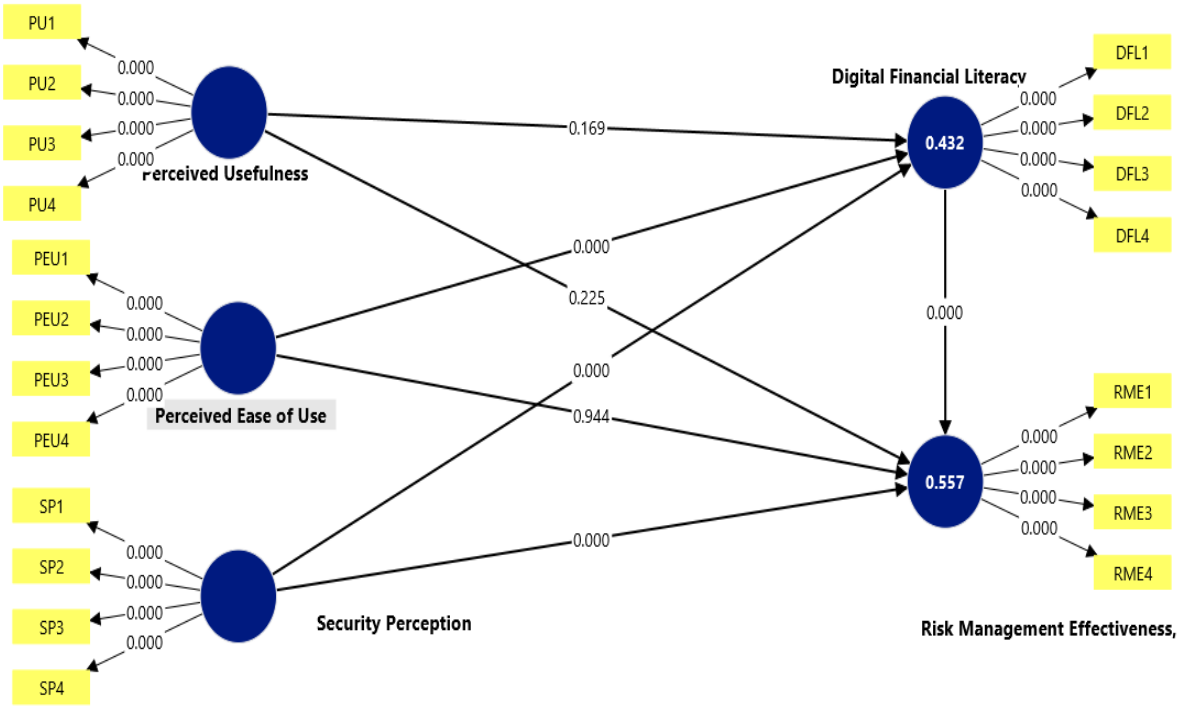

Figure 2: Measurement Model

Table 6: Hypotheses Testing Estimates

Hypo.	Relationships	Standardized Beta	Standard Error	T-Statistic	P-Values	Decision
H1	Digital Financial Literacy -> Risk Management Effectiveness,	0.338	0.052	6.54	0	Supported
H2	Perceived Ease of Use -> Digital Financial Literacy	0.439	0.047	9.274	0	Supported
H3	Perceived Ease of Use -> Risk Management Effectiveness,	0.152	0.045	3.408	0.001	Supported
H4	Perceived Usefulness -> Digital Financial Literacy	0.059	0.043	1.375	0.169	Unsupported
H5	Perceived Usefulness -> Risk Management Effectiveness,	0.07	0.048	1.446	0.148	Unsupported
H6	Security Perception -> Digital Financial Literacy	0.311	0.043	7.238	0	Supported
H7	Security Perception -> Risk Management Effectiveness,	0.596	0.047	12.663	0	Supported

As it can be seen in Table 6, the hypotheses (H1 to H7) exhibit a definite trend of affirmative and non-affirmative relationships between the study constructs. The results of

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the analysis of path coefficients (β), t-test, and p-values prove the existence of a number of significant relationships between the dimensions of fintech adoption, digital financial literacy, and the effectiveness of risk management in the Saudi Stock Exchange. The findings show that digital financial literacy positively influences the risk management effectiveness significantly (= 0.338, = 6.540, = 0.001). This result demonstrates the critical value of digital financial knowledge and competency in improving the ability of investors to evaluate risks, interpret digital financial indicators, and make informed decisions. Moreover, perceived ease of use is a strong and high-impact factor on digital financial literacy (0.439 = -1.274 = 0.001) and a direct positive factor on risk management effectiveness (0.152 = 3.408 = 0.001). These outcomes imply that the easier the fintech platform becomes to use, the more investors will need to investigate it and acquire better digital financial skills and become more capable of responding to market risks. Moreover, security perception has a substantial direct impact on digital financial literacy (0.311, $t = 7.238$, $p < 0.001$) and a potent and highly significant direct impact on the risk management effectiveness (0.596, $t = 12.663$, $p < 0.001$). These interconnections show that as investors feel secure using digital platforms, especially in relation to data security, authentication methods, and privacy of transactions, they tend to better or more strongly use fintech tools, through which their digital literacy and risky decision-making become stronger. Conversely, no statistically significant effects were found on perceived usefulness on digital financial literacy (0.059, $t = 1.375$, $p = 0.169$) or risk management effectiveness (0.070, $t = 1.446$, $p = 0.148$). These insignificant findings suggest that investors in Tadawul do not necessarily relate the perceived value or performance enhancing advantages of fintech tools with the building of their digital capabilities or the improvement of their risk management operations. Rather, convenience and safety seem to be the more dominant interests that promote digital interaction and vulnerability. Collectively, the findings support the main idea that digital financial literacy is one of the most critical mechanisms that provides a connection between fintech adoption perceptions and effective risk management. They also provide emphasis on the significance of the usability of platforms and security features in facilitating digital preparedness and the quality of financial decision-making. The conceptual framework is confirmed by the structural model outcomes, as they show that the adoption of fintech, especially its perception based on ease of use and security perception, has a significant effect on increasing the effectiveness of risk management in the Saudi Stock Exchange.

5. FINDINGS AND IMPLICATIONS

5.1 Summary of Findings

This paper has investigated the impact of fintech adoption, captured by perceived ease of use, perceived usefulness and security perception, on the effectiveness of risk management and the role digital financial literacy plays in mediating the relationships in the Saudi Stock Exchange (Tadawul). The findings of the SmartPLS 4 have a solid empirical support of most of the postulated relationships. The results indicate that the digital financial literacy positively correlates with the effectiveness of risk management (0.338 $t = 6.540$ $p < 0.001$). This shows why the presence of digital knowledge, platform

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fluency, and analytical competence is crucial in helping investors analyze the risks, financial indicators, and respond to market volatility. It is also shown that the perceived ease of use affects, as well, both the digital financial literacy (0.439 = -9.274) and the risk management effectiveness (0.152 = 3.408) significantly in a positive way. This means that easy to use fintech applications encourage a more committed and quicker way of learning and making precise risk-based decisions. There are very strong positive influences of security perception on digital financial literacy (= 0.311, t = 7.238, p < 0.001) and a very strong direct impact on the risk management effectiveness (= 0.596, t = 12.663, p < 0.001). The findings confirm that when investors have the confidence in digital systems, especially their aspects in cybersecurity, they would be more assured of using fintech tools and putting them into practical use in risk assessment and risk reduction. Conversely, perceived usefulness failed to show any significant influence on both digital financial literacy (= 0.059, t = 1.375, p = 0.169) and risk management effectiveness (= 0.070, t = 1.446, p = 0.148). This implies that Tadawul investors might not necessarily ascribe perceived benefits in performance of fintech with better quality of decisions or digital learning. Rather, the usefulness and safety of platforms seem to be the key facilitators of successful fintech interactions. Together, these results suggest that the effective application of fintech tools enhances the levels of digital literacy among investors and their capacity to handle risks adequately, which makes secure and user-friendly environments important within the context of a growing digitization of the Saudi financial environment.

5.2 Theoretical Implications

The paper augments the conceptual synthesis of the Resource-Based View (RBV) and the Technology Acceptance Model (TAM) in the realm of digital financial behavior and risk management. Through the RBV approach, the idea of digital financial literacy as a strategy intangible capability is considered to be a valuable, uncommon, and non-imitable strategic asset, which allows the investor to increase the level of analytical skills and improve financial resilience in general. The dimensions of fintech adoption (ease of use, usefulness, and the perception of security) are enlisting resources that facilitate the creation of this ability. Meanwhile, TAM is confirmed by demonstrating that perceived ease of use and security perception, but not perceived usefulness, are the most prevalent psychological factors that affect investor use of fintech tools. This broadens the TAM theory because it exposes that usability and security ranking higher than performance expectations as predictors of technology-led financial behavior in high-risk financial contexts. Altogether, the results support the theoretical connection between the perceptions of technology, digital capabilities and risk-related results within digitally transforming capital markets.

5.3 Managerial Implications

The findings present some valuable managerial implications to the financial institutions, investors and the policy makers in Saudi Arabia. To begin with, organizations need to focus more on the creation of fintech interfaces that are easy to use, since improved ease

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of use is a major contributor to digital financial literacy and greater risk management behavior.

Second, the cyberspace infrastructure has to be heavily invested in, as effective security perception is one of the main factors of fintech adoption and risk-based decision-making. Third, the institutions are to establish on-going digital literacy initiatives and make a regular training on online financial resources to enhance the quality of decisions and raise the risk awareness.

Fourth, financial service providers and brokers are proposed to incorporate digital literacy materials, including tutorial, guidance modules, and interactive support directly into their trade facilities to help investors feel more confident in digital settings.

Lastly, regulators must encourage regulation frameworks that strengthen the platform functionality, cybersecurity, and openness so that online participation in Tadawul will be secure, knowledgeable, risk-averse.

5.4 Strategic Recommendations

Based on this, a number of strategic recommendations can be adopted to enhance the use of fintech and effective risk management in organizations that work in the context of Tadawul. To begin with, organizations ought to come up with coherent digital ecosystem that incorporates trading platforms, analytical dashboard, and risk-monitoring apps in secure and easy-to-use interfaces.

Also, investors can be provided with the opportunity to increase their digital financial literacy and make better financial decisions by using AI-based advisory tools, automated risk alerts, and intelligent decision-support systems. The strategic partnerships with technological companies and higher educational establishments can also give an additional boost to the innovation and help to develop sophisticated digital skills. In addition, the adoption of a national-level digital government model will support the safe sharing of data, ethical data management, and the interoperability of the Saudi Arabian financial institutions. Lastly, organizations can be motivated to invest in secure and user-friendliness fintech technologies and speed up their digital transformation processes through financial incentives, including grants, subsidies, or tax breaks.

5.5 Limitations and Future Research

Despite the study providing useful information about the adoption of fintech and risk management in Tadawul, it also has some limitations. The sample was limited to financial and investment institutions being in the Saudi Stock Exchange and further studies can apply the model to other industries, including healthcare, logistics, or learning.

It is possible to introduce more mediators or moderators into the further models, like digital culture, leadership agility, or organizational learning, to refine the digital finance behavior understanding further. In addition, longitudinal research might be used to monitor the long-term effect of digital financial literacy and fintech adoption on the institutional resilience and the quality of governance in emerging markets.

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6. CONCLUSION

This paper examined the effectiveness of risk management mediated by digital financial literacy in the Saudi Stock Exchange and how fintech adoption affects it. The results indicate that ease of use and security perception are the most significant predictors of digital literacy and the quality of the risk-related decisions, and the role of perceived usefulness is insignificant. Digital financial literacy is identified among the most significant strategic capabilities that can improve the preparedness of investors, predictive performance, and risk sensitivity.

The study combines both RBV and TAM to present the fact that digital capabilities and technological acceptance have a rich interaction in defining the effective risk management in digital finance settings. In practice, the findings inform managers and policymakers about the necessity to invest in safe and convenient fintech systems and enhance digital literacy programs to help to make their institutions resilient and financially stable. This theoretical framework can be further applied to sectors to investigate the strategic worth of digital literacy and fintech adoption to encourage sustainable competitive advantage of a more digitalized world economy.

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