Cognitive Bias and Emotional Bias in Investment Decision Making With Risk Perception Mediation

AnkkiPandia[1],
[1]Universitas Hayam Wuruk Perbanas, Faculty of Economic and Business
Surabaya, Indonesia

Abstract
This study aims to identify and analyze cognitive bias and emotional bias in investment decision making by mediating risk perception. The research design used is quantitative. The population in this study is limited to bank customers (individuals) who invest in Surabaya using 190 respondents as a sample. Data was measured using SmartPLS software version 3.0 PLS. The results of the study show that cognitive bias is not proven to have a significant effect on investment decisions. Emotional bias is not proven to have a significant effect on investment decisions. Risk perception has been shown to have a significant negative effect on investment decisions. Risk perception has been shown to be able to mediate the effect of cognitive bias on investment decisions. Risk perception is proven to be able to mediate the influence of emotional bias on investment decisions.

Keywords: Cognitive Bias, Emotional Bias, Risk Perception, Investment.

1. Introduction

With higher interest in investment, the development of investment in Indonesia is currently accelerating. Investment is the deposit of a number of funds now with the expectation of future profits. The goal of investing is to make purchases of one or more held securities, which often have a lengthy duration, in the anticipation of making a profit (Muklis, 2016: 223). Investment vehicles available in Indonesia include equities, gold, bonds, deposits, and real estate (Tandelilin, 2010:10). One of the investment products that the public is most interested in is stocks. This is demonstrated by the Jakarta Composite Index's (IHSG) rising value over time (Noviyanto, 2020: 42).

Portfolio is an important aspect of investing in financial markets. It is a collection of financial securities in a unit that is held or created by an investor, investment company, or financial institution. The portfolio will determine the desired return based on capital, objective and risk factors (Ferlianto, et al., 2016: 122). Alternative investments are investment choices that individuals use when investing their funds (Yuniningsih&Taufiq, 2019:25). As stated by Tandelilin (2010:11-14), the way to form an optimal portfolio is to maximize the expected returns at a certain level of risk that investors are willing to bear. Furthermore, Siagian (2018: 108) reveals that most portfolio theory is developed on types of securities such as bonds and stocks while for capital goods or long-term assets this is not done. Profits are received in the

form of net cash in flow, not accounting profit. This applies to all types of financial instruments including common stock, portefferent shares and convertible bonds.

Investor behavior regarding how to frame and assess decisions involving potential gains and losses relative to the type of financial instrument is explained through prospect theory. According to Nofsinger (2014: 6-7) prospect theory describes several statements that influence a person's thought process when making decisions. Emotional involvement, preferences, traits and various kinds of things that are inherent in humans often cause humans to not always behave rationally in making decisions. In addition, this theory explains how a person makes decisions in uncertain conditions. According to Kahneman and Tversky (1979:23-25), human behavior is considered strange and contradictory in making decisions and not always rational. Understanding psychological aspects is important in the process of making effective investment decisions.

One of the aspects in a person's decision-making process that can influence how they respond to investment risk is their psychological makeup. Afriani&Halmawati's (2019) description of the decision usefulness approach in the expected utility theory makes the assumption that investors are sane people. Those who pick the course of action that will result in the greatest expected utility after weighing the trade-off between the expected rate of return and the level of risk they would encounter when making investments.

Components of prospect theory include mental accounting, regret aversion, and loss aversion (Nofsinger, 2014:31-32). Mental accounting is a description of how a person carries out the accounting process which can only be learned by observing a person's behavior or inferring the rules that apply in society. Nofsinger (2014) claims that investors who use mental accounting when making judgments about transactions take into account the advantages and disadvantages of their choices. Investors will feel secure in that way. One of the many benefits of mental accounting is as a technique to aid in self-control, which leads to rational thought and the ability to make wise judgments, as well as to aid in the better understanding of financial issues.

Due to the propensity to generate incorrect predictions, the mental state that can influence the mental accounting process frequently leads to behavioral biases. Behavioral biases are alterations or prejudices that may influence a person's choice of investments (Civek, 2019: 202). Investors that suffer prejudice will disregard the available data and facts and, using all of their skills, will be able to draw their own conclusions, believing that their decision is the best one (Lekovi, 2020: 222). Psychologically induced bias prevents people from making wise financial decisions and causes them to overestimate the hazards that may arise. Cognitive bias and emotional bias are two types of bias that each person has that might affect their decision-making process when it comes to making investments (Pradhana, 2018). Investors that exhibit cognitive and emotional biases exhibit illogical conduct because they are unable to correctly translate information (Chou, et al., 2010).

People who suffer from cognitive bias feel uneasy with new information, which can lead them to have second thoughts about their prior perspective (Yuniningsih&Taufiq, 2019). This results from an imbalanced condition that develops when the cognitive process itself is inappropriate and a conflict results from recently learned knowledge that is different from previously understood information (Civek, 2019). Overconfidence, cognitive dissonance bias, and the illusion of control are three manifestations of cognitive bias (Pradhana, 2018). Due to its emphasis on feelings and spontaneity rather than logic, emotional bias is a deviation (Pradhana,

2018). A person's emotional state, which occurs when they're in a good mood, affects their likelihood of making the right choices and reducing the likelihood of making mistakes. People who are in high spirits will have a better probability of being able to think about how risk will affect their choice of investment (Rengku, 2012). Aspects of loss aversion bias, regret aversion bias, and status quo prejudice make up emotional bias (Pradhana, 2018).

According to the preceding statement, there are a number of research holes that require more investigation. First, it was discovered that investors frequently exhibit cognitive bias by Pradhana (2018), Setiawan, et al. (2018), Khilar& Singh (2020), and Kumar &Nayak (2019). These findings contrast with those of studies by Ali, et al. (2017), Afriani&Halmawati (2019), and Lekovi (2020), which found no evidence of a substantial impact of cognitive bias on investing choices. Second, it was discovered by Al-Dahana, et al. (2019) and Yuniningsih&Taufiq (2019) that emotional bias significantly influences investment decisions in a favorable manner. However, emotional bias based on elements of disposition effect and experience regret has little impact on investment decisions, according to Novianggie&Asandimitra (2019).

Cognitive bias and emotional bias not only have a direct impact on investing decisions but also indirectly alter risk perception, which in turn affects investment decisions. Risk perception is how an investor evaluates a risky scenario, and this evaluation is greatly influenced by the psychological traits and environmental factors of the person (Riaz, et al., 2012). Risky situations cause cognitive bias, which influences risk perception, whereas emotional bias occurs from judgements based on a person's psychological make-up and condition (Rengku, 2012). When making decisions under unclear conditions, risk perception is crucial (Sukamulja&Senoputri, 2019).However, Chou, et al., (2010) stated that risk perception has no effect on investment decisions.

This study aims to obtain empirical evidence about the effect of cognitive bias on investment decision making, the effect of emotional bias on investment decision making, the effect of risk perception on investment decision making, and risk perception mediating the effect of cognitive bias and emotional bias on investment decision making.

2. Theoretical Review and Hypotheses
2.1 Investment Decision
Investment decisions are related to decisions in placing funds in various assets, both financial assets and real assets (Frijns, et al., 2008: 111). Investment is a number of commitments to a number of funds or other resources that are carried out at this time, with the aim of obtaining a number of benefits in the future (Tandelilin, 2010:10-11). Investment decisions will be optimal if they can be achieved if investors make the right decisions by considering the risks and returns (Pompian, 2006:39). Decision theory is a theory about decisions that describes how someone makes decisions about something as a freedom that they have.

When making a choice, a person is presented with a number of options from which they must select one, weigh it against the others, and determine which will help them reach their objective. This suggests that behavior aimed at achieving goals through a variety of options is related to decision theory. Decision theory comes in two flavors: normative decision theory and descriptive theory. A decision must be made in accordance with normative decision theory, which is a theory of decision-making that can describe how a decision ought to be made.

Pompian (2006:19-21) states that investment decisions are based on two rational things of risk and profit, and are irrational related to financial behavior. Investment decision making is influenced by the extent to which investment decisions can maximize wealth and behavioral motivation, namely investment decisions based on psychological aspects of investors. According to Darmawan & Japar (2019: 11-12), investors will consider several factors before making an investment such as accounting information (all information about the company's financial statements), self image (company information about the company's reputation and position in the industry), classic (ability from investors in determining economic criteria), existence factors (considering whether the company is a national or international company) and professional recommendations (recommendations and suggestions from several people who are familiar with investment issues).

The indicators used in measuring portfolio investment decision variables are the percentage of investment in low-risk assets such as savings, deposits and the percentage of investment in high-risk assets such as housing, land, gold (Ainia & Lutfi, 2019). Variable measurement uses a nominal scale with a number code: (1) if the percentage of low-risk assets is greater than high-risk assets, and number (2) if the percentage of high-risk assets is greater than low-risk assets.

2.2 Cognitive Bias

People who suffer from cognitive bias feel uneasy with new information, which can lead them to have second thoughts about their prior perspective (Yuniningsih&Taufiq, 2019). This is an error in how information or facts should be understood, processed, and used to influence decisions. The three (three) components of the type of cognitive bias include overconfidence, cognitive dissonance bias, and illusion of control (Pradhana, 2018). The following are the indicators for disclosing measurements in accordance with the three components of cognitive bias as a measure:

1. Believe in self abilities
2. Believe in the knowledge owned
3. Aggressiveness in buying and selling investments
4. Degree of risk taking
5. Based on the initial information obtained
6. Doubt when there is other information
7. Ignoring information that conflicts with investment beliefs
8. Being careful in every investment decision.

2.3 Emotional Bias

Being emotional relates to a person's feelings at a certain moment can be good mood or bod mood which is an important part in the decision-making process, especially for decisions that have a high level of uncertainty. When in a bad mood, investors tend not to be able to properly assess risky situations, so they cannot make good and correct decisions (Rengku, 2012). Emotional bias has to do with how a person feels making decisions compared to how they think. Emotional bias can result in investors making less than optimal decisions because emotional bias is rarely realized in the decision-making process. Emotional bias consists of aspects of loss aversion bias, regret aversion bias, and status quo bias (Pradhana, 2018). In line with the three

aspects of emotional bias as a measure, the indicators for disclosing measurements are as follows:

1. Avoid losses rather than gains
2. Errors in making investment decisions
3. Is more conservative
4. Avoid change
5. Stay in the same condition (Pradhana, 2018).

2.4 Risk Perception

Risk perception is the result of many factors that form the basis of differences in decision making regarding possible losses (Chou et al., 2010). This is the process when someone interprets the information about the risk obtained. This is formed on views or thoughts about risk, even though risk is uncertain and can also differ from reality (Ainia&Lutfi, 2019). Risk and investment experience tend to show a positive relationship and successful past experience increases investors' risk tolerance (Riaz, et al., 2012). According to Chou et al., (2010) investors who obtain information from optimistic market reports have a lower risk perception. Besides that, information has a positive relationship to risk perception, so that the more information is received, the investor's risk perception will increasingly influence the expected rate of return. The indicators used in measuring risk perception are the right investment and will perform well, future investments have significant value, and investments have very good returns (Ainia&Lutfi, 2019).

In line with the three aspects of emotional bias as a measure, the indicators for disclosing measurements are as follows:

1. The investment chosen must be right and will perform well
2. The investment chosen has good performance and convincing results
3. The investment chosen will experience a significant increase in value in the future
4. The investment chosen will perform well in line with my goals
5. The investment chosen will have a very good rate of return in the medium and long term (Ainia&Lutfi, 2019).

2.5 Prospect Theory

Prospect theory emphasizes that a person does not always act rationally under risk and uncertainty, a person will be influenced by psychological factors and erratic behavior in making rational decisions (Novianggie&Asandimitra, 2019). Kahneman and Tversky (1979:206-207) suggest that prospect theory explains how decisions are made by humans whose results are uncertain in a situation. On the other hand, prospect theory relates to the idea that individuals do not always behave rationally. This theory states that there are persistent biases motivated by psychological factors influencing individual choices under conditions of uncertainty (Leković, 2020). Purchase decisions made by investors are not only based on rational considerations. Emotional aspects also influence investment decision making (Hlouskova, et al., 2017).

2.6 Behavioral Finance

Behavioral finance is a branch of economics that explains the irrational decisions of an investor (Kumar &Nayak, 2019). It focuses on applying psychological and economic principles to develop investment decision-making processes, where finance, psychology and investor behavior are integrated. The main logic of behavioral finance is that investors' decisions in financial markets are irrational as a result of cognitive and emotional prejudice (Mallik, et al., 2017). This is different from traditional financial research, which emphasizes the rational behavior of investors and explains the wrong decisions of people, and whether feelings of fear, greed and other psychological factors that can influence investors' decisions in financial markets are irrational for buyers and sellers (Ali, et al. , 2017). Thus they explain phenomena and anomalies that cannot be explained by rational theory, such as bubbles, crises, and mispriced financial instruments and financial decisions (Al-Dahana, et al., 2019).

Behavioral finance explains the factors for making financial decisions that give rise to investment alternatives as the basics of financial design and management (Al-Dahana, et al., 2019). Investment alternatives are investment choices that individuals use when investing their funds (Yuniningsih&Taufiq, 2019). The state of mind that can affect the investment decision-making process often occurs when behavioral bias occurs due to the tendency to choose wrong investment alternatives (Civek, 2019). Investors who experience bias will ignore existing information and facts and with all their abilities, they are able to conclude something on their own and believe that their choice is the most correct (Leković, 2020). Behavioral bias consists of cognitive bias (cognitive factors) and emotional bias (emotional factors) from within each individual which can influence it in making investment decisions (Pradhana, 2018).

Research Hypothesis
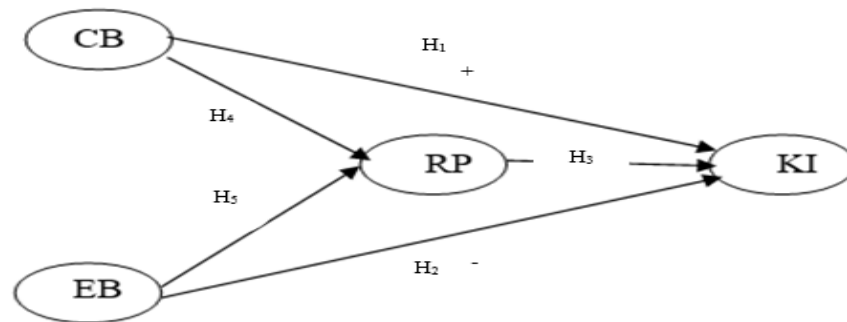
Where:

CB = Cognitive Bias; EB = Emotional Bias;

RP = Risk Perception; KI = Investment Decision

The hypothesis in this study is used to answer the problem formulation as well as research objectives. The following is the research hypothesis:

1. Cognitive bias has a positive effect on investment decision making
2. Emotional bias has a negative effect on investment decision making
3. Risk perception has a negative effect on investment decision making.

4. Risk perception mediates the effect of cognitive bias on portfolio investment decision making
5. Risk perception mediates the influence of emotional bias on portfolio investment decision making.

3. Method

This is a quantitative study with a survey research design. e. a study that takes samples from a population using a questionnaire as a data collection instrument (Morrisan, 2017: 5). The survey was conducted to obtain empirical evidence about risk perception mediating the influence of cognitive bias and emotional bias on portfolio investment decision making. Variables used in research can be classified into independent variables (free), control variables and dependent variables (dependent) with the following explanation:

1. Dependent variable (Y)
   The dependent variable that will be studied in this study is the investment decision.
2. Independent variable (X):
   The independent or independent variables that will be studied in this study are behavioral bias factors which include: Cognitive bias (X1) and Emotional bias (X2).
3. Mediating variable (Z)
   The mediating variable in this study is risk perception.

With 190 samples, the population in this study consists of bank clients (individuals) who invest in Surabaya. Using SmartPLS version 3.0 PLS (Partial Least Square) software, the inferential statistical data analysis in this study was measured in line with the hypothesis that has been formed, beginning with model measurement (outer model), model structure (inner model), and hypothesis testing (Ghozali, 2015 :32-33).

1. Result and Discussion

1.1 Description of Research Subjects

The description of the subject of this study describes the respondent's data such as gender, year of birth and last education. Respondents included 190 bank customers (individuals) who made investments in Surabaya.

The results of the descriptive characteristics of the respondents in this study are presented in the following table:

Table 4.1 Characteristics of Respondents by Gender

Gender	Frequency	Percentage
Male	74	38,9
Female	116	61,1
Total	190	100,0

Source: Processed data (2022)

Table 4.1 shows that out of 190 respondents, 74 r(38.9%) were male and 116 (61.1%) were female. Thus, the majority of respondents in this study were female.

Table 4.2 Characteristics of Respondents by Age

Age	Frequency	Percentage
21 – 25 Years old	67	35,3
26 – 30 Years old	61	32,1
31 – 35 Years old	46	24,2
36 – 40 Years old	16	8,4
Total	190	100,0

Source: Processed data (2022)

Based on Table 4.2, 67 (35.3%) of respondents were aged between 21-25 years, 61 (32.1%) were aged 26-30 years, 46 (24.1%) were aged 31-35 years, and 16 respondents (8 .4%) aged 36-40 years. Thus, the majority of respondents in this study were between 21-25 years old.

Table 4.3 Characteristics of Respondents by Education

Occupation	Frequency	Percentage
State Owned Enterprise	33	17,4
Civil servant	7	3,7
Private company	122	64,2
Businessman	21	11,1
Others	7	3,7
Total	190	100,0

Source: Processed data (2022)

Based on the table above, it is known that 33 (17.4%) of the respondents worked as BUMN employees, 7 (3.7%) worked as PNS/ASN, 122 (64.2%) worked as private employees, 21 (11.1%) worked as entrepreneurs, and 7 (3.7%) other jobs. Thus, the majority of respondents in this study work as private employees.

Table 4.4 Characteristics of Respondents Based on Income

Income	Frequency	Percentage
< Rp.5.000.000	120	63,2
≥Rp.5.000.000 - Rp.10.000.000	57	30,0
≥Rp.10.000.000- Rp.15.000.000	6	3,2
≥Rp.15.000.000 - Rp. 20.000.000	4	2,1
>Rp. 20.000.000	3	1,6
Total	190	100,0

Source: Processed data (2022)

Based on Table 4.4, 120 (63.2%) respondents had a monthly income of < IDR 5,000,000, 57 (30%) had an income of ≥ IDR 5,000,000 – IDR 10,000,000, 6 (3.2%) had an income of ≥Rp 10,000,000 – Rp 15,000,000, 4 (2.1%) had income ≥Rp 15,000,000 – Rp 20,000,000, and 3 (1.6%) had income >Rp 20,000,000. Thus, the majority of respondents has income < IDR 5,000,000.

Table 4.5 Characteristics of Respondents Based on Investment Period

Investment period	Frequency	Percentage
1-2 years	16	8,4
3-4 years	118	62,1
5-6 years	42	22,1
6-8 years	14	7,4
Total	190	100,0

Source: Processed data (2022)

Based on Table 4.5, 16 (8.4%) invested for 1-2 years, 118 (62.1%) invested for 3-4 years, 42 (22.1%) invested for 5-6 years, and 14 (7,4%) invest for 6-8 years. Thus, the majority of respondents in this study invested for 3-4 years.

Table 4.6 Characteristics of Respondents by Type of Investment

Type of investment	Frequency	Percent
Real assets	116	61,1
Financial assets	74	38,9
Total	190	100,0

Source: Processed data (2022)

Based on Table 4.6, 116 (61.1%) chose real asset investment and 74 (38.9%) invested in financial assets. Thus, the majority of respondents choose to invest in real assets.

Table 4.7 Characteristics of Respondents Based on the Percentage of High Risk Assets to Low Risk Assets

% High Risk / Low Risk	Frequency	Percentage
0 - < 20%	55	28,9
20 - < 40%	39	20,5
40 - < 60%	47	24,7
60 - < 80%	45	23,7
≥ 80	4	2.1
Total	190	100,0

Source: Processed data (2022)

Based on Table 4.7 the majority of respondents like to place on low-risk assets, such as savings and time deposits. Only a few respondents whose placements of high-risk assets approached or

even exceeded those of low-risk assets, which can be seen from the placement ratio of at least 8 percent, only 4 respondents or 2 percent of the total respondents.

1.2 Finding

Structural or internal models can show relationships or predictive strengths between latent variables or constructs based on the underlying theory. The stages of evaluating the inner model in this study are as follows:

1. R-Square

To gauge the structural model's prediction ability, start by calculating the R-Square for each endogenous latent variable. The R-square value is used as a model fit test when testing the structural model. If numerous exogenous latent factors have a considerable impact on endogenous latent variables, variations in the R-Square value can be utilized to explain the relationship. The model is strong, moderate, and weak, as shown by R-squared values of 0.75, 0.50, and 0.25. (Ghozali and Latan 2015). The following are the outcomes of this study's R-Square test:

Table 4.8R Square value

	R Square
KI	0,382
RP	0,781

Source: Processed data (2022)

According to Table 4.8, the cognitive bias (CB) and emotional bias (EB) variables account for 0.781 and 78.1%, respectively, of the variance in the risk perception (RP) variable, with the remaining variance being explained by other variables outside the model. The cognitive bias (CB), emotional bias (EB), and risk perception (RP) variables account for 0.31 or 31.9% of the variance in the investment decision variable (IC), with the remaining variance explained by other variables outside the model.

2. Direct Effect Testing

The next test, the bootstrap method, examines the impact of significance across variables by examining the parameter coefficient values and the statistical significance value T. (Ghozali and Latan 2015). The study's path coefficient results are listed below.

Table 4.9 Direct Effect Testing

	Coefficient	T-Statistics	P Values
CB -> KI	0,005	0,030	0,976
CB -> RP	0,380	2,714	0,007
EB -> KI	-0,029	0,160	0,873
EB -> RP	0,517	3,709	0,000
RP -> KI	-0,597	5,616	0,000

Source: Processed data (2022)

Based on the table above, it can be explained as follows:

a. The risk perception cognitive bias variable has a p-value of 0.007 0.05. As a result, risk perception is significantly impacted by cognitive bias.
b. The investment choice cognitive bias variable has a p-value of $0.976 > 0.05$. This indicates that cognitive bias has little direct influence on investment choices.
c. The risk perception emotional bias variable receives a p-value of 0.000 0.05. This implies that emotional bias directly affects risk perception in a substantial way.
d. The investment choice emotional bias variable has a p-value of $0.873 > 0.05$. This indicates that emotional bias has little to no influence on investment choices directly.
e. The impact of risk perception on investment choices has a p-value of 0.000 to 0.05. This implies that risk perception directly influences investing decisions in a substantial way.

3. Indirect Influence

Table 4.10 Indirect Influence Test

	Coefficient	T Statistics	P Values
CB -> RP -> KI	-0,227	2,404	0,016
EB -> RP -> KI	-0,309	2,943	0,003

Source: Processed data (2022)

An explanation of the data in the table above is provided below.
a. The t-statistic for the cognitive bias variable, which is mediated by risk perception on investment decisions, was $2.404 > 1.96$ and the p-value was 0.016 0.05. In other words, risk perception mediates the influence of cognitive bias on investment decisions, which suggests that cognitive bias indirectly has a major impact on investment decisions.
b. The t-statistic for the emotional bias variable, which mediates how much risk perception affects investment choices, is $2.943>1.96$ and the p-value is 0.0030.05. In other words, risk perception mediates the influence of cognitive bias on investment decisions, which means that indirectly emotional bias has a substantial impact on investment decisions.

5. Conclusion and Recommendation
5.1. *Conclusion*
The findings of this research are as follows:
1. cognitive bias significantly influenced investment decisions.
2. Emotional bias did not significantly affect investment decisions.
3. Investor decisions were significantly harmed by risk perception.
4. Risk perception could moderate the impact of cognitive bias on investment decisions.
5. Risk perception could balance the impact of emotional bias on investment choices.

5.2. *Limitation*
a. With R2 of 3.82 percent, the investment decision model was rated as weak.
b. While the research was conducted using the intended methodology, there was no great deal of participant participation in filling out the questionnaire.

5.3. Suggestion

Based on the finding, the suggestions in this study are addressed to:

1. Society
   a. In terms of cognitive bias, investment decisions made after acquiring knowledge had the lowest mean value. The researchers advise the general population to respond to information with greater caution and directly seek the truth from reliable sources. This is to prevent them from receiving in false perceptions.
   b. Related to emotional bias, the lowest mean dealt with preventing losses even when there was a chance of profits. According to research, those who desire to invest money are more selectiveon the investments they make. Many investments promise higher profits, but there is also a high danger of loss.
   c. The lowest mean value related to the chosen investment had strong performance and outcomes in terms of risk perception. According to researchers, there was a greater demand for information among consumers because they want to know everything there is to know about investing.

2. Further research
   a. Include demographic characteristics or research variables,such as herding bias, heuristic bias, prospect bias, market bias, and perceived performance
   b. Increase the sample size, particularly in some areas, to make the results more generalizable.

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