PREDICTION OF USER BEHAVIOR INTENTION TOWARDS ROBO-ADVISOR APPLICATIONS IN FINTECH USING THE UTAUT MODEL

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by

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LIST OF ABBREVIATIONS

AVE	Average Variance Extracted
CR	Composite reliability
DL	Digital Literacy
EE	Effort Expectancy
FC	Facilitating Condition
FL	Financial Literacy
HTMT	Heterotrait-monotrait
IL	Information Literacy
INT	Intention to use
PEoU	Perception Ease of Use
PE	Performance Expectancy
PLS-SEM	Partial Least Square Structural Equation Modelling
PU	Perceived Usefulness
PT	Perceived Trust
SI	Social Influence
SPSS	Statistical Package for Social Sciences
RA	Robo-advisor
TAM	Technology Acceptance Model
UTAUT	Unified Theory of Acceptance and Use of Technology

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RAMALAN NIAT TINGKAH LAKU PENGGUNA TERHADAP APLIKASI PENASIHAT-ROBO DALAM FINTECH MENGGUNAKAN MODEL UTAUT

ABSTRAK

Kemajuan perkhidmatan automatik telah meningkat secara mendadak sejak wabak COVID-19 melanda negara. Pada masa yang sama, ketidakstabilan pasaran kewangan dan inflasi telah mempengaruhi kumpulan bakal pelabur dan kumpulan pelabur sedia ada untuk mempertimbangkan semula pilihan pelaburan dan perancangan kewangan mereka. Walaupun terdapat peningkatan pelabur di pasaran, tetapi bilangan pelabur yang menggunakan perkhidmatan nasihat robot sebagai pilihan pelaburan masih dianggap rendah. Matlamat kajian ini adalah untuk mengkaji faktor-faktor penting yang mempengaruhi niat tingkah laku pelanggan dari perspektif penggunaan perkhidmatan nasihat robot pelaburan kewangan dalam masa COVID-19. Kajian ini menggunakan pendekatan kuantitatif dan penyelidikan berdasarkan penerimaan teknologi model termasuk 11 pembolehubah seperti independen, bergantung, perantara berdasarkan model Unified Theory of Acceptance and Use of Technology (UTAUT). Kaji selidik telah diedarkan kepada peserta atas talian yang mempunyai pengalaman dalam perbankan untuk mengesahkan model yang dicadangkan. Keputusan kajian mendapati Jangkaan Prestasi, Pengaruh Sosial, Keadaan Memudahkan, Literasi Digital, Literasi Maklumat, dan Literasi Kewangan didapati mempunyai kesan signifikan terus terhadap niat untuk menggunakan perkhidmatan nasihat robo. Penemuan ini memberikan implikasi empirikal yang berharga kepada institusi pelaburan kewangan atau bank-bank untuk mengambil langkah-langkah pengenalan dan cadangan pelaburan yang sesuai kepada orang awam dalam mengejar perkhidmatan nasihat pelaburan robo.

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ABSTRACT

In response to the COVID-19 pandemic, the advancement of automated services in the financial technology (fintech) sector had undeniably sped up tremendously. At the same time, the instability of the financial market and inflation had influenced specific groups of potential and existing investors to reconsider investment choices and re-manage their financial planning. Even though, there is increase of investors across the market however the number of investor using robo-advisory service as their investment option is still considered low. The goal of the study was to examine the significant factors to influence customer's behavioral intention from the perspective of using financial investment Robo-advisor (RA) in post-COVID-19 pandemic. The study applied quantitative approach and developed a research model based on technological acceptance model which further incorporated 11 variables including independent, dependent, mediator based on Unified Theory of Acceptance and Use of Technology (UTAUT) model. A survey was distributed to online participants who have experience in online banking to validate the proposed model. The result found Performance Expectancy, Social Influence, Facilitating Condition, Digital Literacy, Information Literacy and Financial Literacy were found to have direct significant effect on intention to use robo-advisory service. The findings provided valuable empirical implication or financial investment institutions or banks for taking suitable investment introductions and recommendations to the public in pursuing investment robo advisory service.

CHAPTER 1

INTRODUCTION

1.1 Background

In the recent years of digitalization, we witness there is a vast difference in the way of operating in many service industries for example in the hospitality industry, transportation, and more industries (Tan, 2020). The outbreak of Covid-19 has further sped up the digitalization in many segments of the economy, including the finance sector. Up to July 2022, global financial markets are extremely volatile with Covid-19, cryptocurrency meltdown, political wars, and fluctuations in the international business environment (Royal, 2022). It is extremely hard for individuals to monitor the investment markets without spending hours of analysis to keep up with the investment trend or to compensate for the insufficiency of financial knowledge. To add salt to the wound, inflation is reflecting aggressive globally, becoming one of possible reasons for inexperienced investors reluctant to even start their investment plan. More than half of the nation, 58% of the Malaysia population emphasized in saving as much as they planned to prepare in case any rainy days (Schroders Global Investor Study 2021, 2021). Banking and financial investment services have no exception but also experiencing the change of working from human-agent advisors into half-human and half-algorithm advisors or even full automated advisors. With the fast-paced technology evolution, the financial investment service has evolved into a fully automated advisor which works using an algorithm-based process without any human intervention. The rapid progress of financial technology, short form is Fintech development has supported client groups to access investment products with ease, gaining increasing popularity from different generations and demographic

backgrounds according to Deloitte's published paper ("The Expansion of Robo-Advisory in Wealth Management", 2016). Based on a CNA article reported by Tang, S. K. (2021) people have grown to accept the possibility of managing their wealth online compared to the traditional approach. However, most of the time stopping investors, especially first-timers, is the thought of losing their hard-earned money, especially after the experience of Covid-19 where the job market has been hit hard in most sectors. A new advent of investment robo-advisor (RA) has alleviated and reduced the friction of people in investment. Furthermore, the convenience of access, low investment capital, and lower commission fees have encouraged a large number of new investors to try out this new investing choice. The current online investment robo advisory platforms that have been introduced in Malaysia are StashAway, MyTheo, Raiz Invest, Wahed Invest, BEST Invest, KDI Invest and Akru. Lim found that Wahed Invest, BEST Invest and Raiz Invest are the preferred choices for Muslim investors as these companies are Shariah-compliant, where they commit to only Halal investment funds in accordance with Islamic principles (Lim, 2022).

1.2 Problem Statement

Before the introduction of financial robo-advisors, people tend to go to financial institutions to consult professional financial advisors for investment advices. Most of the times, these financial advice and support from professionals comes with a hefty price tag to begin the investment journey. This has scared most of the public away and resulting to less risky options like saving up most of the cash flow or saving in a fixed deposit especially after the hit from pandemic. The situation aggravates further as we experienced record-high inflation globally with rising living costs for example the rising food and utility prices have contributed to

the uptrend in inflation, further worsen the situation even with government subsidised in fuel and price controls (Buddhavarapu, R., 2022). According to The 3rd round of the World Bank's High-Frequency (HiFy) Phone Survey, estimate 70% of lower-income households in Malaysia self-assessed themselves as having difficulty in their financial to sustain their monthly living expenses. Over 60% of these households reported having no emergency savings at all (Sanghi et al., 2023). Robo-advisors may be an ideal financial investment tool for wealth planning because the starting investment fund and annual fee are more affordable compared to human advisor. Given with the existing literature on robo-advisors primarily focuses on developed markets left a significant gap in understanding of investment robo-advisors in emerging markets, this study aimed to contribute findings on antecedents of accepting investment robo-advisors. These studies are mostly conducted before Covid-19 pandemic. The acceptance factors of a new technology may differ judging by the global economy instability caused by inflation, war, cryptocurrency downturn, and pandemic.

The introduction of financial robo-advisors in Malaysia is relatively short, where the first robo advisor was launched in 2018. It requires a lot of confidence from the investors to accept this new automated investment service. For example, an beginner to begin with investment journey via robo-advisory platform, it requires a degree of perceived trust (T) to accept the tool, whether it is towards the trust in fin-tech, trust in service provider, trust from interaction in platform or trust from surrounding peers accepting the robo-advisors. In the paper of Gefen et al. (2003), with increasing user's trust and confidence through his or her interaction in the e-commerce world if they had less friction in using the services. In findings of Gan et al., trust as direct effect towards intention to adopt the financial RA (Gan,

2021). Unfortunately, T is rarely investigated act as mediator in influencing the intention to employ the usage of financial robo advisors. In this study, T was added in the framework to examine the indirect influence towards the PE, EE, SI on user's acceptance in robo advisors.

Investment robo-advisory service is an automated service that utilizing mathematical algorithms to analyse the financial market by using big data analysis technology. This is interesting, as the degree of literacy in financial, information, and digital knowledge area are needed for investors to first assess to this new automated investment option. Nikou found that both information literacy and digital literacy directly affected on perceived ease of use of new technology (Nikou et al., 2022). Similarly, Olumide discovered that resistance to information systems is one of the key reasons why people fail to accept and adopt new technologies and achieve information literacy (Durodolu, 2016). In the findings of Asian Development Bank (Yoshino et al., 2020), the team has found a positive relationship between financial literacy and fintech adoption. In fact, financial literacy affects intensity one using fintech product like electronic money and mobile payment apps holding crypto assets. Nonetheless, the existing studies has excluded relevant variables such as financial literacy, digital literacy, and prior knowledge in investment from the analysis. Hence, financial literacy (FL), digital literacy (DL), and information literacy (IL) are considered into this study to validate the relationship of these literacies towards the investor's intention to use RA for their investment plan.

The main model of this study is Unified Theory of Acceptance and Use of Technology (UTAUT) model. Since none of the variables in UTAUT model could represent the literacies and perceived trust from the discussion above, therefore,

FL, DL, IL and T are incorporated into this study in examining the intention to use RA that were found to be relevant to previous studies. The moderating factors (age, gender, experience, voluntary to use) are removed from UTAUT because this study's goal is to examine the direct variables and to align with the study (Gan et al., 2020).

This study has been initiated by:

A. Understanding effective factors that will influence new investor to use robo-advisor on financial platforms after post-Covid-19 pandemic and inflation in Malaysia.

B. Understanding the role of trust as a mediator affecting other UTAUT factors while using financial robo advisors.

C. Understanding individual literacies (financial, digital, information) influencing behavioral intention towards using investment RA among public.

1.3 Research Questions & Objectives

Three specific questions and objectives have been set in this study to carry out this research properly:

A. What are the effective factors related to behavioral intention towards using RA after the pandemic in Malaysia?

B. How UTAUT can be extended to find the effect of trust on PE, EE, SI, and intention to use RA in Malaysia?

C. How UTAUT can be extended to find the effect of literacy level on intention to use RA in Malaysia?

The objectives are-

A. To propose theoretical framework for finding the effective factors of behavioral intention of robo advisor

B. To find the mediating effect of trust between PE, EE, SI, and intention to use robo advisors in Malaysia

C. To find the relationship between literacy and intention to use robo advisors in Malaysia

1.4 Significance of Research

The motivation of this research is influenced by the rise of digitalization in Fintech using robo advisor in Asia especially after the people is experiencing economy downturn and inflation, reported in sources like ChannelNewAsia (CNA), Statista Market Forecast, and Deloitte (2019). The significance of this study is to investigate factors affecting public's acceptance intention towards financial robo advisor after experiencing Covid-19 pandemic. With this finding, this study aims to improve the financial investment service, especially related to automatic investment technology, provides better portfolio to new consumers hopefully helping in normalizing the usage of robo advisor in wealth management services. With the additional literacy variables and trust added in the model, it will provide insight for financial advisory firms to attract new investors based on their digital knowledge, the ability of critical thinking and understanding of financial markets. In addition, this study will support financial advisory firms in strategizing their marketing plan to better target new investors with influencing them to accept the usage of robo-advisory services. It will provide contribution to academia and by closing the gaps in the current literature with the new proposed framework and extracting the factors that impact of the acceptance of investment robo-advisor. Moreover, the study will bring advantages to investment advisory industry

especially traditional financial investment firms to re-evaluate their current gameplan in order to remain sustainable and survive in this rapid changes of investment world.

1.5 Scope of Research

The study has conducted on the online platform, targeting with at least the size of 166 responses from the all-age groups. All age groups are considered, as long as the respondents are new in using investment robo advisors, have interest in fintech area for their investment and additionally have the plan to invest. These participants should have the experience in banking as online transaction are required in using robo advisory platforms. A certain degree of digital literacy like the use of computer is expected since the survey and the use of robo-advisor will be performed online. Finally, based on systematic review of literature, a quantitative method is expected to predict and classify the user behavioral intention towards using robo advisor among new user groups online.

1.6 Overview of the Thesis

The thesis provides a UTAUT as a theoretical background and explores the user behaviour towards the financial robo-advisors. The study is further structured in different chapters as follows. Chapter 2 explains the background and theories of this study; Chapter 3 explains the hypothesis development of this study with variables used in this research are defined and related studies are reviewed. Thereafter, research design and methodology are defined in Chapter 4. The results and main research findings are discussed in Chapter 5, followed by the theoretical and practical implications of the study along with the limitations and future research directions in Chapter 6.

CHAPTER 2

BACKGROUND AND LITERATURE REVIEW

2.1 Introduction

This chapter shows the main elements that will be investigated in the research. The fundamental constructs in this paper are the variables that may cause intention to use RA. In addition, two theories have been investigated to be adapted in this study's framework. The related works of the research will be presented based on the literature review.

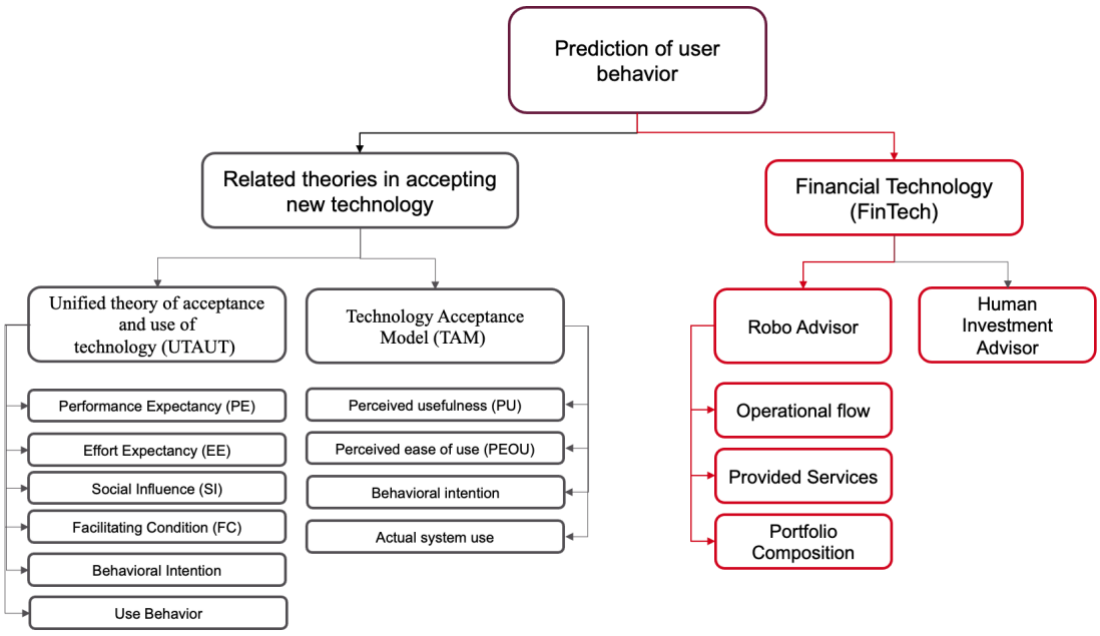

Figure 2.1.1 -Overall view of the related work

2.2 Financial Technology (Fin-Tech)

Fin-tech or Fintech, the abbreviation for financial technology, refers to any technological innovation that related to financial services. Fintech is a financial sector disruption that aims to make access to financial service providers easier and to deliver services more effectively and efficiently. It may cover a broad range of financial services delivered. According to Ernst and Yong (EY)'s research (EY Global FinTech Adoption Index, 2019), there are 5 main categories, that are money

transfer and payments, budgeting and financial planning, savings and investments, borrowing and insurance. Financial services that have successfully change public's lifestyle are money transfer, digital wallet, e-payment. In an insight that published by EY Global, FinTech tool use among consumers and small enterprises in the region has soared over the past two years, especially in China, India, and the financial hubs (EY Global, 2019). The same rising trend in the fintech usage in Malaysia is also observed in the research ISEAS-Yusof Ishak Institute (Alam, 2021). Since the past year, more than 75% of enterprises and businesses in Malaysia have started using at least one FinTech-related good or service. Malaysia's fintech industry has been expanding by 27% in 2021, accumulated to 294 fintech companies and in the Malaysia's market segmentation, payment sector has dominated the fintech industry, with 60 companies while wealthtech sector has also increased to 25 companies in the year 2022 (Fintech News Malaysia, 2022). The Securities Commission (SC) has permitted alternative financing platforms such as Equity Crowdfunding (ECF) and Peer-to-Peer (P2P) platforms to operationalize secondary trading starting from 2020 and allows the funding limit on ECF platforms to be raised to RM10 million. This initiative further boosting the development of FinTech in the nation, particularly among small and medium enterprises (SME) (Alam, 2021).

With the rise of robo-advisory in Fintech, this investment option has challenged a lot of conventional advisory services. The low admin cost and conveniency provided by this new automated fintech investment solution have attract a group of investors that prefer to be hand-off in their investment, but the robo-advisory solution still unlikely to become the target of solution to the High Net Worth Individual (HNWI). Wealth management companies must keep

investing in customer education to raise awareness of and familiarity with robo-advisory platforms in order to promote the adoption of these platform services (Deloitte, 2019). The current trend in fin-tech industry is more customer-oriented, fulfilling the customers' financial needs and demands by introducing innovative technology.

2.3 Robo advisory

The term 'robo-advisory' is composed of two different terms, robo and advisor. "Robo" stands for robotics, and "Advisor" means consulting stands for the advice given by the investment managers. The combination of both words means a fully automated investment process which the advice is no longer coming from human being or in this context, wealth managers but from robot, utilizing mathematical algorithms or artificial intelligence (Jung et al., 2018; Bruckes et al., 2019) studies. Intervention from expensive service provided by wealth managers or human advisors becomes minimal and even zero. Given disintermediation, typical robo advisers have low management fees—usually less than 1% annually. Clients may have to pay between 0.5% and 2.5% annually for unit trust funds, though. Some unit trust funds also charge up to 5% upfront in sales charge, and another 5% when clients redeem their investment value. As a result, robo advisor is more affordable to clients who has less asset in investment.

The current robo advisor in the market has evolved into four generations to come to completely no human intervention. The details can be found in Deloitte (2016). The first generation of robo advisor is based on a set of online questionnaires to capture client's risk profiles (Coombs & Redman, 2018), that operated by firms via web-service or smartphone application to filter suitable product or portfolio proposal by client themselves. In second generation robo

advisor, on top of the services offers by previous generation, investment managers started allocated asset manually on behalf of clients by overseeing the investment algorithm and define the rule. When robo-advisory evolved into third and fourth generations, financial investment decisions based on quantitative methods and algorithms to monitor, construct, and rebalance the portfolios. The only differences between third and fourth generations are the level of automated algorithm used in robo advisor.

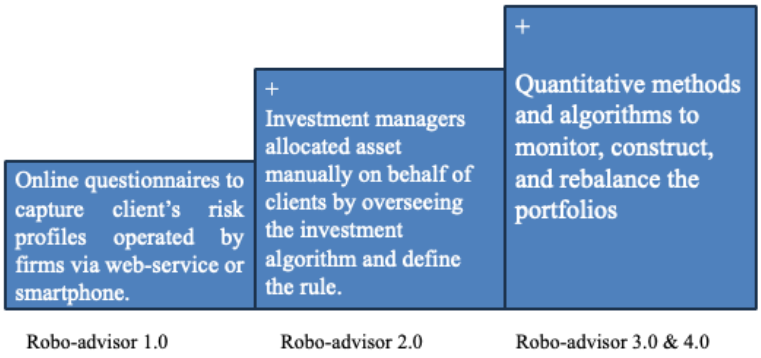

Figure 2.3.1: Overview of Robo-advisors Generations

Most of the financial systems that provided asset allocation methods is using Modern Portfolio Theory (MPT), followed by Sample Portfolios and more. Even though the AI algorithm used by robo advisory platform is hard to be understand, this does not slow down the adoption of robo-advisory from clients in Asia Pacific Region (Deloitte, 2019). In fact, automated rebalancing investor's profile by simulating conventional human advisors based on investment strategies without emotional biases are one of the key benefits from robo advisory solution (Kaya, 2017).

All of the robo advisory platforms required first-time user to go through risk assessment before begin the investing experience. Firstly, customers are required to provide basic information like age, income, investment goal through a survey. Through answering the list of qualitative and quantitative questions, the platform to evaluate customer's risk appetite and tailored with suitable investment portfolio.

According to So, M (So, 2021), 32.6% of these questions are related to customer's risk appetite, 24% focused on the investment time horizon, investment targets and return on investment (ROI), and lastly the remaining 43.4% concentrated on individual's health condition, net worth, and employment background. Three types of investment portfolios: Growth, Income and Inflation Hedge are commonly proposed to investors based on one's risk appetite showed in Figure 2.3.2.

Figure 2.3.2: Investment Portfolios (Cheong, 2021)

Investors who could bear higher risk appetite in long investment period, the system will propose a higher fund allocation in Growth portfolio; whereas smaller fund allocation in both Income and Inflation Hedge as both portfolios are considerably stable but with lower return. The difference in both portfolios are Income focusing in investment dividends and Inflation Hedge concentrates on investments that produce profits.

The benefit of having an automated advisor handling the financial investment is allowing the platform to perform investment decision based on AI, robot process automation, and machine learning, where investor does not need to worry or allocate time in researching. This passive investing method is ideal for novice investor. Besides, the diversification in RA allows investors less affected by the market instability as the platform will re-optimize the investment profile according to market daily with big data. In addition, robo advisor could avoid

unnecessary emotion-based investing as it is calculated based on mathematical algorithm. By allocating an amount of money consistently by investor, RA will automate an individual's investment pattern. Another advantage of RA is the low commissions than existing private advisor is charging to investor. Since the starting fee and commission fee is low, investor is less burdened with the cost. Thus, the wealth robo-advisory service is suitable for individuals that are looking to obtain professional financial advice at a cheaper cost and with greater personalisation. Due to the benefit that robo-advisory service provider could offer, making financial robo-advisory service popular among both seasoned investors and beginners alike. Table 1 shows the comparison between RA and private advisor.

Table 1: Differences between RA and Private bankers (Private Advisor) (Beginner's Guide to Robo Advisors in Malaysia, 2018)

Classification	**Robo Advisor**	**Private banker/ Private Advisor**
Channels	Online/ Mobile	Face-to-face contact
Main Customers	All range of investors	Individual who has huge investment capital
Minimum investment / capital	Small	Large
Commission	Less than 1%	More than 1%
Service Hours	24 hours	Business Hours
Decision making	Analysis using big data	Experience, intuition
Service	Through a survey, the platform assesses investors' profiles and provides asset allocation based on objectives and profile categories.	Human advisor evaluates based on individual interviews with clients.
Investment products	Passive (ETF, Index, Fund, etc.)	Passive & active
Highlights	1. Passive investing 2. Diversification	1. Human interaction

	3. Avoid emotion-based investing 4. Low commission	2. Special profile customization

In Malaysia, all the robo advisory service are required to register under digital investment management (DIM) framework that taking care of regulatory and licensing. One of the most popular RA options is StashAway, a Singapore-based online investment management company, the first authorized robo advisory service provider in Malaysia. KDI Invest is another automated investment option which introduced recently in 2022, supported by Kenanga Investment Bank Berhad (KIBB). Since Malaysia is a multi-racial country, other fintech companies have introduced Shariah-compliant RA such as MyTheo, Wahed Invest, BEST Invest, Raiz Invest, and Akru, attracting Muslim investors may have a concern on how the platform invest.

Table 2: Comparison among Malaysia Robo Advisor platform; imoney- Which Robo Advisor Should You Use In Malaysia?, 2022

Service Provider	**Launch-ed**	**Minimum Investment (RM)**	**Annual Commission Fee**	**Portfolio Composition**	**Shariah Compliant**
StashAway	2018	0	0.2% - 0.8%	Invest in globally diversified, liquid, and low-cost exchange traded funds (ETFs)	No
MyTHEO	2019	100	0.5% - 1%	Create a portfolio based on three functional portfolios to satisfy the needs of customers for growth, income, and inflation hedge.	Yes
Wahed Invest	2019	100	0.39% - 0.79%	Optimizes the investor's portfolio with Shariah-compliant investments using modern portfolio theory	Yes
BEST Invest	2020	10	0.5% to 1.8%	Applies robo-intelligence and big data technology to suggest a portfolio of diversified Shariah-compliant unit trust investments	Yes

Raiz Invest	2020	5	RM1.5 a month (under RM6,000) or 0.3% (RM6,000+)	Uses algorithms to determine your risk profile to construct a portfolio of Amanah Saham Nasional Berhad (ASNB)'s unit trust funds	Yes
Akru	2020	0	0.2% to 0.7%	Invest in an intelligent portfolio of diversified global low-cost ETFs	Yes
KDI Invest	2022	0	0.3%-0.7% for investments above RM3000	Focused on the US stock exchange market	No

With the recent booming RA platforms in Malaysia, there is an increasing trend toward the advent of robo advisor implementation regardless of the outbreak of Covid-19 pandemic. The findings of this study will give the service providers some insights on investors' reaction towards RA in the post pandemic or endemic.

2.4 Review of Previous Researches

2.4.1 Selected Studies on Technology Acceptance of Robo-advisors

This section will discuss the studies related to technology acceptance and adoption for financial robo-advisor in wealth management sector: a) "Study on Factors Affecting Financial Investors' Acceptance Intention to Robo Advisor based on UTAUT" by (Cho, 2019); b) "Understanding consumer's adoption of financial robo-advisors at the outbreak of the COVID-19 crisis in Malaysia", (Gan et al., 2021); c) "Who do you choose? Comparing perceptions of human vs robo-advisor in the context of financial services", (Zhang et al., 2021); d) "Robo-Advisor Adoption, Willingness to Pay, and Trust—An Experimental Investigation", (David & Sade, 2019); e) "The Adoption of Robo-Advisory among Millennials in the 21st Century: Trust, Usability and Knowledge Perception", (Tan et al., 2023); f) "Acceptance Of Robo-Advisors: Effects Of Financial Experience, Affective Reactions, And Self-Enhancement

Motives" (Milani, 2019); g) "Acceptance of robo-advisors: Effects of financial experience, affective reactions, and self-enhancement motives", (Hohenberger et al., 2019); h) "Designing a robo-advisor for risk-averse, low-budget consumers", (Jung et al., 2018); i) "Artificial intelligence in financial services: a qualitative research to discover robo-advisory services", (Bhatia et al., 2021); j) "Adoption of AI-Enabled Robo-Advisors In Fintech: Simultaneous Employment Of UTAUT and the Theory Of Reasoned Action", (Roh et al, 2023); k) "Robo-Advisor Based On Unified Theory Of Acceptance And Use of Technology", (Yeh et al., 2022); l) "Determinants and Barriers of Adopting Robo-Advisory Services", (Bruckes et al., 2019). The summary of these studies are summarized in a comparison table under Appendix B.

2.4.2 Objective, Method & Result of the selected research

The study conducted by Cho et al. examined the acceptance factors in RA enhancing the interest of new consumers, while improving wealth management services quality. The study has removed FC component as the focus is on behavioral intention, with additional variables which are "trust" and "perceived risk" added into their model, using UTAUT as a theoretical theory. The team has conducted reliability analysis, explanatory factor analysis (EFA), and confirmatory factor analysis (CFA) on 337 collected samples. The result showed that PE and perceived risk have an indirect influence due to PE is highly dependent on market conditions, while the perceived risk is related system's performance such as information leakage and hacking. Furthermore, trust is maintained as the most significant direct and indirect influence among all the variables in term of robo advisor acceptance (Cho, 2019).

Li Yin et al. carried out an investigation regarding behavioral intention of consumers in Malaysia investment market to adopt robo-advisors. The goal of the

study is to facilitate robo-advisory platform in understanding the adoption factors to further enhance Malaysia's policies and regulations. A research model was constructed which was empirically tested by PLS-SEM techniques from 285 usable responses out of 400 questionnaires during the initial stage of Covid-19 pandemic. Based on the analyzed result, the team witnessed a positive correlation between perceived financial knowledge and engaging the RA. PE and SI have significant influence in accepting RA service during the pandemic lockdown where face-to-face financial advisory service with human is limited. (Gan et al., 2021)

The purpose of the research directed by Zhang et al. was to investigate the reactions of consumers' trust, PE, and intention to hire between human financial advisor with a degree of expertise and RA. The study had conducted in three rounds of experiments using the MANCOVA method. The finding showed consumers still prefer human financial advisors with high expertise over RA when they are placed in high-risk scenario, in which emotional trust plays a vital role in decision-making process (Zhang et al., 2021).

David et al. had performed research to investigate the differences and factors that influence readiness to adopt (RTA) and willingness to pay (WTP), using "trust" as proxy. They found limited studies are conducted on adoption to use, WTP, and perceived trust with the comparison of RA, human financial advisor, and a hybrid model. Online and laboratory investment experiment were conducted on a total of 625 participants (48.8% of men and 51.2% of women) across different age groups. The result showed RTA is higher in the younger group (20-30 years old) with the highest trust in full algorithmic RA. The RTA decrease with the involvement of human advisor in generation YZ. As for the other age groups, 31-44 years old and 45+ years old have lower tendency RTA and WTP. Also, majority

of men are more willingly accepted RA compared to women, but WTP remained the same (David & Sade, 2019).

Tan et al. (2023) has found that Gen X and Gen Y, who were born between 1981 and 1996 possess financial knowledge, perceived usability and trust have a significant positive effect on the willingness to use RA for financial investment. The higher the financial knowledge, more likely millennials are willing to adopt a robo-advisory service in their wealth management (Tan et al., 2023).

Milani conducted a survey, participated by 635 Italian employees in understanding the adoption of RA based on UTAUT theory. The result showed that tendency in adopting RA increases when participants have higher of education level, financial investment experience, and understanding on RA. Other factors like SI, EE, perceived relative advantage, and trust had a positive impact on behavioral intention (Milani, 2019).

Hohenberger et al. examined the acceptance of RA in US based on 630 adults on demographic characteristics like age, gender, marriage status, education level, financial status. One of the noticeable findings is RA is more likely to be used on white participants, married or lived with a partner, and have postgraduate work. Perceived anxiety is negatively correlated on the willingness to use robo-advisors while perceived joy is positively correlated on the willingness to use robo-advisors (Hohenberger et al., 2019).

Jung et al. conducted an experimental study to design a RA targeted for consumers who has low risk tolerance and has limited investing budget. From their study outcome, they found that the dimension of trustworthiness plays a prominent factor affecting the novice investor's attitude towards the use of RA (Jung et al., 2018).

Bhatia et al. (2021) found that the factors like cost-effectiveness, trust, data security, behavioural biases and sentiments of the investors significantly influence investors intention to use after conducted focus group discussions (FGD) to gather data from active Indian individual investors. From the study, they found that RA is only an alternative wealth management option for some investors. Some investors still prefer human intervention to handle assets in order to keep them engaged (Bhatia et al., 2021)

Roh et al (2023) examined a survey to 638 Chinese users who experienced using RA services to investigate on how the preconditions can induce positive towards attitudes and intentions. The predecessors from UTAUT model: PE, EE, SI FC play a positive effect on one's attitudes toward RA services. Also, perceived security, perceived privacy, and trust in TRA are important in affecting the use of RA. Lastly, trust has significant indirect effect as mediator on for pre-factors like perceived security and privacy, FC, attitudes, and intention to use RA (Roh et al, 2023).

Yeh et al. (2022) distributed 242 questionnaires were collected using survey method in Taiwan. The team found that PE, EE, SI have indirectly influenced to behavioural intention by investor's attitude while FC is positively influence behavioural intention. Investor's experience is found to positively strengthen the relationship between EE and SI on attitude (Yeh et al., 2022).

Bruckes et al. (2019) was to examine the relationship between trust and the intention to use robo-advisors for investments from 246 completed questionnaires. Two characteristics are identified in this study: Organizational characteristics (Trust in banks) and Industry characteristics (Structural assurance). The team concluded that Trust undeniably is a critical factor, which it is negatively linked to

perceived risk but positively linked to industry characteristic (structural assurances). Trust in banks is positively related to initial trust, with the condition that structural assurances are not included. For example, customers who have high trust in banks are more likely to trust robo-advisors but when customers start to comfortably use RA, trust in banks is no longer influencing the decision to adopt RA (Bruckes et al., 2019).

2.4.3 Observation and Deficiency of The Selected Studies

As discussed above and documented in Appendix B, it is observed that over the past few years, there has been a lot of research on robo-advisor in fin-tech industry. There is scant research examining the preconditions that can induce positive T and intentions among investors to accept the usage of RA, which is one of the key attributes of fintech. Trustworthiness of new technologies is important in wealth management especially the user using RA do not directly engage with the service provider unless the user faced issues for example difficulty in using RA platform or during the investment transactions. Most of selected studies, trust has significant direct effect towards intention to adopt the financial robo-advisory service for wealth management (Gan, 2021; David et al., 2019; Jung et al., 2018, Tan, 2023, Roh et al, 2023). Although trust-related factors are conventionally considered in acceptance of new technologies, however there is scarce research on trust as a mediator towards predictor factors on UTAUT model. Limited research focusing the investigation in the mediating effect of trust on UTAUT variables (PE, EE, SI) towards the acceptance intention RA, only one research which is Cho (2019). Trust are often mediating other variables like structural assurance and trust in banks (Bruckes et al., 2019). Therefore, this study includes T as mediator to help

examine the mediating relationship with UTAUT variables with the aim to increase the understanding in technology acceptance of investment RA.

Secondly, an individual's literacy level in financial, technology and information are surprisingly scarce comparing to the research in other sector. Only financial literacy are often used as the predictor in investigate the technology acceptance for financial and banking related research (Gan et al., 2021; Milani, 2019, Hohenberger et al., 2019). Digital literacy and information literacy are relatively less found in the research for financial sector but more investigations are found in education sector (Nikou et al, 2022; Restuputri et al., 2023). Nikou found that both information literacy and digital literacy directly affected on perceived ease of use of new technology (Nikou et al., 2022). Employing big data analysis technologies, investment robo-advisory services automate the process from compute portfolio recommendation based on the investor's risk appetite to rebalance the selected investor's portfolio based on the financial market fluctuation. Investors need a degree of financial, informational, and digital literacy to evaluate the technology used by this new automated financial investment option from various service providers. Hence, the three literacies (DL, IL and FL) are added into the proposed framework to examine the behaviour intention towards robo-advisor applications in fintech using the enhanced UTAUT, which will be explained in section 2.5.2.

2.5 Related theories

2.5.1 Technology Acceptance Model (TAM)

TAM stands for Technology Acceptance Model developed by (Davis et al., 1989, 1992) aims to provide a general explanation on new technology acceptance based on customer attitude. TAM is an adaptation of TRA, Theory of Reasoned

Action, developed by Fishbein & Ajzen (1975). Two main aspects of acceptance behavior in this model are perceived usefulness (PU) and perceived ease of use (PEOU). PU is the degree to which an individual believes using a system would improve their job performance or useful to their doings; while PEOU has been defined as the degree to which an individual believes that using the system would free from effort.

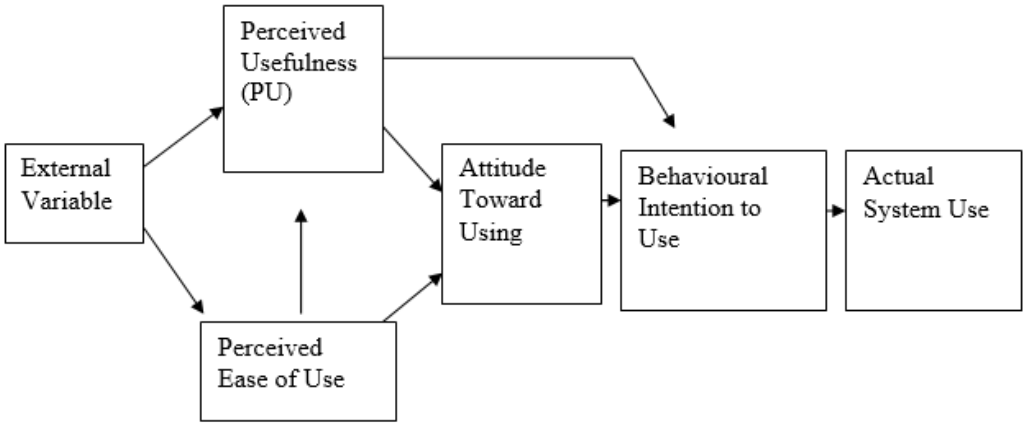

Figure 2.5.1: TAM, stands for Technology Acceptance Model developed by (Davis, 1989)

An assumption is made on the customer's attitude towards the use of technology will directly influence the intention to use, eventually contribute the long-term system usage by customers. Despite the model is developed in year of 1989, the model remains valid on current technology adoption. Many studies have used this theory as the baseline and further developed and extended this model by creating more advanced and in-depth investigations.

However, several studies do reported inadequacies of TAM in explaining the relationship of technology and actual adoption and use of technology. Hai & Kazmi (2015) has reported that TAM is not comprehensive enough to provide explanation in predicting on customer's behavior about response towards the use of technology, as well as social influence and facilitating conditions. Napitupulu

(2017) found that TAM is not able to evidently be proved that extrinsic variables such as social influence and facilitating conditions towards PU and PEOU. Furthermore, based on (King & He, 2006)'s findings, TAM is suitable to applicable to an individual's use and adoption but not suitable applicable to organizations, such as firms and companies where rules and regulation are enforced. The same finding is also supported by (Ajibade, 2018). He harmonized that TAM is more suitable to be conceptualized for an individual perception and determination to use a new technology, argued that the model is unfitting to be projected in business, university, and organizational context.

2.5.2 Unified Theory of Acceptance and Use of Technology (UTAUT)

UTAUT, stands for Unified Theory of Acceptance and Use of Technology, has the consolidation of eight published theoretical acceptance models that has been widely used in global adoption research to understand consumer's behavioral intention. These theoretical acceptance models are TRA (Theory of Reasoned Behavior), TRP (Theory of Planned Behavior), TAM (Technology Acceptance Model), MM (Motivation Model), C-TAM-TPB (Combined TAM and TPB Model), MPCU (Model of PC Utilization), IDT (Innovation Diffusion Theory), SCT (Social Cognitive Theory). It also included 32 constructive concepts that provide a higher power of explanation.

Table 3 - Constructs of UTAUT

Theory	Description	Researcher
TRA	Proposes that attitudes and subjective norms affect behavioral intention. Behavior intention is the main motivator of behavior	Fishbein et al.(1975)
TPB	Adds 'Perceived Behavioral Control' to TRA	Ajzen(1991)

TAM	Evaluates how PU and PEOU affect behavioral intention to use. Attitude is used as a mediator	Davis et al.(1989)
C-TAM-TPB	Expands TAM combined with TPB	Taylor et al. (1995)
MM	Measures the level of "extrinsic motivation," and "intrinsic motivation" affect acceptance intention	Davis et al. (1992)
MPCU	Suggests PC utilization model using social factors, complexity, job-fit, long-term consequences, affect towards use, and facilitating conditions	Thompson et al. (1991)
IDT	Uses "compatibility," "complexity" and "relative advantage" as independent variables affecting rate of innovation adoption	Moore et al. (1991), Rogers(2003)
SCT	Describes the influence of individual experiences, the actions of others, and environmental factors on individual health behaviors	Compeau et al. (1995)

UTAUT has four components that predict the behavioral intention: performance expectancy (PE), effort expectancy (EE), social influence (SI), and facilitating conditions (FC) developed by Venkatesh et al. (2003). These components predict user behavioral intention and leads to acceptance in a holistic view. First three of the components are direct determinants of behavioral intention, and the remaining one component is directly contributed to user behavior. PE is defined as the degree of a consumer believes their performance would be improved with the use of the application, EE encompasses the belief that using a specific application requires little or no effort. SI refers to consumers depend on third-party