

# DIGITAL RISK GOVERNANCE AND BEHAVIOURAL DRIVERS OF ROBO-ADVISOR ADOPTION IN FINANCIAL SERVICES

Yasmeen Ansari <sup>\*</sup>, Rohit Bansal <sup>\*\*</sup>, Anand Kumar Mishra <sup>\*\*\*</sup>, Prince Kumar Maurya <sup>\*\*\*\*</sup>

<sup>\*</sup> Corresponding author, Department of Finance, College of Administrative and Financial Sciences, Saudi Electronic University, Riyadh, Saudi Arabia

Contact details: Department of Finance, College of Administrative and Financial Sciences, Saudi Electronic University, Riyadh 13323, Saudi Arabia

<sup>\*\*</sup> Department of Management Studies, Rajiv Gandhi Institute of Petroleum Technology, Amethi, India

<sup>\*\*\*</sup> School of Business, Galgotias University, Greater Noida, India

<sup>\*\*\*\*</sup> Department of Management, Birla Institute of Technology, Mesra, Jaipur, India



## Abstract

**How to cite this paper:** Ansari, Y., Bansal, R., Mishra, A. K., & Maurya, P. K. (2026). Digital risk governance and behavioural drivers of robo-advisor adoption in financial services. *Risk Governance and Control: Financial Markets & Institutions*, 16(1), 207–224. <https://doi.org/10.22495/rgcv16i1p18>

Copyright © 2026 The Authors

This work is licensed under a Creative Commons Attribution 4.0 International License (CC BY 4.0). <https://creativecommons.org/licenses/by/4.0/>

**ISSN Online:** 2077-4303

**ISSN Print:** 2077-429X

**Received:** 21.06.2025

**Revised:** 10.10.2025; 14.02.2026; 17.03.2026

**Accepted:** 30.03.2026

**JEL Classification:** G1, G2, G4, O1, O3

**DOI:** 10.22495/rgcv16i1p18

This article examines the impact of ‘reasons for’ and ‘reasons against’ factors on the adoption of robo-advisors (RAs) in the Saudi financial services sector. The limited empirical evidence on behavioural drivers and resistance factors that affect the adoption of digital financial innovations (Mishra, Bansal, & Maurya, 2023) is to be addressed within the framework of the behavioural reasoning theory (BRT) (Claudy et al., 2015). The data of 1366 Saudi customers have been analysed using a multi-stage stratified sampling approach. Confirmatory factor analysis (CFA), structural equation modelling (SEM), and artificial neural networks (ANN) have been used for analysis. Our analysis reveals that factors related to ‘reasons for’ and ‘reasons against’ affect RAs adoption. The results indicate that compatibility (COMP) and openness to change (OC) have a significant impact on attitude (ATT) and behavioural intention (BEI), whereas relative advantage (REA) has a direct impact on behavioural intention. Additionally, openness to change and compatibility affect adoption motivations and attitudes toward RAs. The findings highlight the need to analyse both pro-adoption and anti-adoption aspects in marketing strategy. The research has valuable implications for financial service providers and policymakers who are interested in boosting the uptake of digital financial services.

**Keywords:** Consumer Resistance, Innovation Adoption, Robo-Advisors, Financial Services, Behavioural Reasoning Theory

**Authors’ individual contribution:** Conceptualization — Y.A.; Methodology — R.B.; Software — R.B.; Validation — A.K.M.; Formal Analysis — R.B.; Investigation — K.M.; Resources — Y.A.; Data Curation — P.K.M.; Writing — Original Draft — R.B.; Writing — Review & Editing — Y.A.; Visualization — A.K.M.; Supervision — Y.A.; Project Administration — Y.A.; Funding Acquisition — Y.A.

**Declaration of conflicting interests:** The Authors declare that there is no conflict of interest.

**Acknowledgment:** The Authors extend their appreciation to the Deanship of Scientific Research at Saudi Electronic University for funding this research (8234-AFS-2023-1-202301-1).

## 1. INTRODUCTION

The intersection of big data, artificial intelligence (AI), and enhanced computing power, a phenomenon commonly referred to as financial technology (FinTech), is driving an unprecedented and rapid change in the global financial services industry (Alnemer, 2022; Mhlanga, 2020; Patel & Patel, 2018; dos Santos & Ponchio, 2021; S. K. Sharma et al., 2017). Due to hefty fees and significant minimum asset requirements, professional wealth management and investment advice have historically only been accessible to high-net-worth individuals, posing a substantial barrier to entry for the typical retail investor. Many people have long been unable to take advantage of expert, diversified asset management due to this accessibility gap.

The emergence of robo-advisor (RA) digital platforms that use sophisticated mathematical algorithms to provide automated, scalable, and reasonably priced financial planning and investment services with little to no human input has directly addressed this issue (Alnemer, 2022; Jung et al., 2019; Leow et al., 2021; Wagner, 2024). In order to create, manage, and automatically rebalance diversified portfolios typically made up of inexpensive exchange-traded funds (ETFs) that are tailored to a client's unique risk tolerance, financial goals, and time horizon, these platforms primarily rely on financial theories like modern portfolio theory (MPT). The market for RA services has grown quickly, making professional-grade investment strategies more accessible and drastically altering the advisory industry's competitive environment (Allevato & Marques, 2011; Babaei et al., 2022; Leow et al., 2021).

Forecasts indicate that the RA industry will continue to expand at a rapid pace, with assets under management expected to reach \$2.06 trillion by 2025 and an annual growth rate of more than 3.66%, and projected at \$2.38 trillion by 2029<sup>1</sup> with 34 million users. At the same time, the adoption of RAs in the Kingdom of Saudi Arabia (KSA) is still in its early stages, despite the Saudi Vision 2030 initiatives creating a regulatory environment that is supportive of the industry. The Statista report suggests that the RA market is projected to reach \$4.29 billion in 2025 and is expected to grow to \$5.02 billion by 2029, and at the same time, the users are expected to increase by 0.12 million<sup>2</sup>. While comparing Saudi RAs' adoption with the other major economies, the assets under management has grown slowly. When compared to worldwide averages, this delayed penetration shows a substantial discrepancy, indicating that local market factors are posing particular obstacles. To fully realize the promise of RA services in the Saudi market, a more thorough examination of these regional obstacles is thus essential.

Existing studies on behavioural reasoning theory (BRT) and FinTech adoption have largely been conducted in Western or technologically mature markets, often overlooking the influence of distinctive socio-cultural, religious, and regulatory dynamics that characterize emerging economies

such as Saudi Arabia. This study addresses this gap by extending BRT to the Saudi FinTech landscape, empirically examining how context-specific factors — such as trust in technology, perceived risk, regulatory confidence, and cultural norms — shape adoption resistance and intention. By doing so, the research advances the FinTech adoption literature by offering a nuanced, context-sensitive application of BRT, thereby enriching theoretical understanding and providing actionable insights for policymakers and practitioners operating in unique socio-cultural environments.

This research, therefore, seeks to explore behavioural drivers and resistance factors that affect the adoption of RAs in Saudi Arabia through the BRT. Particularly, it seeks to answer the following research questions:

*RQ1: Which variables are identified as the primary drivers and barriers to adopting RAs in financial services, and how do they influence attitudes toward adoption?*

*RQ2: How do relative advantages, compatibility, openness to change, and usage barriers influence the adoption of RAs in the Kingdom of Saudi Arabia?*

*RQ3: How can the findings of this study guide marketing strategies for financial service providers aiming to increase the adoption of RAs, particularly in the context of Saudi Arabia?*

To answer those questions, the study utilises a quantitative research design based on data gathered on 1,366 respondents and analysed by the methods of confirmatory factor analysis (CFA), partial least squares structural equation modeling (PLS-SEM), and artificial neural networks (ANN). The results show that compatibility (COMP) and openness to change (OC) have a strong positive effect on behavioural intention (BEI), whereas usage barriers (UBR) and risk barriers (RBR) have a negative impact on attitude (ATT) and adoption. The extension of BRT to the Saudi FinTech setting makes the study contribute to the digital risk governance literature and give context-specific implications to policymakers and practitioners.

The remaining sections of the paper are organised as follows. The literature review is included in Section 2. Section 3 presents a theoretical foundation and conceptual framework. Section 4 presents a discussion of the research methodology. Section 5 discusses results and findings. Section 6 provides a conclusion and future research direction.

## 2. LITERATURE REVIEW AND HYPOTHESIS DEVELOPMENT

### 2.1. Literature review

The KSA is undergoing a rapid digital and economic transformation anchored by Vision 2030, which explicitly targets the diversification and modernization of its financial sector. Central to this transformation is the rise of FinTech, particularly RA services, which offer automated, algorithm-driven investment management (Cheng et al., 2019). These platforms promise to democratize wealth management by offering cost-effective and accessible financial advice to a broader population, including the young, digitally native generation (Ansari & Bansal, 2024; Gazzaz, 2025). However, the adoption of such novel technologies in culturally

<sup>1</sup> <https://www.statista.com/outlook/fmo/wealth-management/digital-investment/robo-advisors/worldwide>

<sup>2</sup> <https://www.statista.com/outlook/fmo/wealth-management/digital-investment/robo-advisors/saudi-arabia>

and religiously conservative markets is not solely driven by perceived benefits. It is a nuanced process involving substantial psychological and functional resistance (Gazzaz, 2025). This literature review employs the BRT as a guiding framework to systematically analyse the dual forces, the drivers of adoption and the inhibitors of adoption (resistance factors), that collectively shape investor behavioural intention towards RAs in the KSA. The analysis focuses on the interplay between three key drivers: relative advantages (REA), compatibility, and openness to change; and two primary inhibitors: usage barriers and risk barriers, culminating in the formation of the user's attitude and subsequent behavioural intention. This synthesized perspective is particularly relevant for the KSA, where the necessity of Sharia compliance introduces a unique, critical dimension to both compatibility and risk.

The BRT serves as a crucial extension of established adoption models like the technology acceptance model (TAM) and the innovation resistance theory (IRT), providing a holistic view by conceptualizing adoption as a tension between 'push' and 'pull' factors (Ansari et al., 2025; Ansari & Bansal, 2024). While traditional models often emphasize innovation characteristics that encourage adoption, BRT integrates resistance as a primary variable, asserting that adoption only occurs when the perceived benefits and utility of the innovation outweigh the perceived barriers and costs associated with changing existing behaviours (Gazzaz, 2025). In the context of KSA's wealth management sector, the BRT is ideal because the market is defined by a strong preference for traditional human interaction and the necessity of strict religious adherence. This structure allows for a clear delineation between the motivational factors (REA, COMP, OC) and the resistive forces (UBR, RBR) that determine whether a positive attitude forms, which, in turn, dictates behavioural intention to use RAs.

The first set of constructs explores the adoption drivers, or the 'pull' factors, in the BRT framework, characteristics of the innovation that incentivize user acceptance. Relative advantages are the degree to which an innovation is perceived as superior to the idea it supersedes. For RAs in the KSA, the literature consistently highlights compelling economic and operational advantages (Gazzaz, 2025). Firstly, in terms of cost-effectiveness and accessibility, RAs are celebrated for democratizing finance by offering automated portfolio management solutions at significantly lower fee structures than traditional human advisors. This affordability makes wealth management accessible to middle- and low-income Saudi citizens who were previously underserved by high minimum investment requirements (Gazzaz, 2025). Secondly, regarding efficiency and objectivity, the algorithmic nature of RAs ensures consistent, data-driven decisions free from human emotional biases, potentially leading to better long-term risk profiling and portfolio returns (Gazzaz, 2025). The automation capability also allows financial institutions to scale their services rapidly across the large, young population of the KSA (Abraham et al., 2019). Finally, FinTech in KSA, supported by a robust information technology (IT) infrastructure, enhances convenience and accessibility through seamless online transactions and mobile integration,

making investing possible anytime, anywhere (Aleemi et al., 2023; Shaikh et al., 2023).

Following REA, compatibility, the second driver, is the degree to which an innovation aligns with the existing values, past experiences, and needs of potential adopters. In the KSA, compatibility operates on three crucial levels. On a technological level, the KSA boasts high smartphone penetration and a rapidly advancing digital infrastructure, making RAs a natural extension of established digital routines, such as mobile banking and e-wallets<sup>3</sup>. Strategically, the adoption is highly compatible with the KSA's Financial Sector Development Program under Vision 2030, which aims to diversify the economy and promote financial inclusion. Regulatory bodies, such as the Saudi Central Bank (SAMA) and the Capital Market Authority (CMA), actively encourage FinTech through regulatory sandboxes, signaling institutional compatibility. Most importantly, compatibility must address religious/cultural requirements, particularly Sharia compliance. For adoption to be successful, RAs must be intrinsically linked to Sharia principles<sup>3</sup>. Platforms must integrate specific filters to automatically screen out prohibited (haram) investments, ensuring the portfolio is compliant, thereby aligning the technology with the foundational values of the user base (Khan et al., 2023). Successful integration of Sharia compliance acts as a powerful driver of compatibility, fostering trust among local investors<sup>3</sup>.

The final adoption driver is openness to change, which refers to the individual's inherent predisposition to embrace new ideas and technologies. Saudi Arabia's population is relatively young and possesses high levels of technological readiness. Studies on FinTech adoption among Saudi consumers, particularly Generation Z, show that individual innovativeness is a strong predictor of behavioural intention. This indicates a psychological openness to change where individuals are eager to explore and integrate novel financial tools. Furthermore, the government's top-down approach to digital transformation through Vision 2030 cultivates a supportive national environment for openness to change. The successful launch and adoption of other digital payment platforms and e-commerce solutions have conditioned consumers to accept and expect innovation in financial services, reinforcing a cultural shift towards digitalization.

Despite these strong 'pull' factors, the BRT posits that resistance, the 'push' factor, must be overcome for adoption to occur. This resistance is materialized through two primary barrier constructs. Usage barriers refer to issues related to the perceived difficulty, complexity, or lack of necessary knowledge required to use the innovation. A pervasive usage barrier is the limited financial and digital literacy, particularly among older or less educated populations. Users who lack the fundamental knowledge to understand investment concepts, risk assessments, or digital platform navigation are hesitant to adopt complex algorithmic systems (Gazzaz, 2025). This deficiency contributes to low self-efficacy, which enhances user vulnerability (Alashoor et al., 2017). Another key usage barrier is the lack of human interaction. RAs, by definition, minimize human oversight. For many KSA investors accustomed to traditional,

<sup>3</sup> <https://sharikatmubasher.com/media-hub/experts-thoughts/4852?lang=en>

relationship-based financial advice, the loss of human counsel represents a functional barrier. The complexity of financial planning, coupled with the absence of a reliable human contact point, increases the perceived difficulty of usage, manifesting as a usage barrier.

The second and often more impactful barrier construct is risk barriers, which are psychological and functional concerns related to potential negative outcomes, including performance risk, financial risk, and security risk. The literature identifies privacy and data security risk as a key barrier globally, which is also prominent in KSA (Belanche et al., 2019). RAs require extensive sensitive financial data, and Saudi investors often express apprehension about how their information is handled by algorithm-driven systems, leading to substantial concerns regarding control and confidentiality (Zhang, 2024). This constitutes a major risk barrier related to technology and provider vulnerability (Lee & Kim, 2022). Furthermore, the algorithmic and trust risk is significant due to the 'black-box' nature of some sophisticated AI algorithms, which offer limited explainability, raising skepticism and reducing trust (Choung et al., 2023). Magnuson (2020) cautions against misplaced confidence and overreliance on AI. Additionally, the reliance on historical data means that RAs may not be able to accommodate unforeseen market shocks (Puhle, 2019), introducing perceived performance risk. Uniquely in the KSA, the most significant contextual risk barrier is the Sharia compliance risk. While platforms aim for Sharia compatibility, the practical challenges include high implementation costs, insufficient structured Sharia datasets, and the potential for algorithmic bias that could inadvertently contravene Islamic principles of fairness and equity (Khan et al., 2023). This risk is amplified by the current regulatory ambiguity in certain complex FinTech areas (Rjoub et al., 2023), further strengthening the risk barriers.

In the BRT framework, attitude serves as a crucial mediator, reflecting the overall cognitive and affective evaluation of the RA, resulting from the balance between the adoption drivers and resistance barriers. Investors' attitude is positively influenced by factors like perceived usefulness, perceived ease of use, and perceived convenience. However, this positive sentiment is substantially tempered by the inhibitory effects of the barriers. The literature demonstrates that resistance, derived heavily from inertia and risk barriers, significantly impedes a positive attitude. In the KSA, establishing trust and ensuring perceived security are fundamental prerequisites for fostering a positive attitude towards using financial services (Amnas et al., 2024). Crucially, trust in this context must encompass not only financial competence but also religious integrity (Sharia compliance).

Finally, behavioural intention, the ultimate outcome, is the user's conscious plan to adopt and use the technology. The growth in RA users in the KSA (projected to reach 152,8 thousand by 2023) indicates a positive aggregate behavioural intention within the segment of the population that is digitally and financially ready. However, resistance remains a substantial impediment to actual adoption and subsequent behavioural intention. Studies show that when barriers, such as perceived injustice or data privacy risks, are high, they translate into a resistance intention that directly decreases behavioural intention. Regulatory action by SAMA

and CMA, by providing clarity and protecting consumers, plays a vital role in mitigating the legal and compliance aspects of the risk barriers, thereby reinforcing trust and positively impacting behavioural intention.

In conclusion, the adoption of RAs in the KSA is a complex phenomenon best understood through the dual-factor lens of the barrier-resistance theory. The adoption is strongly 'pulled' by high relative advantages (cost, efficiency) and robust compatibility with the national digital infrastructure and Vision 2030, with a positive underlying openness to change in the young population. Critically, the market's emphasis on Sharia-compliant investment is both a driver of compatibility (when successfully implemented) and a severe risk barrier (when compliance is uncertain). The 'push' of resistance is significant, driven primarily by risk barriers concerning privacy, trust, and algorithmic opacity, and usage barriers linked to financial literacy gaps. Ultimately, the positive attitude required to form a strong behavioural intention relies heavily on policymakers and FinTech providers effectively mitigating the core resistance factors, particularly the Sharia compliance and data security risks. While the current literature provides strong qualitative and secondary data analysis, a significant gap remains in quantitative, primary research that empirically tests the causal relationships and moderating effects of the BRT constructs (REA, COMP, OC, UBR, RBR) on attitude and behavioural intention specifically among Saudi investors, utilizing statistical modeling (e.g., PLS-SEM) to validate the BRT framework's applicability within the KSA context.

## 2.2. Theoretical background and conceptual framework

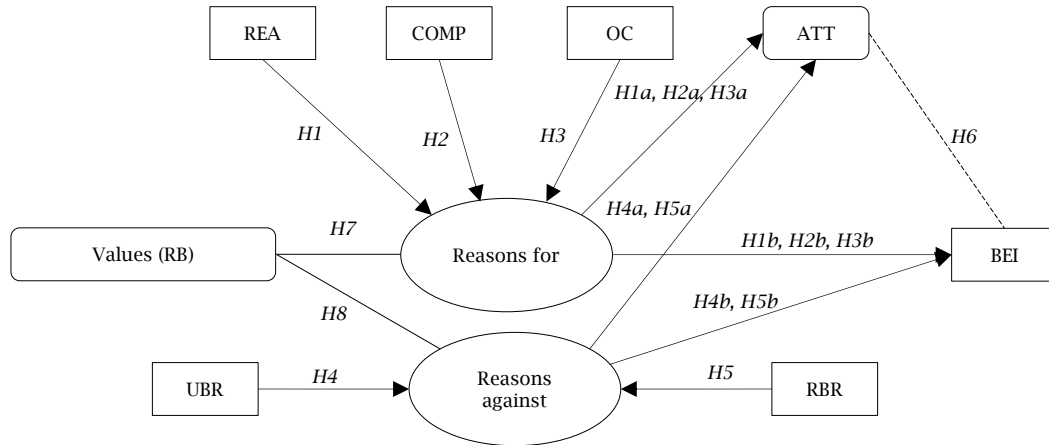
Behavioural research theories, including the theory of reasoned action (TRA) and the theory of planned behaviour (TPB), are utilised extensively to predict people's behavioural intentions and actual behaviours (Hassan et al., 2016). The TRA model comprises fundamental components such as attitude and subjective norms (Ajzen & Fishbein, 2000). In contrast, the TPB models use attitude, subjective norms, and perceived behavioural control (Adam & Shauki, 2014; Apostolakis et al., 2016; Chan et al., 2022; Mehta et al., 2022; Moran & Ward-Christie, 2022).

The BRT is an example of a relatively new theoretical model that addresses enablers and obstacles under a single umbrella (Cunha et al., 2021; Fiordelisi et al., 2022; Hassan et al., 2016). The concept has been utilised in a research process of behavioural decision-making (Kaur et al., 2020; Kumar et al., 2022). Initially, its two components, 'reasons for' and 'reasons against', provide a more thorough analysis of the decision-making process. 'Reasons for' and 'reasons against' are not simply oppositional; they represent two significant yet unique perspectives that influence individuals' intentions and behaviour (Figure 1). To explain the motivations and intentions for conduct, BRT maintains that principles or beliefs are of utmost importance. Compared to other frameworks, BRT frameworks offer a more extensive coverage, as indicated by a review of past research associated with BRT (Claudy et al., 2015).

The BRT framework expands upon the previous research that has been conducted on the RAs adoption behaviour of Saudi users. According to previous research, users' beliefs regarding their religious affiliation have been regarded as a guiding value in defining their reason for adopting RAs.

In the KSA, this research aims to improve and broaden the existing knowledge concerning the current status of RAs adoption and their ability to reduce behavioural biases. The hypotheses developed based on the above theoretical background are as follows.

Figure 1. Proposed research framework



2.3. Hypothesis development

2.3.1. Reasons for

In defending conduct, individuals tend to summon a variety of distinct cognitions (Claudy et al., 2015; Meunier & Ohadi, 2022). Providing individuals with 'reasons for' that encourage favourable perceptions of particular activities increases the likelihood that those individuals will have positive impressions of such activities. On the other hand, 'reasons against' are referred to as impediments because they have the potential to contribute to an unfavourable opinion of a certain action (Dhir et al., 2021; Gutsche & Zwergel, 2020; Manshad & Brannon, 2021; Mehta, 2021; Rayburn et al., 2022). Saudi users will gravitate toward RAs due to REA. Here, we mean that Saudi users have a positive attitude towards RAs adoption for their investment planning. Likewise, relative advantages have a positive influence on behavioural intention for RAs adoption (Bhuiyan et al., 2021; Dash & Paul, 2021). Based on the literature review and past studies, the following hypothesis has been proposed:

H1: The use of RAs is significantly associated with the relative advantages perceived by Saudi customers.

The sub-hypotheses of H1 are as follows:

H1a: There is a significant association between the relative advantages and the attitude towards RAs.

H1b: There is a significant association between the behavioural intention and the relative advantages of RAs.

The adoption of RAs in Saudi Arabia is significantly correlated with the compatibility of these services with customer needs and existing financial practices (Nourallah et al., 2025). This relationship is formalised under H2. The sub-hypotheses further detail this association: H2a posits a significant link between COMP and the attitude level of customers, suggesting that if

RAs align well with customer values and lifestyle, their perception and willingness to use them improve. Furthermore, H2b examines the meaningful relationship between behavioural intention and the compatibility of RAs, implying that a strong fit between RAs and Saudi customers' financial behaviour will drive their decision to use the automated advisory services. This highlights compatibility as a crucial factor for widespread adoption. Based on the literature review and past studies, the following hypothesis has been proposed:

H2: The use of RAs is significantly associated with the compatibility of Saudi customers.

This correlation is considerable. The sub-hypotheses of H2 have been written:

H2a: There is a significant association between the compatibility and the attitude level of customers.

H2b: There is a meaningful relationship between the behavioural intention and the compatibility of RAs.

The third set of hypotheses focuses on the role of openness to change in the adoption of RAs. H3a posits a significant association between a Saudi customer's openness to change and their attitude toward RAs. This suggests that individuals who are more welcoming of new financial technologies and changes in their wealth management approach are likely to form a more favourable attitude toward RAs. Furthermore, H3b examines the significant relationship between behavioural intention and the openness to change of RAs. This relationship implies that a customer's willingness to embrace innovation and change directly translates into their intention to actually use the automated advisory services. Therefore, the willingness to adopt new practices, or openness to change, is a critical precursor to the successful uptake of RAs in the Saudi market. Based on the literature review and

past studies, the following hypothesis has been proposed:

*H3: The use of RAs is significantly associated with the openness to change of Saudi customers.*

The sub-hypotheses of H3 are as follows:

*H3a: There is a significant association between openness to change and attitude.*

*H3b: There is a significant relationship between the behavioural intention and the openness to change of RAs.*

The rise of digital wealth management tools, specifically RA services, has fundamentally reshaped the FinTech landscape globally. Despite offering benefits like low costs and increased accessibility, widespread customer adoption remains contingent on overcoming psychological and practical hurdles. This study shifts focus from motivators to barriers, investigating how specific challenges influence a customer's overall perception and intent to use RAs (Ansari & Bansal, 2024; Back et al., 2023; Mishra, Bansal, & Maurya, 2023; Ong et al., 2022). We theorize that negative perceptions related to usage barriers stemming from concerns over complexity or technical ability and risk barriers driven by anxiety over security or algorithmic transparency are crucial determinants of a customer's attitude toward RAs (H4a, H5a). Furthermore, we explore the dynamic where a customer's existing behavioural intention to adopt RAs may influence how strongly they perceive these inherent barriers (H4b, H5b), suggesting a complex interplay between motivation and perceived challenges in the adoption lifecycle. Based on the literature review and past studies, the following hypotheses have been proposed.

*H4: The use of RAs is significantly associated with the usage barriers perceived by Saudi customers.*

The sub-hypotheses of H4 are as follows:

*H4a: There is a significant association between the usage barriers and the attitude level of customers.*

*H4b: There is a significant relationship between the behavioural intention and the usage barriers of RAs.*

*H5: The use of RAs is significantly associated with the risk barriers perceived by Saudi customers.*

The sub-hypotheses of H5 are as follows:

*H5a: There is a significant association between the risk barriers and the attitude level of customers.*

*H5b: There is a significant association between the behavioural intention and the risk barriers of RAs.*

### 2.3.2. Attitude

The direct relationship between customers' attitude and behavioural intention is a cornerstone of established technology acceptance theory. Grounded largely in the TAM, a positive attitude towards a system formed by perceptions of its usefulness and ease of use is empirically proven to drive a stronger intention to use the technology. In the context of FinTech, a favourable attitude toward RAs is thus considered a crucial prerequisite for customer adoption (Elkhatibi et al., 2024). When customers view RAs as beneficial, convenient, and reliable, they develop a positive attitude that translates directly into a higher willingness to utilize

the service. Based on the literature review and past studies, the following hypothesis has been proposed.

*H6: Attitude has a direct relation with the RA's intention.*

Values, particularly those derived from religious belief (RB), are critical non-technological factors influencing FinTech adoption (Khan et al., 2022). The literature consistently supports the idea that BEI is shaped by an individual's ethical and moral framework. Specifically, religious belief has a significant impact on the reasons for engaging with automated services (H7). For instance, Sharia-compliant RAs are highly valued by Muslim investors because they offer personalized investment solutions that adhere to Islamic principles, thereby aligning finance with personal faith and creating a strong motivational driver for adoption (Hooda et al., 2024). This ethical alignment acts as a positive determinant of BEI. Conversely, religious values also significantly dictate the reasons against adopting conventional technologies (H8). When an RA lacks transparency or compliance, it introduces prohibitions such as *riba* (interest) or *gharar* (uncertainty). These factors act as powerful barriers, requiring continuous human oversight or 'purification' processes (Hooda et al., 2024; Khan et al., 2022), which ultimately diminish BEI. Research incorporating religiosity often finds it a direct and significant predictor of the intention to use faith-based FinTech (Khan et al., 2022). Based on the literature review and past studies, the following hypothesis has been proposed.

*H7: Values religious belief significantly affect the 'reasons for' behavioural intention.*

*H8: Values religious belief significantly affect the 'reasons against' behavioural intention.*

## 3. RESEARCH METHODOLOGY

### 3.1. Data collection

A multi-stage stratified random sampling method was utilized to obtain information from Saudi companies' clients. Specifically, a multi-stage stratified random sampling technique was employed to collect data from Saudi consumers who are potential or existing users of RA services. The target population was first stratified based on geographical regions (Central, Eastern, Western, Northern, and Southern Saudi Arabia), age groups (younger: < 35 years old; middle-aged: 35-50 years old; older: > 50 years old), and income levels (low, middle, and high), ensuring comprehensive representation of key demographic and socio-economic segments.

The sample comprised the respondents' residences to ensure a proportional representation of rural, urban, and suburban areas. There were respondents from all of the major territories in the KSA, including the Makkah, the Eastern Province, the Riyadh, the Qassim, the Medina, the Al-Baha, the Najran, the Asir, the Northern border area, the Jizan, the Tabuk, and the Al-Jouf. The population for the study includes Saudi consumers who are potential or existing users of RA services. The population is divided into well-defined groups based on key characteristics such as geographical regions (e.g., urban vs. rural areas), income levels,

and age demographics. The population is stratified into subgroups (strata) to ensure representation of all relevant groups. Common strata in this study were regions (Central, Eastern, Western, Northern, and Southern regions of Saudi Arabia), age groups (younger (< 35 years), middle-aged (35-50 years), and older (> 50 years), and income levels (low, middle, and high-income consumers).

In the first stage, geographical regions are selected as primary sampling units (PSUs). For example, key cities or provinces within each region were randomly chosen using probability proportional to size (PPS) methods. Within the selected PSUs, further stratification is applied to identify secondary sampling units (SSUs). For example, households or individual respondents are chosen from urban and rural areas within each PSU. In the final stage, individual respondents are

randomly selected within each SSU. We have ensured a representative sample of Saudi consumers by accounting for regional, demographic, and socio-economic diversity and reduced sampling bias through randomization at multiple levels. Also, facilitates more generalizable findings, as the stratification ensures that all significant subgroups are adequately represented in the data.

The online questionnaire was distributed to about 1500 individuals interested in participating. Data was collected beginning in January 2024 and continuing through June 2024. Every indicator was tagged as obligatory to prevent any responses from being overlooked. A total of 1366 complete replies were collected, which resulted in a response rate of 91.6%. A description of the respondents' demographic characteristics is shown in Table 1.

**Table 1.** Description of demographic results for RAs

<i>Variable</i>	<i>Description</i>	<i>%</i>
<i>Gender</i>	Male	41.29
	Female	58.71
<i>Educational level</i>	Diploma	10.36
	High school	15.21
	Bachelor's	48.42
	Master's	22.41
	Ph.D.	03.60
<i>Annual income</i>	Less than 10000	48.49
	10000 to less than 20000	31.67
	20000 to less than 30000	11.32
	More than 30000	08.52
<i>Work experience (in years)</i>	1 to less than 10	67.23
	10 to less than 20	20.72
	20 plus	12.05
<i>Age group (in years)</i>	18-24 years old	27.85
	25-30 years old	33.73
	31-45 years old	29.90
	46-60 years old	06.10
	60 years old and above	02.42
<i>Employment</i>	Student	32.77
	Employee	60.10
	Retired	05.51
	Housewife	0.220
	Self-employed	01.40
<i>Working, sector</i>	Private service	13.01
	Manufacturing	08.01
	Government	18.88
	Education	22.48
	Medical	13.01
	Agriculture	03.67
	Professional service	12.56
	Hospitality	04.41
	Research and development	03.97

**3.2. Measurement scale**

It is important to note that the measurement tools utilized in this study were obtained from previous research on technology adoption and the linked domain. Some of the elements that make up 'reasons for' have been taken from (De Amicis et al., 2020; Mishra, Bansal, & Maurya, 2023; Raut et al., 2020; R. Sharma et al., 2020; Singh & Gurtu, 2022) problem check. Components of 'reasons against' have been taken from (Kaur et al., 2020; Palacios-González & Chamorro-Mera, 2020; Talwar, Talwar, et al., 2021) and fine-tuned to fit the context of RAs. Items of RB have been adopted from (Mishra, Bansal, & Maurya, 2023). Indicators of attitude and behavioural intention were adopted from (Eren, 2021; Fuentes-Moraleda et al., 2020; Hong et al., 2023; Lee & Chen, 2022).

Measuring latent variables in structural equation modelling (SEM) involves using observed indicators to infer the latent constructs, as these cannot be directly measured. The RF has been measured by summing up the values from the following constructs and their items, i.e., REA1, REA2, REA3, COMP1, COMP2, COMP3, COMP4, OC1, OC2, OC3, and OC4. The RA has been measured by summing up the values from the following constructs and their items, i.e., UBR1, UBR2, UBR3, UBR4, and RBR1, RBR2, RBR3, RBR4. This process aligns with the previous studies, which have used a similar underlying process on the 'reasons for' and 'reasons against' (Liu & Peifer, 2022; Mishra, Bansal, & Maurya, 2023; Talwar, Jabeen, et al., 2021).

A preliminary test of the questionnaire was conducted on a total of 40 individuals, including five professors and 35 fellow researchers, before its final distribution.

### 3.3. Data analysis technique

To gain significant insights and ensure the reliability of the findings, the type of data analysis utilized in the study was a combination of several different approaches. The variance-based PLS-SEM was utilized as a symmetric modelling approach to assess the validity and predictive strength of the model and examine the postulated link between the variables (Dash & Paul, 2021). It is recommended that variance-based PLS-SEM be utilized for complicated models since it offers a model capability that is comparatively superior to that of the covariance-based approach. As shown in Figure 2, this allowed us to minimize the complexity of the model, boost its efficiency, and improve its interpretability (Hair et al., 2019; Sarstedt et al., 2022). Although PLS-SEM was chosen based on its predictive power and ability to analyse intricate latent models, other tools like covariance-based SEM, multiple regression analysis, or fsQCA may also be used to test theory confirmation or configurational pathways of RA adoption (Astrachan et al., 2014; Hafish et al., 2024). An ANN study was also conducted to capture the model's non-linear strength and find relevant predictors' relative importance (Talwar, Talwar, et al., 2021). As a result

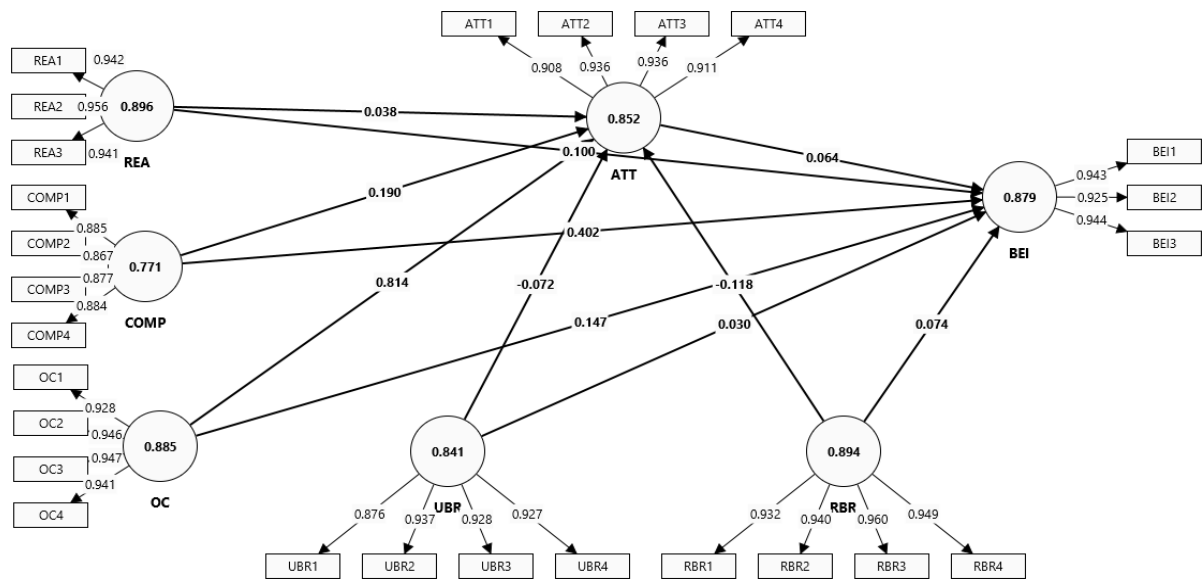
of the hidden-layer black-box operations that it performs, ANN are not deemed to be ideal for hypothesis testing; hence, the PLS-SEM approach is used to supplement them (Mishra, Bansal, Maurya, et al., 2023).

To perform multivariate analysis, it is necessary to fulfil several conditions (Albahri et al., 2022; Lau et al., 2021). The outer loadings for all the items in constructs are greater than 0.85, with most values coming close to or above 0.90. According to this, each item strongly represents its relevant construct, which suggests that the indicators' dependability is satisfactory. The elements ATT1 through ATT4 have loadings that range from 0.908 to 0.936, indicating that they provide a reliable and robust representation of the attitude construct. Next, we examined the variance inflation factors (VIFs) and tolerances to evaluate the multicollinearity problem (Table 2). The full-collinearity assessment recommended by Kock (2015) was employed. The VIF values for all the latent constructs fall within the range of 1.173 to 2.997, which is lower than the critical value of 3.30. That multicollinearity is not a cause for concern is demonstrated by the tolerances ranging from 0.182 to 0.701, greater than 0.10 (Teck Soon & Syed A. Kadir, 2017).

**Table 2.** Item-wise values for outer loadings and VIF statistics

<i>Construct-items</i>	<i>Outer loadings</i>	<i>Construct-items</i>	<i>Collinearity statistics (VIF)</i>
ATT1 ← ATT	0.908	ATT1	2.883
ATT2 ← ATT	0.936	ATT2	2.888
ATT3 ← ATT	0.936	ATT3	2.628
ATT4 ← ATT	0.911	ATT4	2.690
BEI1 ← BEI	0.943	BEI1	1.173
BEI2 ← BEI	0.925	BEI2	2.321
BEI3 ← BEI	0.944	BEI3	2.175
COMP1 ← COMP	0.885	COMP1	2.706
COMP2 ← COMP	0.867	COMP2	2.492
COMP3 ← COMP	0.877	COMP3	2.716
COMP4 ← COMP	0.884	COMP4	2.806
OC1 ← OC	0.928	OC1	2.510
OC2 ← OC	0.946	OC2	2.657
OC3 ← OC	0.947	OC3	2.632
OC4 ← OC	0.941	OC4	2.158
RBR1 ← RBR	0.932	RBR1	2.516
RBR2 ← RBR	0.940	RBR2	2.996
RBR3 ← RBR	0.960	RBR3	2.337
RBR4 ← RBR	0.949	RBR4	2.198
REA1 ← REA	0.942	REA1	2.205
REA2 ← REA	0.956	REA2	2.256
REA3 ← REA	0.941	REA3	2.140
UBR1 ← UBR	0.876	UBR1	2.547
UBR2 ← UBR	0.937	UBR2	2.997
UBR3 ← UBR	0.928	UBR3	2.739
UBR4 ← UBR	0.927	UBR4	2.117
RB1 ← RB	0.912	RB1	2.656
RB2 ← RB	0.924	RB2	2.821

Figure 2. Reliability and SMART-PLS algorithm result for RAs adoption in KSA



In the next stage, all constructs have Cronbach's alpha values above 0.90, demonstrating high internal consistency (Table 3). These values confirm that the construct is highly correlated, indicating reliable measurement scales. Openness to

change with 0.956, followed closely by risk barriers with 0.960, suggesting strong reliability for these constructs. Compatibility with 0.901, indicating good reliability.

Table 3. Assessment of reliability and validity overview

Items	Cronbach's alpha	rho_a	rho_c	Average variance extracted (AVE)			
ATT	0.942	0.943	0.958	0.852			
BEI	0.931	0.932	0.956	0.879			
COMP	0.901	0.901	0.931	0.771			
OC	0.956	0.957	0.968	0.885			
RBR	0.960	0.960	0.971	0.894			
REA	0.942	0.942	0.963	0.896			
UBR	0.937	0.937	0.955	0.841			
RB	0.918	0.924	0.935	0.837			
Heterotrait-Monotrait ratio (HTMT) matrix							
Items	ATT	BEI	COMP	OC	RBR	REA	UBR
ATT							
BEI	0.559						
COMP	0.652	0.721					
OC	0.847	0.609	0.688				
RBR	0.490	0.569	0.641	0.622			
REA	0.458	0.553	0.621	0.558	0.819		
UBR	0.635	0.655	0.808	0.734	0.677	0.628	
RB	0.532	0.602	0.626	0.521	0.634	0.587	0.624
Fornell-Larcker criterion							
Items	ATT	BEI	COMP	OC	RBR	REA	UBR
ATT	0.923						
BEI	0.524	0.937					
COMP	0.601	0.661	0.878				
OC	0.834	0.576	0.639	0.941			
RBR	0.466	0.538	0.596	0.596	0.945		
REA	0.432	0.517	0.572	0.530	0.874	0.947	
UBR	0.598	0.612	0.834	0.695	0.643	0.590	0.621
RB	0.521	0.593	0.601	0.621	0.634	0.583	0.587

The rho\_a and rho\_c are higher than 0.90 for all constructs, which indicates that the constructs have a high level of reliability and confirms that the indicators belonging to each construct accurately assess a shared latent variable. Both RBR and OC have the greatest rho\_c values, which correspond to 0.971 and 0.968, respectively, indicating that they are extremely reliable. COMP has a rho\_c value of 0.931, which indicates that it is still reliable over the threshold of 0.70, which is considered acceptable. The minimum condition for convergent validity is satisfied by all the constructs because

their AVE values are greater than 0.50. The conclusion that can be drawn from this is that every construct accounts for a sizeable percentage of the variance in its indicators.

Discriminant validity is established as per Fornell-Larcker's criterion as well as the HTMT ratio (Hair et al., 2019). The square root of AVE for all the constructs is greater than the inter-construct correlation, respecting Fornell-Larcker's criterion. Similarly, the HTMT ratio between the constructs lies below the threshold of 0.85, confirming discriminant validity (Henseler et al., 2015; Shmueli et al., 2019).

## 4. RESULTS

### 4.1. Hypothesis testing

Structural equation modelling was employed using SmartPLS V.4.20 with a 5000-subsample for hypothesis testing, with acceptance of 10 hypotheses (Table 4).

*H1a*: REA → ATT shows a mean of 0.038, a T-statistic of 0.942, and a p-value of 0.347, indicating that the relationship is insignificant. Therefore, *H1a* is not supported. Acceptance of *H1b* ( $\beta = 0.100$ ) suggests a positive influence of relative advantages on BEI; *H1b* has a  $\beta$  of 0.100 and a p-value of 0.031, suggesting a significant positive effect. *H1b* is supported, which aligns with the findings of Roos et al. (2024) and Yee et al. (2022).

*H2a*: COMP → ATT shows a strong positive effect with a  $\beta$  of 0.190 and a T-statistic of 4.899, indicating significance. Thus, *H2a* is supported. *H2b*: COMP → BEI has a mean of 0.402, showing a significant positive effect. Therefore, *H2b* is supported. This aligns with the findings of Jonwall et al. (2023) and Palacios-González and Chamorro-Mera (2020).

*H3a*: OC → ATT shows a very strong effect with a  $\beta$  of 0.814, and a T-statistic of 42.583, indicating a highly significant relationship. Thus, *H3a* is supported. *H3b*: OC → BEI has a  $\beta$  of 0.147 and a p-value of 0.002, suggesting a significant positive effect. *H3b* is supported. Also, the positive association between OC and BEI aligns with the conclusion of Brodmann et al. (2023) and Fiordelisi et al. (2022).

The findings indicate that openness to change exerts a strong influence on attitudes, whereas relative advantages do not show a significant effect, and this distinction can be explained both theoretically and contextually. Openness to change reflects an individual's intrinsic disposition toward innovation, flexibility, and willingness to experiment with new technologies. In the Saudi context — where financial decision-making is closely tied to trust, familiarity, and cultural norms — attitudinal formation toward FinTech is driven more by psychological readiness and value congruence than by purely functional evaluations. Individuals who are open to change are more likely to perceive new financial technologies positively, even in the presence of uncertainty, thereby forming favourable attitudes.

**Table 4.** Results for hypothesis testing for RAs adoption in KSA

Construct	Hypothesis	$\beta$	Std. dev.	T-statistics	p-values	Supported
REA → ATT	<i>H1a</i>	0.038	0.040	0.942	0.347	No
REA → BEI	<i>H1b</i>	0.100	0.046	2.158	0.031**	Yes
COMP → ATT	<i>H2a</i>	0.190	0.039	4.899	0.000*	Yes
COMP → BEI	<i>H2b</i>	0.402	0.043	9.339	0.000*	Yes
OC → ATT	<i>H3a</i>	0.814	0.019	42.583	0.000*	Yes
OC → BEI	<i>H3b</i>	0.147	0.047	3.147	0.002*	Yes
UBR → ATT	<i>H4a</i>	-0.072	0.037	1.945	0.052**	Yes
UBR → BEI	<i>H4b</i>	0.030	0.046	0.655	0.513	No
RBR → ATT	<i>H5a</i>	-0.118	0.038	3.068	0.002*	Yes
RBR → BEI	<i>H5b</i>	-0.114	0.040	2.478	0.005*	Yes
ATT → BEI	<i>H6</i>	0.164	0.041	2.632	0.013*	Yes
RB → RF	<i>H7</i>	0.184	0.040	4.125	0.000*	Yes
RB → RA	<i>H8</i>	-0.029	0.042	0.685	0.504	No

Note: \* 1% significance level; \*\* 5% significance level.

*H4a*: UBR → ATT has a  $\beta$  of -0.072, and a T-statistic of 1.945, showing a marginally significant negative effect. Hence, *H4a* is supported.

*H4b*: UBR → BEI has a  $\beta$  of 0.030, and a p-value of 0.513, indicating no significant relationship. Therefore, *H4b* is not supported. The significant findings support the study of Hong et al. (2023) and Hu et al. (2019).

*H5a*: RBR → ATT has a  $\beta$  of -0.118 and a p-value of 0.002, showing a significant negative effect. *H5a* is supported.

*H5b*: RBR → BEI has a  $\beta$  of -0.114, and a p-value of 0.005, indicating a significant negative effect. Therefore, *H5b* is supported. Similarly, the significant relationship between reasons against and BEI, ATT aligns with the findings of Brodmann et al. (2023); Carranza et al. (2021), Fiordelisi et al. (2022), Garg et al. (2022), and Yan et al. (2021).

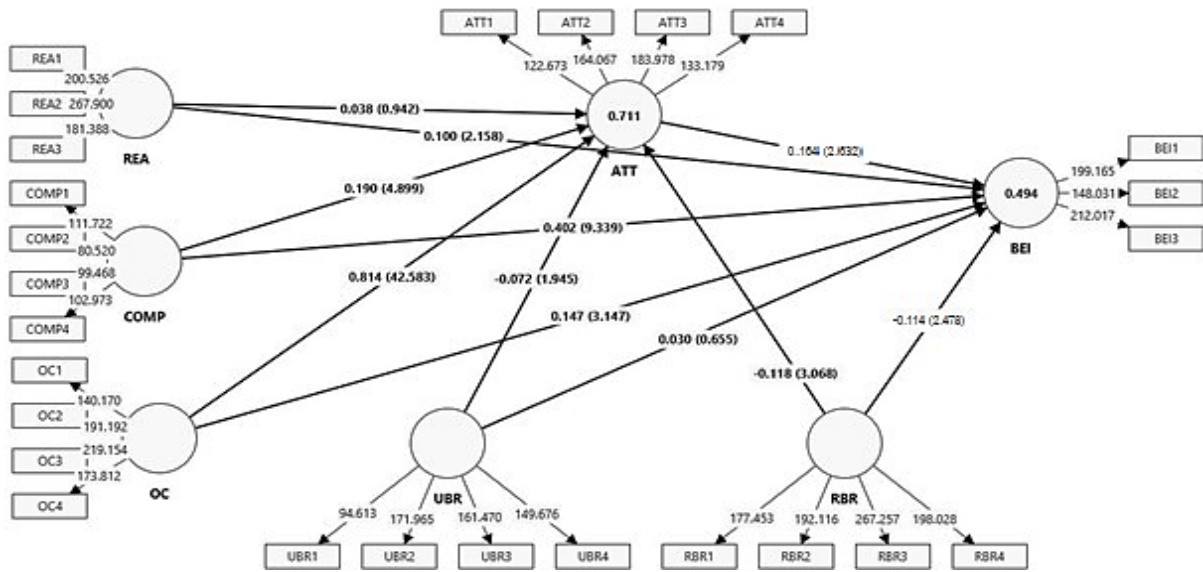
*H6*: ATT → BEI shows a  $\beta$  of 0.164, and a p-value of 0.013, indicating a significant positive relationship. Thus, *H6* is supported, and the significant findings support the study by Seiler and Fanenbruck (2021), Semeraro et al. (2023), and Singh and Kumar (2024).

*H7*: RB → RF (risk factor) has a  $\beta$  of 0.184 and a p-value of 0.000, showing a significant positive effect; the findings align with the results of Mishra,

Bansal, and Maurya (2023). *H7* is supported. The path from RB to RF shows a significant positive effect, indicating that higher levels of resistance barriers are associated with increased perceived risk among consumers. This suggests that as users encounter greater functional or psychological resistance, their perception of risk related to the technology correspondingly intensifies. These findings are consistent with earlier empirical evidence reported by Mishra, Bansal, and Maurya (2023), thereby reinforcing the robustness of this relationship in the context of technology and FinTech adoption.

*H8*: RB → RA has a  $\beta$  of -0.029, and a p-value of 0.504, showing no significant relationship. Thus, *H8* is unsupported (Feng et al., 2022; Liu & Peifer, 2022). In contrast, the relationship between RB and RA is negative but statistically non-significant. This indicates that resistance barriers do not meaningfully influence consumers' perceptions of the relative advantages of the technology. In other words, even when users experience resistance, it does not necessarily diminish their recognition of the potential benefits. This result aligns with prior studies (Feng et al., 2022; Liu & Peifer, 2022), which also report weak or insignificant effects for similar relationships.

Figure 3. SEM regression result



The results indicate that several constructs, including compatibility, openness to change, and REA, have significant relationships with attitude and intention, supporting the hypotheses. However, certain constructs, such as risk barriers and usage barriers, show limited impact on attitude and behavioural intention, with some hypotheses not supported (Back et al., 2023; Isaia & Oggero, 2022; Oehler et al., 2022; Yeh et al., 2023). The findings highlight key factors influencing RA adoption intentions and attitudes, providing insight into promoting RA adoption in Saudi Arabia.

#### 4.2. Artificial neural networks analysis

We brought the SEM-PLS path analysis components into play for the ANN model (Table 7). These components were used as input neurons in the ANN model, which was conducted in tandem with (Liébana-Cabanillas et al., 2017) (Figure 5). The ANN is a proven statistical method that is utilized for

analysing non-linear interactions between endogenous and exogenous factors. As a result of its capacity to deal with non-linear data, it is an excellent tool for predicting the distribution of non-linear observations. In addition, the ANN is resistant to outliers and sample magnitudes that are quite small. IBM’s SPSS V26.0 neural network module was utilized to carry out the ANN analysis. The software can learn to anticipate analytical outcomes through the training phase by utilizing the feed-forward-backward-propagation technique. During this phase, the program receives inputs in the forward direction, and estimated errors continue to move backwards (Taneja & Arora, 2019). The sigmoid activation function and multilayer perceptrons were utilized for predictive relevance and sensitivity analysis (S. K. Sharma & Sharma, 2019). Following Leong et al. (2019), 70% of the samples were used for the training technique, while 30% were used for testing.

Table 7. ANN and RMSE analysis

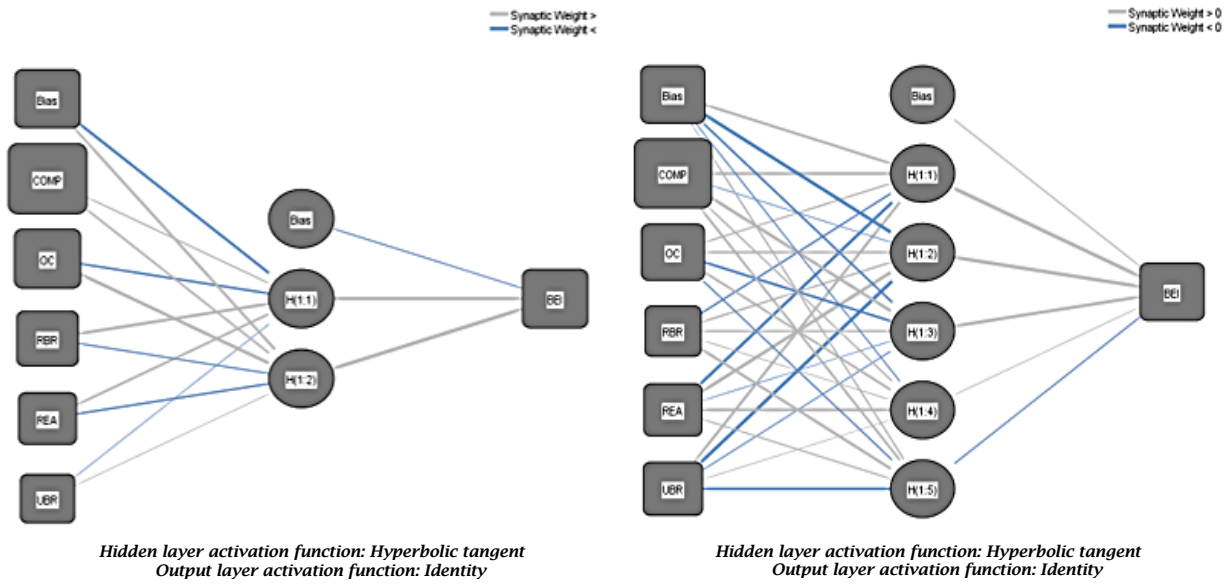
ANN case	Training			Testing		
	N	SSE	RMSE	N	SSE	RMSE
1	948	99.288	0.515	418	0.487	0.027
2	956	102.74	0.492	410	0.501	0.009
3	944	97.863	0.496	422	0.482	0.014
4	967	101.625	0.499	399	0.505	0.006
5	960	100.677	0.507	406	0.498	0.009
6	964	91.369	0.498	402	0.477	0.022
7	967	120.191	0.536	399	0.549	0.013
8	957	97.754	0.495	409	0.489	0.006
9	971	99.377	0.500	395	0.502	0.001
10	964	98.146	0.504	402	0.494	0.010
Mean		100.903	0.504		0.498	0.012
SD		7.061	0.012		0.019	0.007

Note: N: sample size; SSE: sum of squares of errors; RMSE: root mean square of errors; SD: standard deviation.

Undertaking behavioural intention as a dependent variable, values for the training and testing measures are correspondingly minimal, coming up at 0.012 and 0.007. These data may be found in

Table 7. The RMSE training and testing differences are 0.005, lower than the thumb rule of fit indices. This indicates that the difference is positive (Gupta et al., 2024).

Figure 5. ANN analysis



### 4.3. Sensitivity analysis

We utilised sensitivity analysis to determine the input neurons’ prediction power about behavioural intention (Karaca et al., 2019). Based on the results, it can be shown that the compatibility is the most important predictor, followed by the openness to change, which has a normalized value of 53.12%. We have risk barriers at 27.06%, relative advantages at 23.87%, and usage barriers at 24.06%. As seen in Table 8, the values of all the latent variables associated with the average and normalized importance are present. The normalized importance is calculated by dividing the relative value of an input neuron by the relative importance of the neuron in the ANN model with the highest relative importance. The result is then reported as a percentage.

Table 8. Sensitivity analysis

NN ANN case	Dependent: BEI				
	COMP	OC	RBR	REA	UBR
1	0.370	0.261	0.125	0.098	0.145
2	0.451	0.194	0.114	0.084	0.158
3	0.404	0.199	0.118	0.141	0.138
4	0.410	0.268	0.148	0.098	0.077
5	0.461	0.244	0.163	0.098	0.033
6	0.452	0.204	0.084	0.120	0.140
7	0.441	0.225	0.098	0.180	0.055
8	0.506	0.271	0.129	0.069	0.025
9	0.431	0.242	0.094	0.096	0.136
10	0.457	0.221	0.113	0.061	0.148
Average importance	0.438	0.233	0.119	0.105	0.105
Normalized importance	100.00%	53.12%	27.06%	23.87%	24.06%

## 5. DISCUSSION

This study offers a complete examination of the factors driving and limiting the adoption of RAs among consumers in Saudi Arabia. Using BRT as a conceptual framework, we investigated both ‘reasons for’ and ‘reasons against’ adoption, thereby exposing the distinct influences that each of these

factors has on the attitude and behavioural intention of consumers; our findings are consistent with the results of Hong et al. (2023). Our findings, derived from a comprehensive analysis that included CFA, SEM, and ANN, established that several elements, including compatibility, openness to change, and relative advantages, play a significant role in forming positive intentions that align with the findings of Piehlmaier (2022). In contrast, the usage barriers appeared as the most significant barrier, highlighting a considerable obstacle that must be overcome to achieve the widespread acceptance of RAs in Saudi Arabia.

According to our research findings, openness to change and compatibility are crucial in forming a positive attitude about RAs. Based on these findings, emphasizing compatibility with the technologies already in place and encouraging openness to digital financial solutions could be beneficial strategies for increasing adoption (Brenner & Meyll, 2020). This highlights the significance of addressing both motives and deterrents from the perspective of marketing strategies for suppliers of financial services to achieve the highest possible level of acceptability among Saudi consumers. Compared to the previous research, which was carried out in the Western market context where the functional benefits are the most significant factors influencing adoption choices (Belanche et al., 2019; Hong et al., 2023), the Saudi environment reveals that compatibility is not limited to technological fit but is also determined by religious compatibility and regulatory trust. It means that the adoption of RAs in the socio-religious emerging markets is also characterized by a different logic of decision-making.

This research offers practical implications for the Saudi financial services sector by providing insights that can assist in adapting marketing efforts to facilitate broader acceptance of RAs. Additionally, this study provides a foundation and encourages additional research to be conducted across a wide range of demographics and geographical areas to investigate the wider relevance of our findings and evaluate the potential mediating role of demographic factors in adopting RA.

This research is the first of its type in Saudi Arabia to apply BRT to the adoption of RA, and it provides unique insights into the behavioural dynamics that influence the acceptance of digital financial services. Our findings suggest the necessity of targeted measures that remove usage obstacles and highlight interoperability with existing financial practices to increase the acceptance of RA in KSA. Financial service providers can increase adoption rates by incorporating marketing techniques that support and inhibit market conditions. This study contributes to expanding the existing body of information regarding implementing digital financial innovations in KSA. It provides practitioners and policymakers with insights that can be put into action to advance the use of RAs inside the Kingdom. The plans may be better aligned to overcome obstacles and capitalize on consumers' receptivity to technology improvements in the Saudi market if they acknowledge the significance of both pro-adoption and anti-adoption variables. This is because recognising the significance of both types of factors is necessary.

The research identified compatibility, openness to change, and relative advantages as essential elements influencing favourable views and behavioural intentions towards RAs. These findings corroborate prior research and affirm the significance of these aspects in affecting technology adoption. Compatibility greatly affects attitude, indicating consumers are more inclined to embrace RAs when they view these instruments as harmoniously integrating with their current financial activities. To foster trust and familiarity, financial service providers should illustrate how RAs enhance existing technology, such as online banking platforms. Openness to change significantly influences favourable perceptions of RAs, suggesting that consumers who are more receptive to digital financial solutions are more inclined to embrace these tools. Educational initiatives and focused marketing strategies highlighting the advantages of digital financial innovation can promote receptivity among reluctant consumers. Relative advantages play a crucial role in shaping behavioural intention by emphasizing the efficiency, time-saving attributes, and tailored recommendations RAs offer. Financial institutions should highlight these benefits in their marketing to enhance client interest and trust.

The study identified the usage barriers as the primary impediment to RA adoption, underscoring the necessity of addressing this obstacle to get general acceptance. This discovery corroborates a previous study by Hong et al. (2023) and emphasizes the significance of usability and accessibility. Consumers regard RAs as intricate or challenging to utilize, resulting in reluctance towards adoption. This may arise from insufficient technological expertise, apprehension regarding mistakes, or doubts about reliability. Streamlining user interfaces, providing customer support, and executing awareness campaigns help alleviate the usage barriers. Furthermore, offering demonstrations or trials enables users to acquire direct experience and foster confidence in RA performance.

The study's simultaneous emphasis on 'reasons for' and 'reasons against' adoption provides a balanced viewpoint, facilitating the formulation of comprehensive marketing strategies. Identifying and resolving both incentives and obstacles is essential

for improving RA uptake. The results are significant for financial service providers and authorities in the KSA. Organizations can customize their strategy to align with consumer requirements and preferences by utilizing findings from this study. Develop educational programs to improve digital literacy and illustrate the advantages of RAs. Formulate culturally pertinent campaigns that tackle the distinct issues of Saudi customers.

This research is the inaugural application of BRT to the adoption of RAs in KSA, hence offering a distinctive contribution to the literature on digital financial innovation. It enhances comprehension of behavioural motivators and obstacles in a swiftly evolving socio-economic landscape. Incorporating BRT provides a sophisticated framework for examining adoption behaviour, emphasizing the interaction between positive and negative factors. The findings offer practical insights into the Saudi market, serving as a basis for future studies and initiatives.

This study offers a balanced and actionable framework for financial service providers seeking to enhance RA adoption in KSA by examining the 'reasons for' and 'reasons against' adoption. It underscores the integration of marketing tactics that use motivators and mitigate hurdles, hence advancing the KSA's digital transformation objectives. This discourse situates the findings within the extensive literature and practical applications, delineating a distinct trajectory for actionable insights and subsequent research.

### 5.1. Theoretical contribution

By incorporating values and beliefs, causes, impediments, behavioural intention, and actual customer behaviour, it offers a comprehensive framework that facilitates the formation of a solid foundation for future study. In addition, research on the behaviour of individuals with RA has been limited to only a few cultural contexts, such as the USA, Taiwan, the Netherlands, Spain, the Nordic nations, India, and Malaysia. Alternatively, the framework that was utilized in the present investigation could be expanded upon. Furthermore, the fact that the usage barrier was identified as the key deterrent shows that RA providers must prioritise simplifying the user experience to better serve their customers. Additionally, training activities that promote digital confidence can assist in lowering perceived complexity and usage issues, particularly for customers who are less experienced with technology. Clear and user-friendly onboarding processes can also help lessen these worries. Additionally, this strategy has the potential to overcome resistance among subsets of the population that might otherwise be hesitant to use RAs.

This study makes a meaningful theoretical contribution by extending BRT to the context of RA adoption in Saudi Arabia, a socio-cultural and regulatory environment that has been largely underexplored in prior FinTech research. By empirically validating the role of key resistance-related factors and distinguishing between supported and non-supported relationships, the study refines the explanatory power of BRT beyond Western-centric settings. The findings demonstrate that resistance to innovation in Saudi Arabia is shaped not only by functional

considerations but also by cultural compatibility, regulatory trust, and contextual awareness, thereby enriching existing FinTech adoption theories with a context-sensitive perspective.

This study lays the framework for future research examining the RA in various cultural and demographic contexts. This research has the potential to further confirm and extend the applicability of BRT. Using a unified framework to analyse both facilitators and barriers, this study enables a more comprehensive understanding of adoption dynamics, thereby enriching the theoretical discourse on FinTech adoption within emerging markets and providing insights that can inform regional and cross-cultural studies on innovation acceptance.

## 5.2. Practical implications

Customers must first have a comprehensive understanding of the many facets of RAs before implementing them. It is possible to make a significant difference and reduce the knowledge gap by educating customers about their attitudes. Fund houses can launch RAs attitude campaigns for Saudi customers if they work with regulatory organizations and entities that make policy. On top of that, the lack of RAs awareness among customers directly results from imprecise limits and an uncertain description of the notion of RAs, both of which contribute to widespread misconceptions. Policymakers must specify the parameters, scope, and structure of the performance evaluation of RAs clearly and concisely.

Furthermore, the government ought to establish stringent legal sanctions for non-compliance and any wrongdoing that pertains to disclosure. Greenwashing practices will be considerably reduced because of these efforts, which will close the existing loopholes. It is also important to consider the potential privacy and security problems that are associated with the adoption of the RAs (risk barriers). When people get rid of their smart gadgets, such as their phones, tablets, and laptops, they are typically anxious about their personal information being stolen and misused. This is why this is of utmost importance.

From a practical standpoint, the results offer clear and actionable guidance for FinTech firms and policymakers. To enhance compatibility, RAs platforms should integrate Arabic-language interfaces, Shariah-compliant investment portfolios, and seamless connectivity with users' existing banking and digital payment ecosystems. To reduce the usage barriers, targeted educational initiatives — such as guided onboarding processes, interactive tutorials, and simplified explanations of RA algorithms, risks, and regulatory protections — are essential. Policymakers and regulators can further support adoption by promoting transparent guidelines, certification mechanisms, and public awareness campaigns that strengthen trust and reduce perceived uncertainty surrounding RA services in Saudi Arabia.

## REFERENCES

- Abraham, F., Schmukler, S. L., & Tessada, J. (2019, February). *Robo-advisors: Investing through machines*. World Bank Group. <https://surl.li/xprmst>
- Adam, A. A., & Shauki, E. R. (2014). Socially responsible investment in Malaysia: Behavioral framework in evaluating investors' decision making process. *Journal of Cleaner Production*, 80, 224–240. <https://doi.org/10.1016/j.jclepro.2014.05.075>

## 6. CONCLUSION

This paper explored the behavioural motivation and obstacles that determine the adoption of RA in Saudi Arabia in relation to the BRT. The results, based on 1,366 respondents and using CFA, PLS-SEM, and ANN methods, confirm that compatibility, openness to change, and relative advantages have significant positive effects on behavioural intention, whereas usage barriers have a small impact on attitude but no direct effect on behavioural intention, whereas RBR has a significant and negative impact on both attitude and behavioural intention. Openness to change proved to be the most predictive of attitude, and usage barriers were found to be the most significant barrier to adoption. The relationship between drivers and behavioural intention is greatly mediated by attitude. The research brings BRT to socio-cultural and religiously sensitive, emergent market situations, proving that functionality gains are not the only determinants of adoption, but compatibility with cultural and regulatory systems. In practice, the findings imply that financial institutions ought to improve user interfaces, digital literacy, require Sharia-compliance, and improve data security to encourage adoption. The research study is, however, restricted to the Saudi setting and cross-sectional data. Future studies can use longitudinal designs, actual usage behaviour, and cross-cultural comparisons in order to further support the BRT framework in various financial settings.

Although the authors tried to address the most crucial features and valuable opinions pertinent to the study, drawing attention to a few shortcomings is essential. The research was concerned with potential users of RAs in the KSA, and its application to this technology was restricted to a limited scope. In addition, there is a possibility that inherent restrictions are connected to the sample quantity and the method utilized for the sampling process. Since the authors did not consider demographic characteristics relevant to the study's objective, they did not incorporate any of them into their analysis.

Regarding the future, it might be beneficial to focus on early adopters to gain insight into their behaviour rather than their intentions to adopt RAs. Because of this, it would be possible to have a deeper comprehension of their behaviour. Further, research may be carried out in a cross-cultural environment to gain further insights into the differences in behaviour of individuals across cultures. Users' trust in technology is an important determinant of adoption, which could not be catered to in this study. Future research may investigate this regard.

The study's findings provide a foundation for further investigation into FinTech innovation in the Gulf area. Considering the minimal study conducted on RAs in developing countries such as KSA, it is especially crucial to note this.

- Ajzen, I., & Fishbein, M. (2000). Attitudes and the attitude-behavior relation: Reasoned and automatic processes. *European Review of Social Psychology*, 11(1), 1–33. <https://doi.org/10.1080/14792779943000116>
- Alashoor, T., Han, S., & Joseph, R. C. (2017). Familiarity with big data, privacy concerns, and self-disclosure accuracy in social networking websites: An APCO model. *Communications of the Association for Information Systems*, 41, 62–96. <https://doi.org/10.17705/1cais.04104>
- Albahri, A. S., Alnoor, A., Zaidan, A. A., Albahri, O. S., Hameed, H., Zaidan, B. B., Peh, S. S., Zain, A. B., Siraj, S. B., Masnan, A. H. B., & Yass, A. A. (2022). Hybrid artificial neural network and structural equation modelling techniques: A survey. *Complex & Intelligent Systems*, 8, 1781–1801. <https://doi.org/10.1007/s40747-021-00503-w>
- Aleemi, A. R., Javadi, F., & Hafeez, S. S. (2023). Finclusion: The nexus of FinTech and financial inclusion against banks' market power. *Heliyon*, 9(12), Article e22551. <https://doi.org/10.1016/j.heliyon.2023.e22551>
- Allevato, E., & Marques, J. (2011). Systemic thinking from a scientific and spiritual perspective. *Journal of Global Responsibility*, 2(1), 23–45. <https://doi.org/10.1108/20412561111128500>
- Alnemer, H. A. (2022). Determinants of digital banking adoption in the Kingdom of Saudi Arabia: A technology acceptance model approach. *Digital Business*, 2(2), Article 100037. <https://doi.org/10.1016/j.digbus.2022.100037>
- Amnas, M. B., Selvam, M., & Parayitam, S. (2024). FinTech and financial inclusion: Exploring the mediating role of digital financial literacy and the moderating influence of perceived regulatory support. *Journal of Risk and Financial Management*, 17(3, special issue), Article 108. <https://doi.org/10.3390/jrfm17030108>
- Ansari, Y., & Bansal, R. (2024). Robo-advisory financial services and the dynamics of new innovation in Saudi Arabia. *Journal of Open Innovation: Technology, Market, and Complexity*, 10(4), Article 100397. <https://doi.org/10.1016/j.joitmc.2024.100397>
- Ansari, Y., Bansal, R., Mishra, A. K., & Maurya, P. K. (2025). Analyzing the factors influencing the adoption of artificial intelligence-based robo-advisory for digital financial services. *International Journal of Environmental Sciences*, 11(4), 2293–2307. <https://theaspd.com/index.php/ijes/article/view/3799>
- Apostolakis, G., Kraanen, F., & van Dijk, G. (2016). Examining pension beneficiaries' willingness to pay for a socially responsible and impact investment portfolio: A case study in the Dutch healthcare sector. *Journal of Behavioral and Experimental Finance*, 11, 27–43. <https://doi.org/10.1016/j.jbef.2016.06.001>
- Astrachan, C. B., Patel, V. K., & Wanzenried, G. (2014). A comparative study of CB-SEM and PLS-SEM for theory development in family firm research. *Journal of Family Business Strategy*, 5(1), 116–128. <https://doi.org/10.1016/j.jfbs.2013.12.002>
- Babaei, G., Giudici, P., & Raffinetti, E. (2022). Explainable artificial intelligence for crypto asset allocation. *Finance Research Letters*, 47(Part B), Article 102941. <https://doi.org/10.1016/j.frl.2022.102941>
- Back, C., Morana, S., & Spann, M. (2023). When do robo-advisors make us better investors? The impact of social design elements on investor behavior. *Journal of Behavioral and Experimental Economics*, 103, Article 101984. <https://doi.org/10.1016/j.socec.2023.101984>
- Belanche, D., Casalo, L. V., & Flavián, C. (2019). Artificial Intelligence in FinTech: Understanding robo-advisors adoption among customers. *Industrial Management & Data Systems*, 119(7), 1411–1430. <https://doi.org/10.1108/IMDS-08-2018-0368>
- Bhuiyan, M. B. U., Huang, H. J., & de Villiers, C. (2021). Determinants of environmental investment: Evidence from Europe. *Journal of Cleaner Production*, 292, Article 125990. <https://doi.org/10.1016/j.jclepro.2021.125990>
- Brenner, L., & Meyll, T. (2020). Robo-advisors: A substitute for human financial advice? *Journal of Behavioral and Experimental Finance*, 25, Article 100275. <https://doi.org/10.1016/j.jbef.2020.100275>
- Brodmann, J., Wuthisatian, P., & Malladi, R. K. (2023). The liquidity, performance and investor preference of socially responsible investments. *Review of Behavioral Finance*, 15(2), 224–239. <https://doi.org/10.1108/RBF-09-2021-0191>
- Carranza, R., Diaz, E., Sánchez-Camacho, C., & Martín-Consuegra, D. (2021). E-banking adoption: An opportunity for customer value co-creation. *Frontiers in Psychology*, 11. <https://doi.org/10.3389/fpsyg.2020.621248>
- Chan, K. H., Chong, L. L., Ng, T. H., & Ong, W. L. (2022). A model of green investment decision making for societal well-being. *Heliyon*, 8(8), Article e10024. <https://doi.org/10.1016/j.heliyon.2022.e10024>
- Cheng, X., Guo, F., Chen, J., Li, K., Zhang, Y., & Gao, P. (2019). Exploring the trust influencing mechanism of robo-advisor service: A mixed method approach. *Sustainability*, 11(18, special issue), Article 4917. <https://doi.org/10.3390/su11184917>
- Choung, H., David, P., & Ross, A. (2023). Trust in AI and its role in the acceptance of AI technologies. *International Journal of Human-Computer Interaction*, 39(9), 1727–1739. <https://doi.org/10.1080/10447318.2022.2050543>
- Claudy, M. C., Garcia, R., & O'Driscoll, A. (2015). Consumer resistance to innovation — A behavioral reasoning perspective. *Journal of the Academy of Marketing Science*, 43, 528–544. <https://doi.org/10.1007/s11747-014-0399-0>
- Cunha, F. A. F. d. S., Meira, E., & Orsato, R. J. (2021). Sustainable finance and investment: Review and research agenda. *Business Strategy and the Environment*, 30(8), 3821–3838. <https://doi.org/10.1002/bse.2842>
- Dash, G., & Paul, J. (2021). CB-SEM vs PLS-SEM methods for research in social sciences and technology forecasting. *Technological Forecasting and Social Change*, 173, Article 121092. <https://doi.org/10.1016/j.techfore.2021.121092>
- De Amicis, L., Binenti, S., Maciel Cardoso, F., Gracia-Lázaro, C., Sánchez, Á., & Moreno, Y. (2020). Understanding drivers when investing for impact: An experimental study. *Humanities and Social Sciences Communications*, 6, Article 86. <https://doi.org/10.1057/s41599-020-0447-y>
- Dhir, A., Koshta, N., Goyal, R. K., Sakashita, M., & Almotairi, M. (2021). Behavioral reasoning theory (BRT) perspectives on e-waste recycling and management. *Journal of Cleaner Production*, 280(Part 1), Article 124269. <https://doi.org/10.1016/j.jclepro.2020.124269>
- dos Santos, A. A., & Ponchio, M. C. (2021). Functional, psychological and emotional barriers and the resistance to the use of digital banking services. *Innovation & Management Review*, 18(3), 331–348. <https://doi.org/10.1108/INMR-07-2020-0093>
- Elkhatibi, Y., Guelzim, H., & Benabdelouahed, R. (2024). Factors influencing the adoption of AI-powered chatbots in the Moroccan banking sector: An extended UTAUT model. *Journal of Logistics, Informatics and Service Science*, 11(7), 559–585. <https://doi.org/10.33168/JLISS.2024.0730>
- Eren, B. A. (2021). Determinants of customer satisfaction in chatbot use: Evidence from a banking application in Turkey. *International Journal of Bank Marketing*, 39(2), 294–311. <https://doi.org/10.1108/IJBM-02-2020-0056>

- Feng, H., Liu, Z., Wu, J., Iqbal, W., Ahmad, W., & Marie, M. (2022). Nexus between government spending and green economic performance: Role of green finance and structure effect. *Environmental Technology & Innovation*, 27, Article 102461. <https://doi.org/10.1016/j.eti.2022.102461>
- Fiordelisi, F., Galloppo, G., & Paimanova, V. (2022). Climate change shocks and socially responsible investments. *Business Ethics, the Environment & Responsibility*, 32(1), 40–56. <https://doi.org/10.1111/beer.12477>
- Fuentes-Moraleda, L., Díaz-Pérez, P., Orea-Giner, A., Muñoz-Mazón, A., & Villacé-Molinero, T. (2020). Interaction between hotel service robots and humans: A hotel-specific service robot acceptance model (sRAM). *Tourism Management Perspectives*, 36, Article 100751. <https://doi.org/10.1016/j.tmp.2020.100751>
- Garg, A., Goel, P., Sharma, A., & Rana, N. P. (2022). As you sow, so shall you reap: Assessing drivers of socially responsible investment attitude and intention. *Technological Forecasting and Social Change*, 184, Article 122030. <https://doi.org/10.1016/j.techfore.2022.122030>
- Gazzaz, H. (2025). Dynamics of robo-advisory financial services in Saudi Arabia. *Journal of Accounting and Finance in Emerging Economies*, 11(2), 209–230. <https://doi.org/10.26710/jafee.v11i2.3369>
- Gupta, S., Bansal, R., Bankoti, N., Kar, S. K., Mishra, S. K., Kaur, P., & Harichandan, S. (2024). Factors affecting consumers' intention to use electric vehicles: Mediating role of awareness and knowledge. *Journal of Advanced Transportation*. <https://doi.org/10.1155/2024/5922430>
- Gutsche, G., & Zwergel, B. (2020). Investment barriers and labeling schemes for socially responsible investments. *Schmalenbach Business Review*, 72, 111–157. <https://doi.org/10.1007/s41464-020-00085-z>
- Hafish, M. A., Masudin, I., Zulfikariyah, F., Nasyiah, T., & Restuputri, D. P. (2024). An integrated structural equation modeling and fuzzy qualitative comparative analysis model for examining green procurement adoption drivers. *Decision Analytics Journal*, 11, Article 100469. <https://doi.org/10.1016/j.dajour.2024.100469>
- Hair, J. F., Risher, J. J., Sarstedt, M., & Ringle, C. M. (2019). When to use and how to report the results of PLS-SEM. *European Business Review*, 31(1), 2–24. <https://doi.org/10.1108/EBR-11-2018-0203>
- Hassan, L. M., Shiu, E., & Shaw, D. (2016). Who says there is an intention-behaviour gap? Assessing the empirical evidence of an intention-behaviour gap in ethical consumption. *Journal of Business Ethics*, 136, 219–236. <https://doi.org/10.1007/s10551-014-2440-0>
- Henseler, J., Ringle, C. M., & Sarstedt, M. (2015). A new criterion for assessing discriminant validity in variance-based structural equation modeling. *Journal of the Academy of Marketing Science*, 43, 115–135. <https://doi.org/10.1007/s11747-014-0403-8>
- Hong, X., Pan, L., Gong, Y., & Chen, Q. (2023). Robo-advisors and investment intention: A perspective of value-based adoption. *Information & Management*, 60(6), Article 103832. <https://doi.org/10.1016/j.im.2023.103832>
- Hooda, J., Singh, V., Kazaure, M. A., & Singh, R. (2024). Shariah-compliant robo-advisors: Exploring the development and implementation of Islamic finance's automated investment solutions. In M. Irfan, S. Kadry, M. Sharif, & H. Khan (Eds.), *FinTech applications in Islamic finance: AI, machine learning, and blockchain techniques* (pp. 223–235). IGI Global Scientific Publishing. <https://doi.org/10.4018/979-8-3693-1038-0.ch015>
- Hu, Z., Ding, S., Li, S., Chen, L., & Yang, S. (2019). Adoption intention of FinTech services for bank users: An empirical examination with an extended technology acceptance model. *Symmetry*, 11(3, special issue), Article 340. <https://doi.org/10.3390/sym11030340>
- Isaia, E., & Oggero, N. (2022). The potential use of robo-advisors among the young generation: Evidence from Italy. *Finance Research Letters*, 48, Article 103046. <https://doi.org/10.1016/j.frl.2022.103046>
- Jonwall, R., Gupta, S., & Pahuja, S. (2023). Socially responsible investment behavior: A study of individual investors from India. *Review of Behavioral Finance*, 15(6), 865–888. <https://doi.org/10.1108/RBF-05-2021-0099>
- Jung, D., Glaser, F., & Köpplin, W. (2019). Robo-advisory: Opportunities and risks for the future of financial advisory. In V. Nissen (Ed.), *Advances in consulting research* (pp. 405–427). Springer. [https://doi.org/10.1007/978-3-319-95999-3\\_20](https://doi.org/10.1007/978-3-319-95999-3_20)
- Karaca, Y., Moonis, M., Zhang, Y.-D., & Gezgez, C. (2019). Mobile cloud computing based stroke healthcare system. *International Journal of Information Management*, 45, 250–261. <https://doi.org/10.1016/j.ijinfomgt.2018.09.012>
- Kaur, P., Dhir, A., Singh, N., Sahu, G., & Almotairi, M. (2020). An innovation resistance theory perspective on mobile payment solutions. *Journal of Retailing and Consumer Services*, 55, Article 102059. <https://doi.org/10.1016/j.jretconser.2020.102059>
- Khan, A. H., Shah, A., Ali, A., Shahid, R., Zahid, Z. U., Sharif, M. U., Jan, T., & Zafar, M. H. (2023). A performance comparison of machine learning models for stock market prediction with novel investment strategy. *PLoS ONE*, 18(9), Article e0286362. <https://doi.org/10.1371/journal.pone.0286362>
- Khan, M. S., Rabbani, M. R., Hawaldar, I. T., & Bashar, A. (2022). Determinants of behavioral intentions to use Islamic financial technology: An empirical assessment. *Risks*, 10(6), Article 114. <https://doi.org/10.3390/risks10060114>
- Kock, N. (2015). Common method bias in PLS-SEM: A full collinearity assessment approach. *International Journal of e-Collaboration*, 11(4), 1–10. <https://doi.org/10.4018/ijec.2015100101>
- Kumar, S., Sahoo, S., Lim, W. M., & Dana, L.-P. (2022). Religion as a social shaping force in entrepreneurship and business: Insights from a technology-empowered systematic literature review. *Technological Forecasting and Social Change*, 175, Article 121393. <https://doi.org/10.1016/j.techfore.2021.121393>
- Lau, A. J., Tan, G. W.-H., Loh, X.-M., Leong, L.-Y., Lee, V.-H., & Ooi, K.-B. (2021). On the way: Hailing a taxi with a smartphone? A hybrid SEM-neural network approach. *Machine Learning with Applications*, 4, Article 100034. <https://doi.org/10.1016/j.mlwa.2021.100034>
- Lee, G., & Kim, Y. (2022). Effects of resistance barriers to service robots on alternative attractiveness and intention to use. *SAGE Open*, 12(2). <https://doi.org/10.1177/21582440221099293>
- Lee, J.-C., & Chen, X. (2022). Exploring users' adoption intentions in the evolution of artificial intelligence mobile banking applications: The intelligent and anthropomorphic perspectives. *International Journal of Bank Marketing*, 40(4), 631–658. <https://doi.org/10.1108/IJBM-08-2021-0394>
- Leong, L.-Y., Hew, T.-S., Ooi, K.-B., Lee, V.-H., & Hew, J.-J. (2019). A hybrid SEM-neural network analysis of social media addiction. *Expert Systems with Applications*, 133, 296–316. <https://doi.org/10.1016/j.eswa.2019.05.024>
- Leow, E. K. W., Nguyen, B. P., & Chua, M. C. H. (2021). Robo-advisor using genetic algorithm and BERT sentiments from tweets for hybrid portfolio optimisation. *Expert Systems with Applications*, 179, Article 115060. <https://doi.org/10.1016/j.eswa.2021.115060>
- Liébana-Cabanillas, F., Marinković, V., & Kalinić, Z. (2017). A SEM-neural network approach for predicting antecedents of m-commerce acceptance. *International Journal of Information Management*, 37(2), 14–24. <https://doi.org/10.1016/j.ijinfomgt.2016.10.008>

- Liu, J., & Peifer, J. L. (2022). A moral foundations framing approach: Retail investors' investment intention in ethical mutual funds. *Business & Society*, 61(7), 1804-1837. <https://doi.org/10.1177/00076503211062186>
- Magnuson, W. J. (2020). Artificial financial intelligence. *Harvard Business Law Review*, 10(2), 337-382. <https://doi.org/10.2139/ssrn.3403712>
- Manshad, M. S., & Brannon, D. (2021). Haptic-payment: Exploring vibration feedback as a means of reducing overspending in mobile payment. *Journal of Business Research*, 122, 88-96. <https://doi.org/10.1016/j.jbusres.2020.08.049>
- Mehta, P. (2021). Teachers' readiness to adopt online teaching amid COVID-19 lockdown and perceived stress: Pain or panacea? *Corporate Governance*, 21(6), 1229-1249. <https://doi.org/10.1108/CG-09-2020-0385>
- Mehta, P., Singh, M., Mittal, M., & Singla, H. (2022). Is knowledge alone enough for socially responsible investing? A moderation of religiosity and serial mediation analysis. *Qualitative Research in Financial Markets*, 14(3), 413-432. <https://doi.org/10.1108/QRFM-11-2020-0218>
- Meunier, L., & Ohadi, S. (2022). Misconceptions about socially responsible investments. *Journal of Cleaner Production*, 373, Article 133868. <https://doi.org/10.1016/j.jclepro.2022.133868>
- Mhlanga, D. (2020). Industry 4.0 in finance: The impact of artificial intelligence (AI) on digital financial inclusion. *International Journal of Financial Studies*, 8(3, special issue), Article 45. <https://doi.org/10.3390/ijfs8030045>
- Mishra, A. K., Bansal, R., & Maurya, P. K. (2023). Investing for a better tomorrow: Values-driven antecedents of investment in socially responsible equity funds by Indian retail investors. *Journal of Cleaner Production*, 420, Article 138441. <https://doi.org/10.1016/j.jclepro.2023.138441>
- Mishra, A. K., Bansal, R., Maurya, P. K., Kar, S. K., & Bakshi, P. K. (2023). Predicting the antecedents of consumers' intention toward purchase of mutual funds: A hybrid PLS-SEM-neural network approach. *International Journal of Consumer Studies*, 47(2), 563-587. <https://doi.org/10.1111/ijcs.12850>
- Moran, M., & Ward-Christie, L. (2022). Blended social impact investment transactions: Why are they so complex? *Journal of Business Ethics*, 179, 1011-1031. <https://doi.org/10.1007/s10551-022-05153-7>
- Nourallah, M., Öhman, P., Walther, T., & Nguyen, D. K. (2025). *Financial robo-advisors: A comprehensive review and future directions*. <https://doi.org/10.2139/ssrn.5215748>
- Oehler, A., Horn, M., & Wendt, S. (2022). Investor characteristics and their impact on the decision to use a robo-advisor. *Journal of Financial Services Research*, 62, 91-125. <https://doi.org/10.1007/s10693-021-00367-8>
- Ong, A. K. S., Kurata, Y. B., Castro, S. A. D. G., De Leon, J. P. B., Dela Rosa, H. V., & Tomines, A. P. J. (2022). Factors influencing the acceptance of telemedicine in the Philippines. *Technology in Society*, 70, Article 102040. <https://doi.org/10.1016/j.techsoc.2022.102040>
- Palacios-González, M. M., & Chamorro-Mera, A. (2020). Analysis of the intention to invest in a socially responsible manner: A segmentation of the Spanish investor. *Spanish Journal of Finance and Accounting*, 49(2), 127-142. <https://doi.org/10.1080/02102412.2019.1598700>
- Patel, K. J., & Patel, H. J. (2018). Adoption of internet banking services in Gujarat: An extension of TAM with perceived security and social influence. *International Journal of Bank Marketing*, 36(1), 147-169. <https://doi.org/10.1108/IJBM-08-2016-0104>
- Piehlmaier, D. M. (2022). Overconfidence and the adoption of robo-advice: Why overconfident investors drive the expansion of automated financial advice. *Financial Innovation*, 8, Article 14. <https://doi.org/10.1186/s40854-021-00324-3>
- Puhle, M. (2019). The performance and asset allocation of German robo-advisors. *Society and Economy*, 41(3), 331-351. <https://doi.org/10.1556/204.2019.41.3.4>
- Raut, R. K., Kumar, R., & Das, N. (2020). Individual investors' intention towards SRI in India: An implementation of the theory of reasoned action. *Social Responsibility Journal*, 17(7), 877-896. <https://doi.org/10.1108/SRJ-02-2018-0052>
- Rayburn, S. W., McGeorge, A., Anderson, S., & Sierra, J. J. (2022). Crisis-induced behavior: From fear and frugality to the familiar. *International Journal of Consumer Studies*, 46(2), 524-539. <https://doi.org/10.1111/ijcs.12698>
- Rjoub, H., Adebayo, T. S., & Kirikkaleli, D. (2023). Blockchain technology-based FinTech banking sector involvement using adaptive neuro-fuzzy-based K-nearest neighbors algorithm. *Financial Innovation*, 9, Article 65. <https://doi.org/10.1186/s40854-023-00469-3>
- Roos, J. M., Jansson, M., & Gärling, T. (2024). A three-level analysis of values related to socially responsible retirement investments. *Journal of Sustainable Finance & Investment*, 14(2), 327-343. <https://doi.org/10.1080/20430795.2022.2077291>
- Sarstedt, M., Ringle, C. M., & Hair, J. F. (2022). Partial least squares structural equation modeling. In C. Homburg, M. Klarmann, & A. Vomberg (Eds.), *Handbook of market research* (pp. 587-632). Springer. [https://doi.org/10.1007/978-3-319-57413-4\\_15](https://doi.org/10.1007/978-3-319-57413-4_15)
- Seiler, V., & Fanenbruck, K. M. (2021). Acceptance of digital investment solutions: The case of robo advisory in Germany. *Research in International Business and Finance*, 58, Article 101490. <https://doi.org/10.1016/j.ribaf.2021.101490>
- Semeraro, F., Griffiths, A., & Cangelosi, A. (2023). Human-robot collaboration and machine learning: A systematic review of recent research. *Robotics and Computer-Integrated Manufacturing*, 79, Article 102432. <https://doi.org/10.1016/j.rcim.2022.102432>
- Shaikh, A. A., Glavee-Geo, R., Karjaluoto, H., & Hinson, R. E. (2023). Mobile money as a driver of digital financial inclusion. *Technological Forecasting and Social Change*, 186(Part B), Article 122158. <https://doi.org/10.1016/j.techfore.2022.122158>
- Sharma, R., Mehta, K., & Vyas, V. (2020). Responsible investing: A study on non-economic goals and investors' characteristics. *Applied Finance Letters*, 9(1, special issue), 63-78. <https://doi.org/10.24135/afl.v9i2.245>
- Sharma, S. K., & Sharma, M. (2019). Examining the role of trust and quality dimensions in the actual usage of mobile banking services: An empirical investigation. *International Journal of Information Management*, 44, 65-75. <https://doi.org/10.1016/j.ijinfomgt.2018.09.013>
- Sharma, S. K., Govindaluri, S. M., Al-Muharrami, S., & Tarhini, A. (2017). A multi-analytical model for mobile banking adoption: A developing country perspective. *Review of International Business and Strategy*, 27(1), 133-148. <https://doi.org/10.1108/RIBS-11-2016-0074>
- Shmueli, G., Sarstedt, M., Hair, J. F., Cheah, J.-H., Ting, H., Vaithilingam, S., & Ringle, C. M. (2019). Predictive model assessment in PLS-SEM: Guidelines for using PLSpredict. *European Journal of Marketing*, 53(11), 2322-2347. <https://doi.org/10.1108/EJM-02-2019-0189>

- Singh, R. K., & Gurtu, A. (2022). Embracing advanced manufacturing technologies for performance improvement: An empirical study. *Benchmarking: An International Journal*, 29(6), 1979–1998. <https://doi.org/10.1108/BIJ-02-2021-0110>
- Singh, S., & Kumar, A. (2024). Investing in the future: An integrated model for analysing user attitudes towards robo-advisory services with AI integration. *Vilakshan — XIMB Journal of Management*, 22(1), 158–175. <https://doi.org/10.1108/XJM-03-2024-0046>
- Talwar, M., Talwar, S., Kaur, P., Tripathy, N., & Dhir, A. (2021). Has financial attitude impacted the trading activity of retail investors during the COVID-19 pandemic? *Journal of Retailing and Consumer Services*, 58, Article 102341. <https://doi.org/10.1016/j.jretconser.2020.102341>
- Talwar, S., Jabeen, F., Tandon, A., Sakashita, M., & Dhir, A. (2021). What drives willingness to purchase and stated buying behavior toward organic food? A stimulus-organism-behavior-consequence (SOBC) perspective. *Journal of Cleaner Production*, 293, Article 125882. <https://doi.org/10.1016/j.jclepro.2021.125882>
- Taneja, A., & Arora, A. (2019). Modeling user preferences using neural networks and tensor factorization model. *International Journal of Information Management*, 45, 132–148. <https://doi.org/10.1016/j.ijinfomgt.2018.10.010>
- Teck Soon, H., & Syed A. Kadir, S. L. (2017). The drivers for cloud-based virtual learning environment: Examining the moderating effect of school category. *Internet Research*, 27(4), 942–973. <https://doi.org/10.1108/IntR-08-2016-0256>
- Wagner, F. (2024). Determinants of conventional and digital investment advisory decisions: A systematic literature review. *Financial Innovation*, 10, Article 18. <https://doi.org/10.1186/s40854-023-00538-7>
- Yan, S., Almandoz, J., & Ferraro, F. (2021). The impact of logic (in)compatibility: Green investing, state policy, and corporate environmental performance. *Administrative Science Quarterly*, 66(4), 903–944. <https://doi.org/10.1177/00018392211005756>
- Yee, C. H., Al-Mulali, U., & Ling, G. M. (2022). Intention towards renewable energy investments in Malaysia: Extending theory of planned behaviour. *Environmental Science and Pollution Research*, 29, 1021–1036. <https://doi.org/10.1007/s11356-021-15737-x>
- Yeh, H.-C., Yu, M.-C., Liu, C.-H., & Huang, C.-I. (2023). Robo-advisor based on unified theory of acceptance and use of technology. *Asia Pacific Journal of Marketing and Logistics*, 35(4), 962–979. <https://doi.org/10.1108/APJML-07-2021-0493>
- Zhang, W. (2024). AI fairness in practice: Paradigm, challenges, and prospects. *AI Magazine*, 45(3), 386–395. <https://doi.org/10.1002/aaai.12189>