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# Influence of Robo Advisory in Investment Decision: A Case Study in Indonesian Mutual Fund Market

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## Abstract

This research is conducted to identify the potential influence of robo advisory, equipped with its features and technological improvements that would aid and assist in investment decision, and compare the relevancy as well as its efficiency to human financial advisor. The objective of this research is to study the discourse of robo advisor's phase of development and the understanding on behavioral aspect in financial investment, in order to gain proper understanding on investor's preference in accessing financial advisory services in order to aid in their investment decision. In this respect, the research is conducted through qualitative study, conducted through the process of interviewing a sample of respondents with substantial experience and exposure to financial investment, and had utilized financial advisory services, in which their response are further studied in a case basis through Analytic Hierarchy Process, to find out the relevance and the potency of robo advisors in comparison to human financial advisors in adjusting to investor's investment decision as well as detecting behavioral investment pattern to determine its preferences to either alternatives of financial advisory. The result of the research indicates stronger preferences to human financial advisors rather than robo advisors, and emphasizes financial literacy as the most influential criteria in determining financial investment decisions.

## 1. Introduction

The financial service sector is the sector in which operates through the allocation of assets and equity management in addition to providing financial investment services for commercial and retail investors, in which the sector comprised of banks, capital assets, insurance, real estate finance, among few others. Financial market, which focuses on the capital assets, serve as the marketplace for variety of investment instruments, and have seen substantial development as part of the contribution to economic scale. In this respect, there have been developing utilization of the system revolving around financial investment functions, including but not limited to investment banks or wealth management companies established to manage the fund pools and capital allocation, to financial advisory services which focuses on the advisory aspects towards the clients and/or investors. Hence, the substantial trend of development is seen all across the world, promoting more active implementation of investment activities and participation.

In the Indonesian capital market, AUM represents the various financial products from mutual funds, index funds, stocks, bonds, and so on, which notably represent the composition of the financial sector in the capital market. This growth is supported through increasing influence of financial inclusion and financial literacy in which occur amongst the

citizens of Indonesia. Based on the survey of Indonesian Financial Service Authorities (OJK) which represented the growing trend of financial inclusion and literacy from 2016 to 2019, indicating significant growth banking, insurance, and financing institutions.

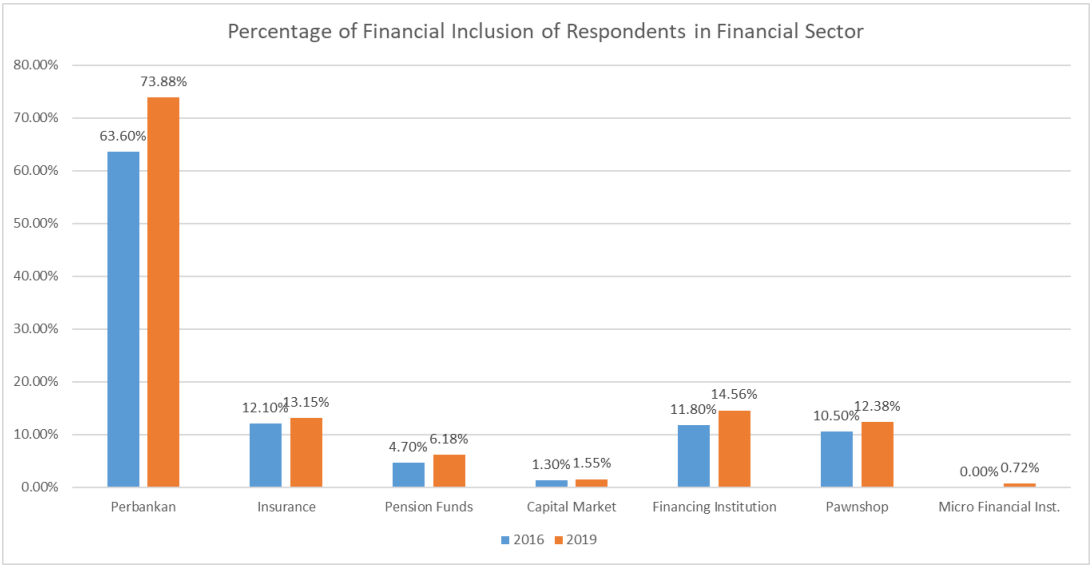



Figure 1. Percentage of Financial Inclusion of Indonesian Respondents from year 2016-2019

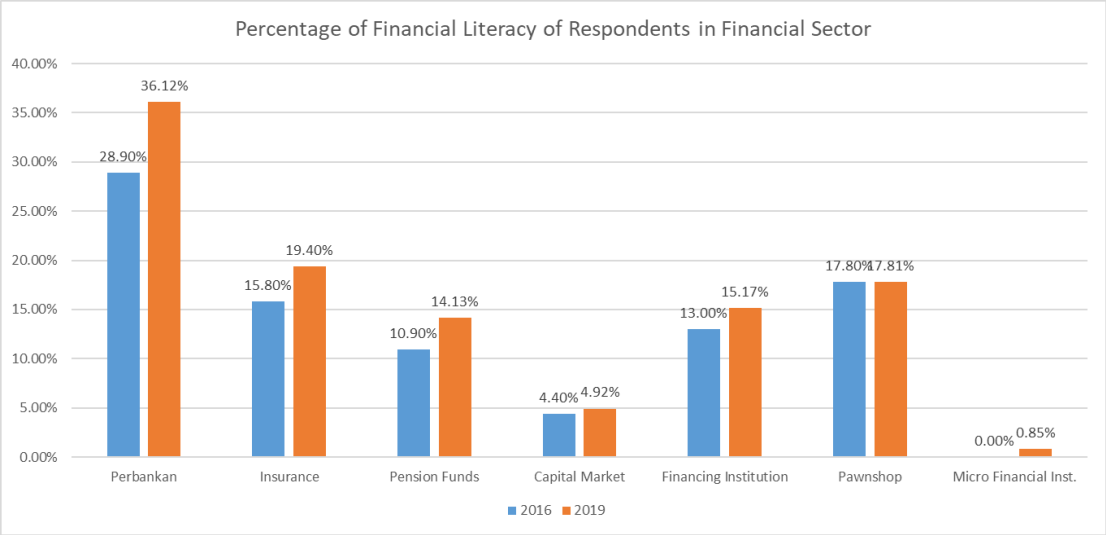



Figure 2. Percentage of Financial Literacy of Indonesian Respondents from year 2016-2019

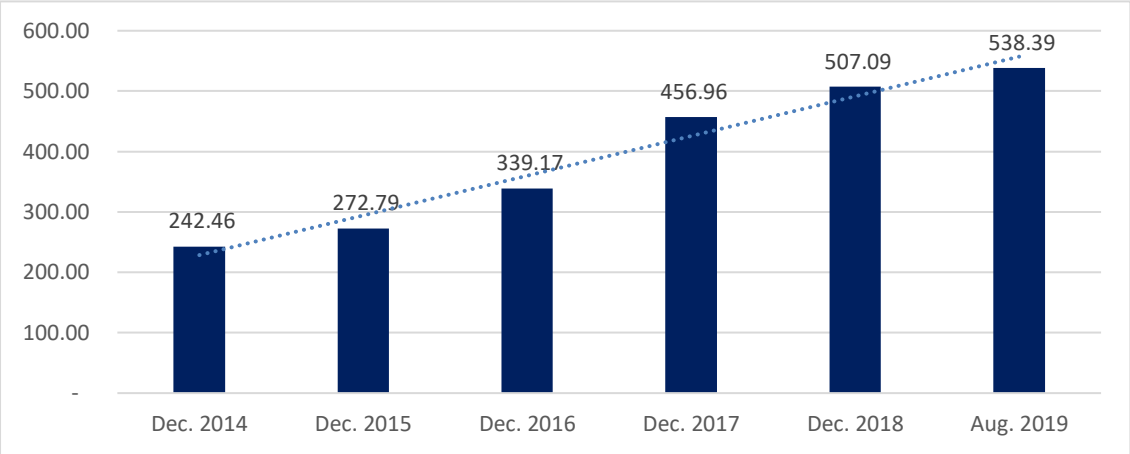
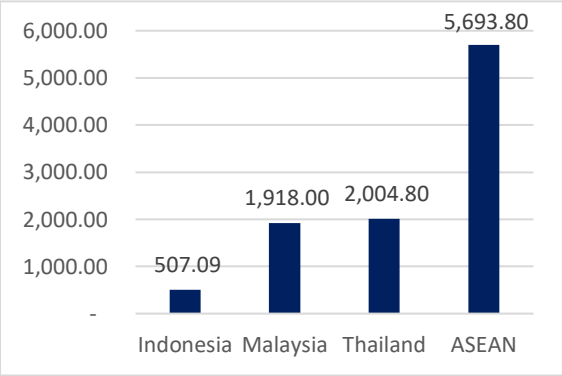



Figure 3. Total Value of AUM in Indonesia, 2019 (in Rp Trillion) Source: Statista.com

AUM market in Indonesia is experiencing positive and progressive growth, with its 4-year Compounded Annual Growth Rate (CAGR) of 20%, from 2015 to 2019. The growth is based on the Net Asset Value (NAV) as the indicator of AUM market growth, reaching as high as Rp 507 trillion by 2019.

However, the growth comparison of the Indonesian AUM market seems underwhelming in comparison to the AUM market in overseas, in which based of total AUM value in December 2018, where Indonesia was ranked lowest compared to Thailand, Malaysia, and the overall ASEAN composition, recorded Rp 507.09 trillion, as opposed to Malaysia (Rp 1,918.00 trillion), Thailand (Rp2,004.80 trillion), and ASEAN (Rp 5,693.80 trillion) total AUM value. In terms of AUM Value per Capita, which represents the rate of involvement of the number of investors by the AUM value managed, also shown Indonesia's underwhelming value of Rp 1,888,105.78, in which is a stark contrast to Malaysia's Rp 60,834,749.82. The data shows that despite Indonesia's steady AUM market growth, the country is still lagging in terms of invested funds into AUM market as well as the lack of Indonesian citizens participated in investing in the capital market.



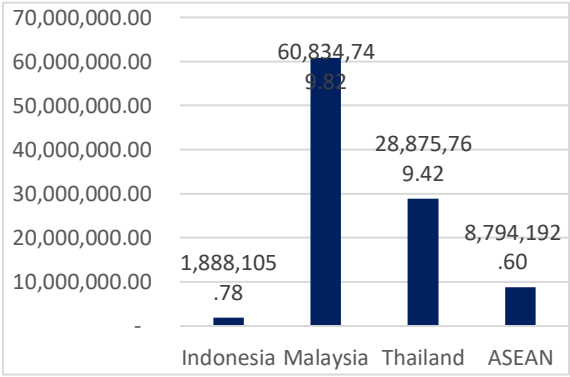




Figure 4. Total AUM Value in December 2018 (in Rp Trillion), Figure 5. AUM Value per Capita at year end 2018 (in Rp Trillion)

One of the most notable differences in which determine a fundamental highlight in comparing the performance of AUM as well as participation in investment practice between Indonesia and its neighboring countries, in addition to the growth of developed countries are their substantial development in technological advancement (PWC 2017). In this respect, the effect of technological development and implication in the financial sector, including the development of financial platforms and its service. In this respect, in terms of advisory services, there have been a significant development with Robo advisory services and implementation over the course of the decade. Respectively, notable development can be traced back to 2008 with the pioneer innovation of Betterment, which paved its gradual growth, such as one of the biggest breakthroughs in 2015, in which robo advisory utilization from Charles Schwab's Schwab Intelligent Portfolio. From then on, it continued with many of large implementation of wealth management firms follow suit with the provision and development of the service, with notable mentions such as Blackrock, Vanguard, SigFig, and many others. Based on 7 years of development, the number of Robo-Advisors Launched in wealth management companies over the US experienced 33% CAGR, with the recent leading wealth managers worldwide in 2015 are led by Schwab Intelligent Portfolios, and later Vanguard with AUM value of USD 112bn and USD 33.3 bn, respectively. (Abraham, Schmukler, and Tessada 2019)

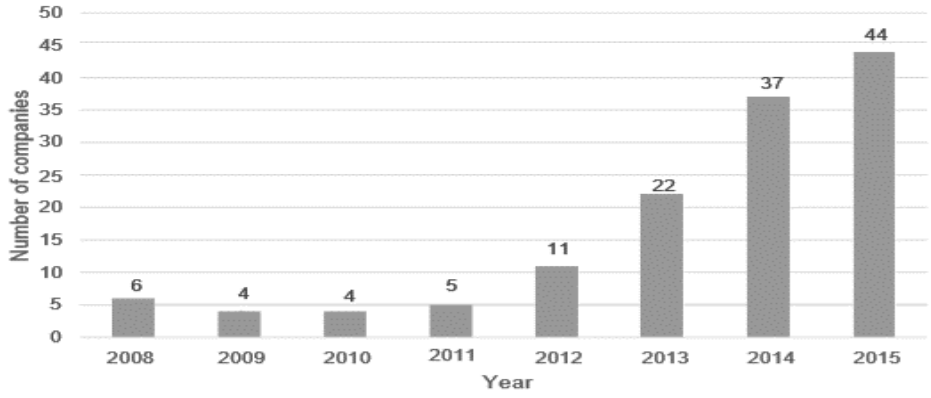



Figure 1.5: Number of Robo-Advisors Launched in Companies in the US, 2008-2015

With the apparent introduction and development of robo advisors across the world, it has brought notable improvement to the financial advisory sector(Baker 2017; D'Acunto, Prabhala, and Rossi 2018; Phoon and Koh 2018). In this respect, robo advisors have an indispensable effect and impact on investor's investment behavior and pattern within the financial market. In this respect, the advantages of Robo-advisory are worth considering, especially in terms of both the benefits for the companies and the customers themselves. One of the benefits is that robo-advisors do not involve as much as human intervention, in which instead utilized the automation of asset allocation and investment principles. In this regard, in spite of the effect of less human intervention, it gives opportunity to a more concrete and objective logical decision making by the robo-advisors, less interrupted by common bias and emotional decision making which may be apparent in human financial managers.

These can be achieved as Robo-advisory utilize the potential of Artificial Intelligence and programmed logical thinking in which may prove to be efficient in analysing and perform numerous decision-making strategy in accordance to the

personalized specification of investor orientation, in which produced an objective, and informed decision. (Lourenço, Dellaert, and Donkers 2020)

In regards of its implementation growth, A study by Deloitte has shown the stage of development and implementation of Robo advisors in several phases, as the following (Deloitte. 2019):

A. Robo Advisor 1.0

Establish portfolio allocation structured by the fund managers and forward to the client in the form of structured questionnaire and later allocate the recommendation in accordance to the risk and preference of the investor/client to the pre-determined portfolio recommendation by the fund managers

B. Robo Advisor 2.0

Dedicated and structured fund allocation and portfolio prospectus aligned with the risk and preference of the investors. Fund managers still have most of oversight and recommendation to its investors, and robo advisors mainly utilize data collection of investor's risk and preference on investment behavior

C. Robo Advisor 3.0

Start to implement machine learning algorithm in portfolio adjustments & fund rebalancing to manage and allocate fund allocation, as well as constructing more advanced financial model and analysis for recommendation on investment portfolio in accordance to the investor/client's preference. Human wealth managers have relatively significant on oversight on monitoring the recommendations and consulting and/or advisory services

D. Robo Advisor 4.0

Implementation includes utilizing self-learning algorithm and Artificial Intelligence (AI) to handle more sophisticated financial modelling and portfolio assessment in recommending and executing more prompts and commands for the investor/clients in accordance to the predetermined risk and reward preference. In this phase, human wealth fund managers have relatively medium to little oversight over the activities, and focus more on additional advisory services and maintenance.

In terms of Indonesia's stage of development, there has not been a detailed documentation and reporting in regards to Robo Advisory development and implementation, which made it quite challenging to determine the precise stage of implementation in Indonesian capital market, as well as the current financial investment platform. Several notable documentations include the apparent introduction of robo advisory service in Indonesia pioneered by Bibit.id, and Halofina, which specializes in advisory in investment products such as mutual funds, and index fund, which utilize goal-based investing in determining and recommending the investment activities to its investors in accordance to its risk preference and reward target.

Several notable features and benefits provided by robo advisor implementation lie more on the accessibility to many investors if made available in financial platforms, as opposed to human financial managers with limited capabilities in handling large scale of clients/investors. In addition, the ability to further develop to be more sophisticated in

providing adequate and proper recommendation and insights in regards to quantitative analysis, allowing more rational approach to investing.

However, in spite of its benefits and potential, robo advisors are not without its flaws, as there are several limitations as well as challenge revolving its implementation and utilization. In this respect, one of the most notable aspect starts from legal issues, in which may revolves regarding the use case of robo advisor implementation and its issues regarding data security, legal practice, as well as legitimacy in permit and investment activities over the oversight officials/authorities, which may present its own respective problems. (Fein 2015). In addition, the problems regarding its check and balance when compared with human financial advisors as one of the available alternatives for investor's alternatives on investment decision making. Furthermore, robo-advisors' lack of response in terms of unusual or unconventional preferences and patterns happening in the AUM market, or the scenario in which may be foreign to the system. In this regard, human intervention in regards to critical decision making may be essential in which still to be found in human financial managers. Automated response and modelling may not be as reliable to swiftly respond to the anomaly that may occur and the investors may cannot look for consultation if necessary.

In spite of this, Robo-advisors are gradually developing in terms of its capabilities and features, there are still arguments in regards to the function of taking more complex financial planning in which tailored for personal investors coming from an array of different backgrounds. Financial planning issues such as estate planning, tax planning, retirement planning, insurance needs, and saving goals may present significant challenges as these are variables that are very complex and may pose different prompts for automated arrangement. Although, there are developments of Robo-advisors in order to overcome this challenge such as basis on financial planning through Modern Portfolio Theory (MPT) in order to manage better the Capital Allocation Line (CAL), there are still functions that are better suited when it comes to providing advice in tax or legal issues, plan target on retirement or estate planning, and overall consultation in terms of investment objectives.

Overall, Indonesia's current standpoint is still relatively lagging behind other countries in terms of its adaptability into integrating technological platforms that apply and aid to financial advisory services, in which would cater towards variety of behavioral aspects in investment decision in the financial market. In this respect, the objective of the research is to identify the influence of Robo advisors as an alternative to cater for investors' financial advisory alternatives in comparison to human financial managers/advisors, along with studying the underlying criteria that have substantial influence in investors' decision making and aid in investment decision.

## 2. Literature Review

a. Agency Theory

Agency Theory represents the theory that focuses on the relationship between the management's objectives and the shareholders' principle (Jensen and Meckling, 1976). The theory highlights the differences in interests and priorities in each of the objectives between perspectives. The problem lies commonly on the balance of prioritization between the two agencies, in which in the perspective of investing in the financial market, financial managers and/or investors may tend to have conflicting priorities in terms of risk management and target setting, in which the perspective may be represented by management's agency priorities to achieve the management's targets which may be

conflicting investors' interest in gaining profit on their investment, thus may be failing to simultaneously achieve both goals.

This theory is highly considered to be relevant to the research as it helps understanding investors' preferences on its investment decision or motivation established through its fundamental role and position.

b. Asset Under Management (AUM)

Asset Under Management (AUM) comprised of many variations of financial instruments within the financial market, which comprised of a combination of financial products combining into the AUM's total market value. The combination of the products is constructed into an AUM investment portfolio. There are several types of AUM based on the type of assets within its portfolio:

- Equity Funds
- Fixed-income funds
- Money market funds
- Balanced funds
- Index fund
- Exchange-Traded Fund (ETF)

These financial instruments are the products in which combined into an arranged portfolio of investment, based on the preference of the investment instrument, and the management of risk may result with many variations of AUM products provided to suit the array of the level of investors' preference and involvement in their AUM investment funds. Overall, the aforementioned alternatives of financial instruments under AUM category helps categorize the financial instruments that become part of investors' investment

c. Goal-Based Investing (GBI)

Goal-Based Investing (GBI) focuses on the perspective of an individual's decision making based on the goal or target setting which may affect the individual's behavior in facing a certain situation. The behavior considered in investment activities may comprise of risk and return preferences, and their orientation in target to make decisions (Sironi 2016).

In this aspect, GBI in itself is one of the newfound concepts in behavioral finance which helps emphasize the effect of investor's behavior and preference, which is why investors may require personalized preference in organizing their investment portfolio in accordance with their risk and return target preference. The rising trend of robo advisors may contribute to the increasing accessibility of AUM investment products provided to investors and may affect forming personalization of AUM investment recommendations for the investors(Shanmuganathan 2020).

Shanmuganathan's presentation of robo advisory and its theoretical framework helps to explain how robo advisors are capable to utilize and process quantitative and subjective inputs and process it to recommend which may contribute to the client's investment decision, and allow continuous feedback in between the robo-advisors input and output. The illustration of the theoretical framework is as shown in Figure 1.

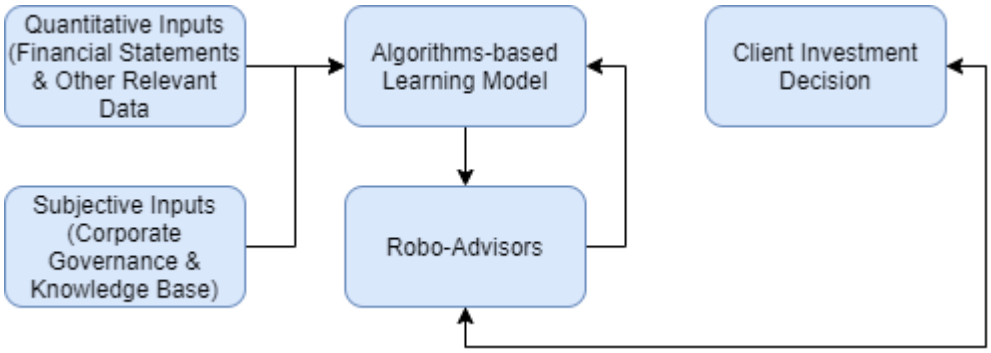



Figure 2.1: Shanmuganathan's Robo Advisor Theoretical Framework
Source: Shanmuganathan's Robo Advisor Theoretical Framework

d. Modern Portfolio Theory (MPT)

Modern Portfolio Theory (MPT) is the calculation method in terms of defining risk a return allocation in investment portfolios consisting of the composition of assets attributed to the risk in a given period(Markowitz 1959). This mathematical method is further modified by extensive study, contributing to the previously overlooked factors in MPT, such as estimation in error maximization, along with sensitivity analysis on highly concentrated portfolio(Beketov, Lehmann, and Wittke 2018; Grinblatt, Titman, and Wermers 1995; Grinblatt and Titman 1992). These modifications and contributions to the theory complemented the theory into "Multidimensional Improvement of Modern Portfolio Theory".

There are several assumptions in which correlated with this theory, which are:

- *Investors were risk-averse:* investors, when they are faced with two or more portfolios offered with the same expected return, the investors would opt for the less risky portfolio. Therefore, investors are willing to take more risk in the case of a portfolio with a higher expected return, with the applicable case of higher risk attributed to the portfolio.
- *Investors were rational:* Investors would not likely to invest in a portfolio if there is another alternative portfolio providing a more favorable risk-expected return profile, which represents the trade-off between risk level and expected return existed for all investors. However, investors had their risk preference profile, which differentiates how investors evaluate the trade-off based on their risk aversion level
- *Efficient Frontier and the Capital Allocation Line (CAL):* CAL represents the theory in which in assumption to the tendency of the "risk-averse" attitude of investors, asset managers were always trying to look for portfolios that provide the highest expected return at a given level of risk. The efficient frontier was a set of efficient portfolios that offered the highest expected return for a fixed level of risk and offered the lowest risk for a fixed level of expected return.

The concept of MPT and CAL are few among many other mathematical theories in which suited the concept of economic finance and have been the foundation in which formed the functions and role of Robo Advisory expected in the modern technological

finance, in which emphasized the significance of Robo Advisory in adopting these theories to practice it for identification of client's risk profile as well as investment goas, in which utilizes the theories for the purpose (Markowitz 1959).

e. AUM Fund Flow

Fund flows refer to the new cash flow value or changes in the total Net Asset Value (NAV) deducted with the performance appreciation of the fund's assets. In this respect, appreciation is obtained through calculating the total net asset value at the beginning of the period, multiplied with the rate of return earned by the fund during the period (Gruber 1996). Furthermore, fund flows represent the proportionate increase in the fund's total Asset Under Management (AUM) between the beginning and ending AUM net of internal growth(Chevalier and Ellison 1995). The formula of the calculation is expressed as follows:

$$Flow = \frac{Assets_{it+1} - Assets_{it}}{Assets_{it}} - r_{it+1}$$

Fund flow serves as the underlying indicator in valuing the AUM performance and AUM growth, which is studied through the performance coefficient of mutual fund growth indicated greater growth in positive market-model excess return than negative, which emphasized the purpose of investors investing in AUM(Ippolito 1992).

Fund flow can also be observed through its significance of sensitivity between strong performing AUM and poorer performing AUM, which resulted with the idea in which investors are observant in their decision on investing towards strong performing AUM, thus considering the factor of AUM fund flow based on the asset composition within the AUM in terms of market return (Goetzmann and Peles 1997).

f. Investor Bias in Behavioral Finance

Investor's bias is one of the most critical factors in affecting investment decision and risk profiling, and have been part of the study discipline in behavioral finance, focusing more on the psychological and sociological aspects on the theories explaining investment decision conducted in which may contradict the theories of modern economics or rational models, hence may be regarded by these aspects as anomaly situation. Behavioral finance demonstrates the existence of biases in human decision making and judgment, which emphasize investor behavior that may be the response in terms of what is considered to be abnormal behavior (Kahneman and Tversky 1979).

Studies regarding investor behavior found the various anormal behavior resulted by the bias, in which one example is the decision making of investors' likeliness to sell shares that experience increase in price but tend to keep the shares that dropped in prices, which may be found contradicting to the prospect theory (SHEFRIN and STATMAN 1985). Examples of overconfidence in financial judgment can also be observed in which may occur on both professionals and non-professionals in the finance sector, and professionals' tendency to be more overconfident and bias in terms of their decision making (Muradoglu and Harvey 2012; DeBondt et al. 2010) in which may also be emphasized according to the factor of preference upon specific investment instruments, or preference to a reputable and/or well-known company stock or bonds, in which may affect the factor in bias in investment decision making.

## 3. Methodology

The research method and design are represented through the theoretical framework established by scope of the research, highlighting the key points and focus of the overall research. The theoretical framework is constructed by defining the attributes to the research objectives such as the existing variables or criteria considered relevant to the study and clearly defined, and the conceptual model is used to describe the relationship of the available criteria in order to provide a conclusion to the research objective (Sekaran and Bougie 2016).

In this respect, therefore, the theoretical framework is presented as shown in Figure.

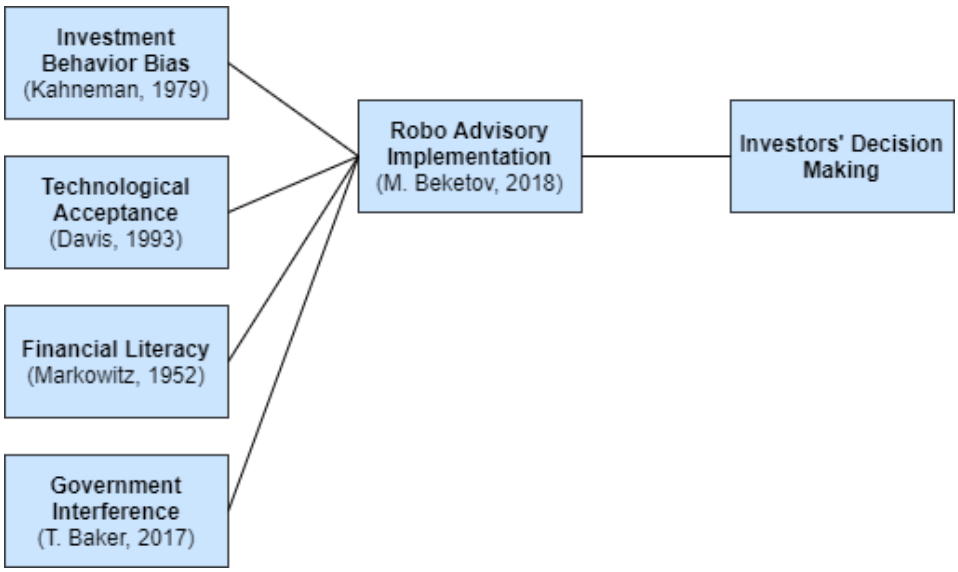



Figure 3.1: Theoretical Framework

Based on the theoretical framework presentation, the research is determined through the established criteria that are relevant and are incorporated as part of the criteria in response to the research question and background. "Robo Advisory Implementation", in this aspect, serves as the correlating alternatives that incorporate the aforementioned criteria and to be scaled based on the response of the respondents associating the most influential criteria incorporated into the alternatives, in which therefore would have correlation to "Investors' Decision Making".

The research paper would be conducted through a mixed method study, which combined the quantitative aspects of data collection through data input from the respondents presented in numerical value to be further processed, while also utilizing qualitative research in form of literature review as well as presenting the underlying research criteria that would be most suitable in determining the scenario and survey upon which presented to the respondents.

In addition, to conduct and process the questionnaire data results obtained, the researcher decides on to use the Analytical Hierarchy Process (AHP) This method is essential to discuss and evaluate the results and compare in regards to the multiple criteria in which correlates with the alternatives in question. AHP is firstly introduced by Thurstone (1927) which is conducted through pairwise the criteria and/or attributes at one

time towards the relativity of the decision. In this case, the method utilizes Pairwise Comparison Matrix (PCM) or also known as Positive Reciprocal Matrix, in which serves as the mathematical method of comparing the relative importance of the attributes and alternatives towards the decision or goal, which serves as the essential method in assessing qualitative data results into research.

In respect to the author's reference in utilizing AHP research method, previous research of similar themes in behavioral finance has been conducted using AHP method by Marcarelli, which studies the impact of financial literacy in relation to the capability in analyzing and navigate through the alternative investment market of France and Spain in respective to the calendar event studies of each of the financial market. The study involved 69 respondents for the experimental research and conducted using AHP method(Marcarelli et al. 2020).

3.1. Quota Sampling Method & Judgement Sample Selection

The research will be conducted utilizing Quota Sampling Method by utilizing the selection of particular number of respondents in relation to the topic research, allowing more focused and direct approach on the focused and specific requirement and criteria considered for the research topic. In addition, judgement sampling is also utilized to emphasize the selected respondents in accordance to the criteria established for the eligibility of the sample categorization.

In regards to the previous sampling method, the researcher had established the following sample criteria for the potential respondents:

- Retail investors registered as investors in KSEI database in Indonesian Capital Market
- Investors are at least had 1 year of experience in investment or trading in mutual funds and/or stock investment
- Respondents have known or have used financial investment platform which utilize robo advisory features (example in Indonesian platform given: Halofina, Bibit.id, etc)
- Respondents have at least High School Diploma level of education

Based on the aforementioned criteria, the author has collected a total of 40 respondents, in which are represented as presented in Table 1.

Table 1: List of respondents in the research

| | |
|---|---|
| Occupation | |
| College Student | 31 |
| Consultant | 2 |
| Employee | 2 |
| Stock Trader | 1 |
| Others | 2 |
| Age Category | |
| 20-30 | 33 |
| 30-40 | 3 |
| 40-50 | 0 |
| 50-60 | 2 |
| Others | 2 |

| | |
|---|---|
| Latest Education Background | |
| High School Diploma | 19 |
| Bachelor Degree | 18 |
| Master's Degree | 2 |
| Others | 1 |
| Investment Experience | |
| 1-5 years | 34 |
| 5-10 years | 4 |
| 10-20 years | 1 |
| Others | 1 |

Based on the respondents' participation, the respondents in which participated for this experiment had sufficiently fulfilled the aforementioned criteria.

3.2. Analytic Hierarchy Process (AHP)

The AHP method utilizes the numerical scale for the matrix to scale the importance of the criteria to the available alternatives. One of the methods to construct the matrix is by applying the 9 point Scale which was introduced by (Saaty and Kearns 1985) to quantify the scale of importance of each of the criteria and how it relates to each of the alternatives. In this respect, it tries to pursue consistency in seeing the relative importance of the alternatives in suiting up to the criteria into the goal. The 9-point scale represents the level of importance for each value, as shown in Table 2 below:

Table 2: 9 Point Scale by Saaty

| Definition | Intensity of Importance |
|---|---|
| Equal importance | 1 |
| Weak | 2 |
| Moderate importance | 3 |
| Moderate plus | 4 |
| Strong importance | 5 |
| Strong plus | 6 |
| Very strong or demonstrated importance | 7 |
| Very, very strong | 8 |
| Extreme importance | 9 |

Based on the total respondents obtained, the author has decided to eliminate a total of 3 respondents, in which due to the following reasons:

- One of the respondents claim to not have any prior experience in investment experience, therefore the response from the respective respondents will be ruled out to prevent misrepresentation along with the sample
- The remaining respondents are eliminated due to the results having relatively high Consistency Ratio (CR) in which exceeded the acceptable variance level of transitivity consistency value, in which will be discarded.

In this respect, the researcher will be more focusing on utilizing the AHP method, in which it is more representative and adaptable towards the objective of the research, which is to find the connections in between the hierarchical characteristics of functions or elements in which may affect the change in AUM Fund Flow in the capital market, in which may be delivered by the alternatives which are Robo Advisors and Human Financial Manager in which have distinctive functions and elements. The established AHP hierarchical structure is as shown in Figure 3.2 as follow:

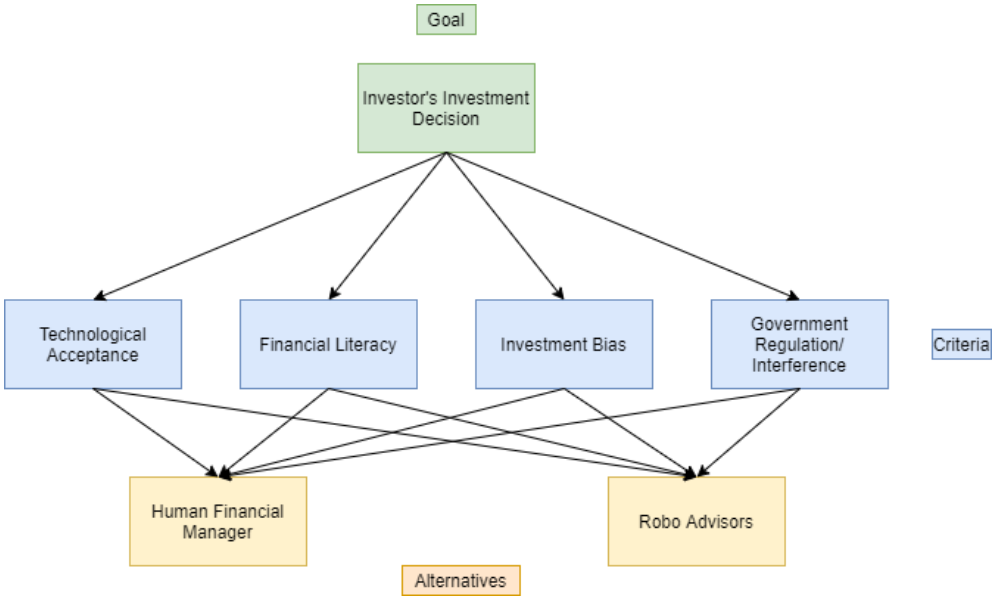



Figure 3.2: Established AHP hierarchical structure

The AHP hierarchy construction outlines the overall presentation and the connection in regards to the considered criteria in which may have a degree of relevance to the effect of the goal, which is to determine the composition of investor's investment decision, whereas the criteria is connected down the hierarchy with the available alternatives. In this respect, the diagram is represented as follows:

**Goal**

**Investor's Investment Decision:** This particular goal represents the decision making made by the investors, which may be described as how the investor's decision are based on a foundation of analysis and/or considerations in which it obtained from references and materials in which they have access to and utilize.

**Criteria**

a. **Technological Acceptance:** Technological Acceptance represents the criteria in which revolves around the level of literacy and adaptability to a certain technological implementation
b. **Financial Literacy:** Financial Literacy refers to the criteria defining the level of literacy and adeptness of the investors in facing the financial investment product in the capital

market, and its knowledge base as well as its understanding regarding the mechanism and the concept of the capital investment.

c. **Investment Bias:** Investment Bias refers to the bias or subjectivity of the investors when approaching a financial investment consideration, analysis, and decision making.

d. **Government Regulation/Interference:** Government regulation and/or interference refers to the effect of government regulation or even interference in regards to political, socio-economic actions and/or policies in which may affect the capital market, both in terms of its practice or its regulatory activities.

**Alternatives**

a. **Human Financial Advisor:** Composes of human financial advisor who manages the client investment portfolio directly for oversight and/or investment analysis as well as recommendation to the investors

b. **Robo Advisor:** Composes of digitally built, programmable machine or algorithm created to execute investment product portfolio screening, analysis, and reporting as well as producing recommendation and reported insights, in which relies on its sophistication, may cover extensive functions from self-learning in terms of investment product analysis, to automated trading execution.

Therefore, the summary of the research phase is as the following:

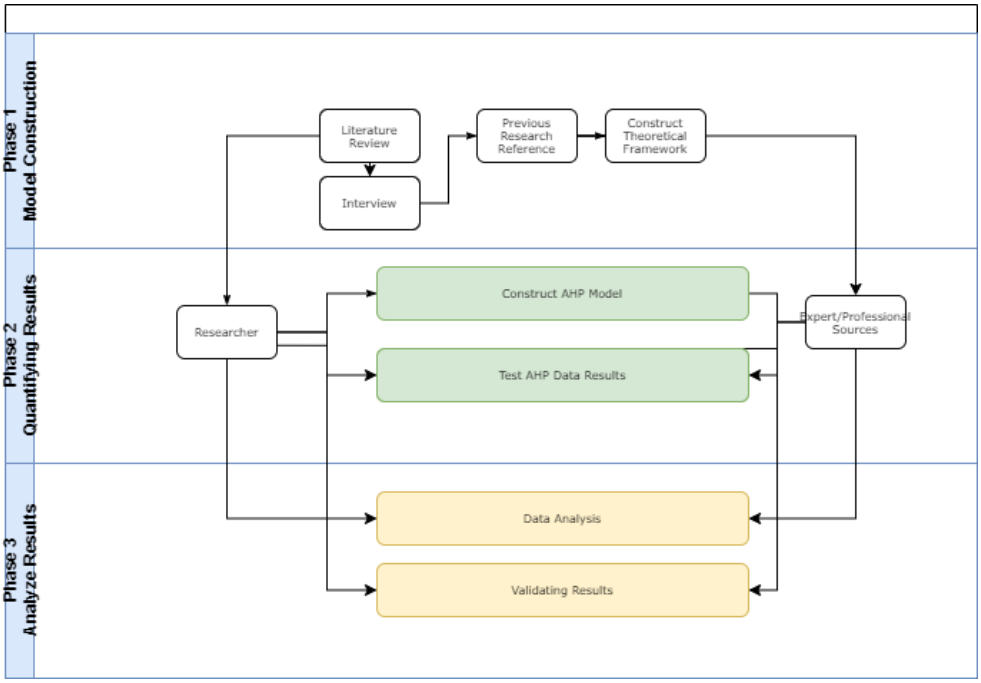



Figure 3.3: Research Phase

Based on the figure 3.3, the research phase is presented to establish the flow of research divided by 3 phases of research, which are detailed as follow:

a. **Phase 1- Model Construction:** Mainly involves the initial process of the research, conducting preliminary research and literature review through previous relevant documentation, in order to establish the research's theoretical framework

b. **Phase 2- Quantifying Results:** Quantifying Results are incorporated through compiling the collection of data obtained from the AHP research process, to be further processed into its conclusion
c. **Phase 3- Analyze Results:** Concluding phase of the research which involves summarizing the final findings of the research and present the conclusion as well as validating results.

## 4. Results and Discussions

4.1.1. Matrix Prioritization Result- Criteria Assessment

Based on the AHP method presentation, the criteria in regards to the research objective and review assessment, the researcher has managed to obtain and properly processed the result of the criteria comparison rate, in which was obtained from the respondents' results from the questionnaire. Based on the respective steps in AHP calculation, the researcher has utilized the transitivity threshold which would be useful to represent aggregate values obtained from multiple samples, which may present relatively diverse values in regards to the judgement of compared elements. In this respect, the values obtained out of the collective 38 respondents (n=38) has been calculated in terms of its respective consistency index, and has represented acceptable transitivity threshold to be considered and calculated as part of the matrix.

Therefore, the end result of the matrix for the criteria are presented as follow:

$$\begin{matrix} 1 & 1 & \frac{1}{2} & 1 \\ 1 & 1 & \frac{1}{3} & 1 \\ 2 & 3 & 1 & 3 \\ 1 & 1 & \frac{1}{3} & 1 \end{matrix}$$

**Figure 4.1 Matrix Calculation**
Source: Author's Calculation

In regards to the collective response of all of the sample, the researcher utilized transitivity index in order to accommodate to the relative issue regarding consistency index, given the sample obtained as well as the variable inputs obtained throughout the AHP research method.(Amenta, Lucadamo, and Marcarelli 2019)

Based on the matrix presented, the researcher has managed to conclude with the result value of the criteria assessment based on the 38 respondents, which are presented below:

Table 3. Matrix of Geometric Mean Method (GMM)

| Criteria | Geometric Mean Method (GMM) | Ranking |
|---|---|---|
| Investment Bias | 0.15 | 2 |
| Technological Acceptance | 0.13 | 3 |

| | | |
|---|---|---|
| Financial Literacy | 0.34 | 1 |
| Government Regulation | 0.11 | 4 |

Based on the Geometric Mean Method (GMM) the presented value results based on the total respondents presents significantly favourable result for Financial Literacy criteria (0.34) as one of the most important and influential criteria in affecting Investor's Investment Decision, followed with second marginal importance of Investment Bias (0.15), followed by Technological Acceptance (0.13) and Government Regulation (0.11). This result is emphasized with the normalized priority value presented below:

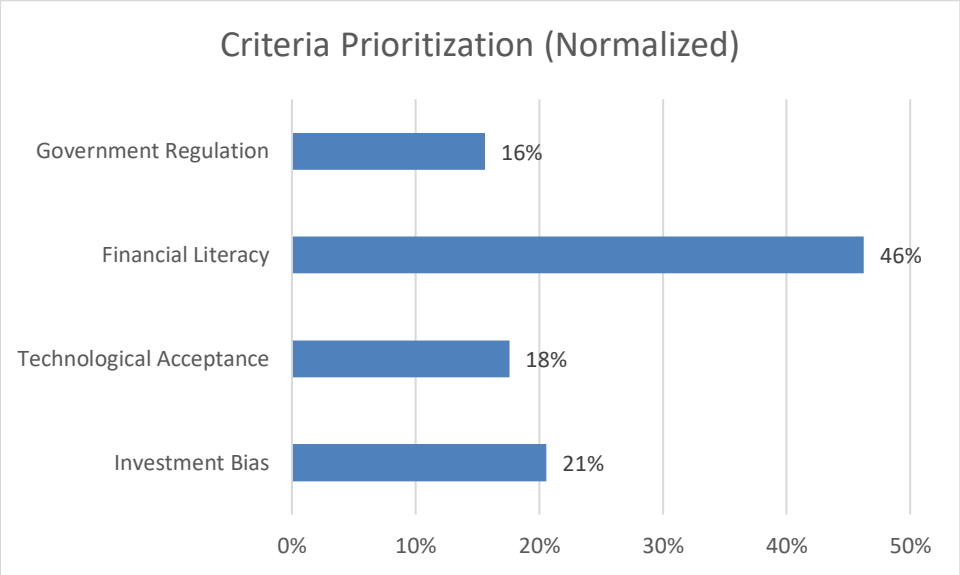



Figure 4.2. Criteria Prioritization Normalized

Table 4. Normalized Priority Values

| Criteria | Normalized Priority Values | Ranking |
|---|---|---|
| Investment Bias | 0.20563 | 2 |
| Technological Acceptance | 0.17581 | 3 |
| Financial Literacy | 0.46252 | 1 |
| Government Regulation | 0.15604 | 4 |

Based on the results of the criteria prioritization, It is conclusive that Financial Literacy (0.46) is the most important and most influential criteria in affecting Investor's Investment decision. The second most influential criteria in this research is Investment Bias, accommodating 0.21 of significance in affecting investor's investment decision. In this respect, the key takeaway is that Financial Literacy comprised the most important criteria in determining the quality and the consideration in investor's decision making in investment practice. In other words, investors with varying experiences, knowledge base, and skillsets in financial literacy would accommodate investor's capabilities in executing their decision making, and would determine the difference between each respective investors in regards to their understanding, perspective, and investment behaviour altogether.

4.1.2. Matrix Prioritization Result- Alternative Assessment

Based on this aspect, the matrix assessment on the alternative is obtained through the same method as did for the criteria. The priorities are collected through the aggregation of the respondents result from geometric mean results of the collective 38 respondents. In regards to the relatively acceptable consistency, the result of the matrix assessment on alternative prioritisation are as follows:

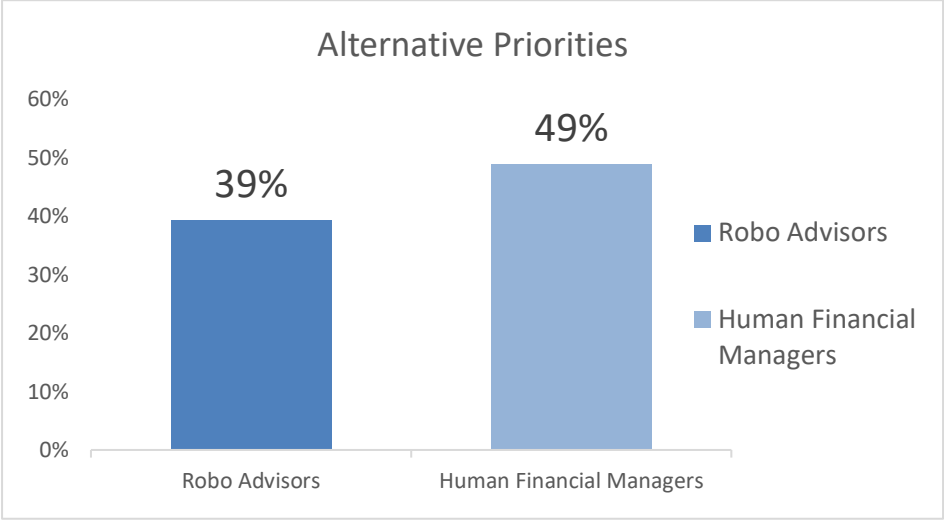



Figure 4.3. Alternative Priorites

The results shown that in regards to alternative prioritization, the results highlighted Human Financial Managers with 49% and 39% for Robo Advisors.

In summary, Human Financial Managers is regarded as the more important and more preferred alternatives as opposed to Robo Advisory, in regards to the response obtained in the scope of Indonesian investors. The key takeaway to this result is that Human Financial Managers are still the more preferred alternatives as most Indonesian investors still prefer the service and the insights possessed and serviced by human financial managers and not really in favor of the exposure of robo advisors. In addition, the lack of exposure accompanied with the struggle of technological implication to align toward Indonesian citizens, either due to lack of accessibility to technological gadgets or the lack of understanding in keeping up with the features of modern technology, in which emphasized with the growing market segment in robo advisory services albeit on its current early stages of implementation. In this respect, the most important criteria in affecting investor's investment decision would be Financial Literacy, and as Indonesian investors relatively consider the knowledge base of financial literacy within its population as the determining factor in the quality of investment decision, Human financial managers are still perceived as the favorable alternatives in reaching this approach.

## 5. Conclusions

The concluding remarks regarding the results obtained from the research is that through the research scope of Indonesian investor in the study case of Indonesian capital market, the research has concluded that in terms of influencing and affecting investor's

investment decision when it comes to executing investment practice, Financial literacy is regarded as the most important and indispensable quality traits in which must be developed and has the most significant impact towards how the investors behave in terms of allocating their capital to the financial investment activities. In addition, Financial Literacy is one of the criteria that is representative in terms of fundamental financial investment, since the level of financial literacy represent the skills, experiences, as well as knowledge base that differentiates investors. In this respect, the expertise and validity of financial advisory is best represented through financial literacy and is proven crucial for making proper financial investment decision. The second most influential criteria based on the research's findings is Investment Bias, which accommodate investors with the variety and difference in preference, as well as investment behavior which is translated into different patterns of investment decision. These two criteria represent the most influential criteria in which may influence investors' investment decision in financial market. Furthermore, in terms of alternative, Human Financial Advisors are the more preferred alternatives of financial advisory services amongst the respondents, which are representative to Indonesian investor. In this respect, Human Financial Advisors have more preference in regards to its accessibility and its stronger association with the influential criteria, as Robo Advisors are more strongly associated with Technological Literacy which may establish a barrier in its accessibility for potential users/investors that are not as technologically literate, thus handing over its relevance to the more conventional Human Financial Advisors.

In this regard, through the current development of Robo advisory in Indonesia, and considering its early development stage although increasingly mainstream and increasingly available features and platforms for the use of retail investors in Indonesia, the research still has concluded the lack of exposure and lack of preference in Robo advisors and more preference on Human financial managers/advisors as the alternative towards financial investment activities.

In summary, The research is expected to contribute to its purpose in outlining the topics regarding behavioral investment, and its complex association to investors' myriad behavioral pattern in establishing its investment decision, and how the continuous technological implication may attribute to the development in understanding the association of behavioral, qualitative aspect of investing outside of its quantitative, mathematical traits of investment analysis which may dominate most investment decision in the financial market.

The result of this research is expected to be able to provide the perspective, and document the situation in regards to Indonesian retail investor, in Indonesian capital market which represented the condition of the essence of financial investment practice in Indonesia, which accommodate more scope of investors due to increasing level of financial literacy and financial inclusion, with the current challenge and obstacle of technological acceptance to newfound and developing technological implication and utilization, which may be the main benefactor in terms of introducing and utilizing new technological features being introduced and provided to the general users. Therefore, the author has believed in which as the technology implication on Robo advisors continue to develop, the growth of its user base along with the technological utilization of Indonesian investors

would be able to align more to their behavior in practicing financial investment in the capital market.

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