The Influence of Overconfidence, Representative Bias, and Risk Tolerance in Investment Decision Making: Evidence on Stock Investors in Indonesia

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Abstract: The purpose of this study is to analyze the influence of overconfidence, representativeness bias, and risk tolerance on investment decision making, in which psychological factors can influence investors in making investment decisions based on emotional and cognitive factors. The sample collection is carried out using a purposive sampling technique on 230 stock investors in Indonesia. The data are analyzed using the *Smart PLS 3.2.8* application. This study indicates that overconfidence, representativeness bias, and risk tolerance significantly influence investment decision-making.The practical implications of this paper encourage investors to be wiser in relying on their overconfidence, representativeness bias, and risk tolerance on making investments. It provides awareness and understanding about controlling emotional and cognitive biases in investment management, which can be very useful for decision-makers and professionals in financial institutions. This paper helps investors choose better investment tools and avoids the repetition of expensive mistakes, which occur due to failure to recognize bias and valuation errors that make us all vulnerable to failing to make investment decisions. Thus, it is necessary to focus on specific investment strategies to control "mental mistakes" by investors.

Keywords: overconfidence, representativeness bias, risk tolerance, investment decision.

过度自信，代表性偏差和风险容忍度对投资决策的影响：对印度尼西亚证券投资者的证据

摘要：本研究旨在分析过度自信，代表性偏差和风险承受能力对投资决策的影响。使用目标抽样技术对印度尼西亚的230名股票投资者进行了样本收集。使用智能偏最小二乘3.2.8应用程序分析数据。这项研究的结果表明，过度自信，代表性偏差和风险承受能力对投资决策有重大影响。本文的实际含义鼓励投资者在进行投资时要依靠他们的过度自信，代表性偏差和风险承受能力。它提供了有关控制投资管理中的情绪和认知偏见的认识和理解，这对于金融机构的决策者和专业人员而言非常有用。本文可帮助投资者选择更好的投资工具，并避免重复出现昂贵的错误，这些错误是由于未能认识到偏见和估值错误而导致的，这些错误使我们所有人都容易做出投资决策失败。因此，有必要关注特定的投资策略，以控制投资者的"心理错误"。

关键字：过度自信，代表性偏差，风险承受能力,投资决策。

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1. Introduction

Behavioral finance is a study of psychological factors that can influence investors in making investment decisions. After receiving information and facts from the company where it is invested, investors will make investment decisions based on emotional and cognitive factors. The problem is these two factors tend to be susceptible to deviation or bias. Behavior finance assumes that investment decisions can be irrational due to imperfect information [1], bound rationality [2], anomalies [3], fundamental heuristics [4], psychological bias [4] or behavioral bias [5], and

psychological or mental investors play a key role in understanding irrational decision making.

Cognitive bias is the process of understanding, processing, and drawing conclusions based on information or facts obtained. Cognitive bias describes deviations in the process, while emotional bias is an emotion that emphasizes feelings rather than facts. Emotional bias illustrates investors' mistakes in making decisions because of ignoring the facts.

In making a decision, investors tend to lead to overconfidence, which is an emotional bias. Overconfidence is related to how much prejudice or feeling about how well someone understands their abilities and limits their knowledge. That is supported by [5], which states overconfidence is a bias that pertains to how well people understand their abilities and the limits of their knowledge. The consequence of overconfidence is that investors will overestimate their ability to evaluate a company as a potential investment, tend to trade excessively (overtrading), and underestimate risk. As a result, it can produce a portfolio that shows poor performance [6]. Overconfidence causes investors to overestimate their knowledge, underestimate risk and overestimate their ability to control what happens. Investors believe that the investment will get a high return and has low risk, even though this cannot be guaranteed and may not happen because it may lead to wrong expectation. This type of bias can influence an investor's decision-making. In a study conducted by [7], investors who frequently buy and sell shares tend to have increased confidence. Overconfidence can cause investors to carry out excessive trade transactions that result in a low portfolio return obtained. [8-9] examine the theoretical relationship between self-confidence and trade frequency, which provides empirical evidence that male investors are more confident and more willing to take risks than women investors. Based on the results of [10], overconfidence has a positive influence on investment decision-making. Research with the same results is also found by [11] that overconfidence has a significant positive effect on investment decision making. Also from [12] reveals that overconfidence has a significant positive effect on investment decision making.

Representativeness bias is a mental shortcut and is defined as a tendency to connect one characteristic with another [13] irrationally. Investors affected by representativeness bias can become overconfident and may ignore the sample size and average returns on the investment. The consequence of representativeness bias is investors tend to adopt estimation based on small samples and trust their beliefs using simple classifications instead of complex data. [14] finds that representativeness bias has a significant positive influence on investment decision making in Islamabad Stock Exchange. The same thing is stated by [15] that representativeness bias significantly influences

investment decision-making. However, according to [16] research, representativeness bias significantly negatively affects investment decision-making.

Risk tolerance is how far a person chooses to experience less favorable risks to have the opportunity to obtain more favorable results [17]. Investors with a high level of risk tolerance mean giving greater tolerance to risks that can cause losses, making someone bolder in accepting risk. In comparison, investors with a lower level of risk tolerance mean having less tolerance for risk, so investors tend to choose to avoid risk. According to [18], the investigation of risk tolerance includes psychological factors and includes demographic, socio-economic, and attitude factors because considerations such as gender, age, marital status, income, and employment can influence individual level in risk-taking on daily money problems. According to research conducted by [12], risk tolerance has a significant positive effect on investment decision-making. Research with the same results conducted by [19] states that risk tolerance positively affects investment decision-making.

The novelty of this study is that it examines investor decisions that are influenced by psychological factors and include demographic, socio-economic, and attitudinal factors so that this study will provide more comprehensive results.

2. Literature Review

2.1 Investment Decision

The function of the financial manager is to find and analyze more than one investment alternative then an alternative investment decision is taken. This decision is very important to make the company grow. The more developed a company is, the more management must continue making investment decisions, such as business expansion, opening branches, or establishing other companies [20]. According to [21], investment can be defined as the commitment of funds to one or more assets held over some future period. Investment decision-making is how financial managers can allocate company funds in investments that will bring benefits in the future. In making investment decisions, several important factors are the basis for consideration in determining investment choices. These factors are demographic variables, such as age, gender, experience, education level, and income level [22].

According to [23], there are concepts in investment decisions. The first one is the expected rate of return. In the context of investment, it is necessary to pay attention to expected returns. The second is a risk. In investing, investors must be expecting high returns. However, it should be noted how much risk must be handled in investing. The third concept is the relationship between the level of risk and expected return. Ideally, the relationship between the level of risk and expected return is a parallel and linear

relationship. In [24] explained the indicators in investing, such as investor security, risk coverage, and future planning.

2.2 Behavior Finance

Behavior finance is parallel with the developments in the academic and business world. There are behavioral aspects in financial or investment decision-making. That is inspired by the increasing role of behavior as a determinant in buying and selling shares. The discussion on behavior finance is also conducted by [25]. [25] states that behavioral finance is a theory based on psychology that seeks to understand how emotions and cognitive deviations can influence investor behavior.

Emotional aspects or biases usually focus on feelings and spontaneity rather than the facts. The emotional bias can be in the form of overconfidence bias, loss-aversion bias, self-control bias, status-quo bias, endowment bias, regret-aversion bias, and greed bias. On the other hand, aspects of cognitive bias are deviation caused by information owned by investors, such as a brief assessment of a company without in-depth analysis. Cognitive bias can be in the form of representativeness bias, anchoring & adjustment bias, availability bias, self-attribution bias, conservatism bias, confirmation bias, and the illusion of control.

2.3 Overconfidence

One of the emotional biases is overconfidence. Excessive beliefs can be explained as unwarranted beliefs in a person's reasoning, judgment, and cognitive abilities. The concept of overconfidence is taken from many cognitive psychology experiments and surveys in which subjects exaggerate their predictive abilities and the accuracy of the information given to them. Investors who tend to have overconfidence overestimate their knowledge and underestimate their predictions. That is because investors believe they have high capabilities [26]. That happens because investors who have made two or three investment transactions already feel quite confident in their ability to make investment decisions.

According to [2], four mistakes often arise as a result of overconfidence behavior. First, overconfidence can cause investors to trade excessively because they think they have special knowledge that is not owned. Second, overconfidence can cause investors to underestimate risk. Third, overconfidence can cause investors to overestimate investment values. Fourth, investors may not diversify in their investment portfolios, which can increase the risks. Investor demographic factors such as age, gender, education, and investment duration or experience are expected to influence investor overconfidence. [8] and [27] conclude that men are more courageous in taking high-risk investment products because men tend to have overconfidence than women.

According to research conducted by [28], employees are more vulnerable to being overconfident because they already make their own money to make more investments. According to [16], overconfidence can be measured using indicators, such as knowledge of the stock market, confidence in their abilities, confidence to get more returns, investments to make money quickly, and having a better investment record.

There is a connection between overconfidence and investment decision-making. According to [29], rational investors are outnumbered by the overconfidence one. It can make the average investor's utilities decrease and cause aggressive trading when the overconfidence one sees an opening. Research conducted by [12] concludes that overconfidence has a significant positive effect in making investment decisions. Investors who have overconfidence in knowledge are optimistic and able to control portfolio performance. The same thing is stated by [16] that overconfidence has a positive and significant effect on investment decision-making. However, according to [30], overconfidence does not influence investment decision-making. Thus, the first hypothesis the researcher propose in this research is:

H1: Overconfidence influences Investment Decision Making.

2.4 Representativeness Bias

One of the cognitive biases is representativeness bias. Representativeness bias relies on stereotypes to form opinions or decisions that are fast but irrational [5]. Meanwhile, according to [13], representativeness bias is a person's mental shortcut and is defined as a tendency to connect one characteristic with another irrationally. Representativeness bias can make a person or investor simply think that if a company has a good performance, it will continue to the future performance and ignore the previous performance (good company means good investment). This bias also thinks that if the company has bad performance and fails, then the future performance will also result in bad performance.

There are two types of representativeness bias. The first one is the base level of neglecting which means that investor neglects other information that they think is wrong or irrelevant in investment decision making. The investor relies on their point of view without thinking of any other possibilities [2]. The second is neglecting the sample size, which happens when the decision-makers try to generalize the investment based on few samples [31]. [15-16] and [32] state that indicators of representativeness bias are avoiding investments that have a bad history, relying on past performance, analyzing past performance can determine future performance, considering past performance before investing, and thinking that well-known companies can provide good performance.

There is a connection between representativeness bias and investment decision-making. According to

[14], if investors want to follow their past trends, they will take information sharply and take advice from experts to make investment decisions. [33] finds a positive relationship between representativeness bias with investment decision making in the Islamabad Stock Exchange, which means investors can get more returns by using representativeness bias. The same thing is stated by [30] that there is a positive relationship between representativeness bias and investment decision-making. However, according to [16], representativeness can have a negative influence on investment decision-making. Thus, the second hypothesis the researcher proposes is:

H2: Representativeness bias influences investment decision-making.

2.5 Risk Tolerance

Risk tolerance is the level of an investor's ability to accept investment risk. According to [18], in making modern investment decisions, knowing one's risk tolerance is very important in developing investments and future financial plans, besides knowing one's goals, financial stability, and time horizon. The same thing is said by [34] that risk tolerance plays an important role in making decisions and achieving financial goals. Risk tolerance can help someone understand the level of risk from an investment and help the investors tolerate the existing risks to suit the investment objectives. Thus, the known risk can be accepted by investors following the level of return that will be received in the future. [35-36] describe that the indicators used to measure risk tolerance are choosing high-risk investments to get high returns, considering profits are more important than security, believing that risks do not always suffer losses, investing without consideration, and willing to accept if the investment fails.

Risk tolerance can affect investment decision making which can be influenced by several factors such as gender, age, income, education, and investment experience. Investors who are happy to take risks (risk seekers) can risk their assets to get a lot of returns, but investors who do not like risk (risk averter), prefer to get a small return rather than experiencing many losses. According to [12], risk tolerance has a positive and significant influence on investment decision-making. The same result can be found in the research conducted by [24] that risk tolerance significantly affects investment decision-making. [19] also state that risk tolerance has a significant influence on investment decision-making. Thus, the third hypothesis that can be formulated is:

H3: Risk Tolerance affects Investment Decision Making.

3. Methods

The population used in this research is that people in Indonesia who are interested in investing through stock ownership. As it is unknown how certain the community is interested in investing, the researcher takes the samples at least 10 multiplied by the number of questionnaire items [37]. Thus, this study takes 230 respondents, which are considered sufficient to represent the population.

The author uses a non-probability sampling technique that does not provide equal opportunities for each sample. This research is conducted by distributing questionnaires online during December 2019 through *WhatsApp*, *line messenger*, and email created using *Google Form*. Then, the results of the questionnaire are carried out by statistical tests using PLS (Partial Least Squares) software. Statistical tests are conducted to test the research hypothesis.

Overconfidence variable, according to [16], is measured using these indicators:
1. Knowledge of the stock market.
2. Confidence in one's abilities
3. Confidence to get more return
4. Investment to make money quickly
5. Have a better investment record.

Representativeness Bias is the tendency of investors to make decisions based on tangible characteristics only. Representativeness bias has a significant effect on investment decision-making. According to [15-16] and [32], indicators in the representativeness bias are:
1. Avoiding investments that have a bad history.
2. Relying on past performance.
3. Analyzing the past performance can determine future performance.
4. Considering past performance before investing.
5. Famous companies can give good performance

Risk Tolerance is how far a person chooses to experience less favorable risks to have the opportunity to obtain more favorable results. The indicators used in risk tolerance according to [35-36] are:
1. Choosing high-risk investments to get high returns.
2. Profit is more important than security.
3. Believing that risk does not always suffer loss.
4. Investing without consideration.
5. Willing to accept if the investment fails.

Investment Decision Making is a policy to determine the deposit of funds and how long they want to keep the funds. Indicators in investment decision making according to [24] are:
1. Investor security
2. Risk coverage
3. Future planning

The analytical method used in this research is the PLS (Partial Least Squares) method. According to [38], PLS is a predictive technique that handles many independent variables, even if multicollinearity exists between these variables. This method aims to determine the direct effect of each independent variable on the dependent variable and test the hypotheses that have been made in this study. PLS method suits this study because, according to [37], the use of PLS-SEM

method is to analyze data that do not have to be normally distributed, and the number of samples does not have to be large. In this analysis technique, there are an outer model test and inner model tests. The outer model test connects latent variables with indicators such as *convergent validity*, *composite reliability*, *Cronbach alpha*, and *cross-loading*. The inner model tests are structural models that describe the relationship between latent variables. There are 3 tests in the inner model:

    a.   R Square (Determination Coefficient)

According to [36], if the R-Square is 0.25, then the model is considered weak. If the R-square is 0.50, then the model is considered moderate. Meanwhile, if the R-square is 0.75, then the model is considered strong.

    b.   Q Square

Q square is also known as Stone-Geisser's. Q Square test is used to determine predictive capabilities. Q Square is considered large if the value is above 0.35, while it is considered moderate if the value is 0.15 and it is considered small if the value is 0.02.

    c.   Hypothesis test

The hypothesis can be tested using a significant level on the research model. A significant level can be seen from the T value. The T value must be above 1.96 if the model wants to be considered significant [39].

4. Research Result

Statistical analysis will be carried out by testing the outer and inner models. The outer model test is used to test validity and reliability. Furthermore, the inner model test is used to test the hypothesis, Q Square, and the coefficient of determination. The research model presented in Fig. 1 presents how each variable will relate to one another as a causal variable based on previous theoretical studies. The number of indicators

in each variable will be used for research. Data analysis using Smart-PLS application software.
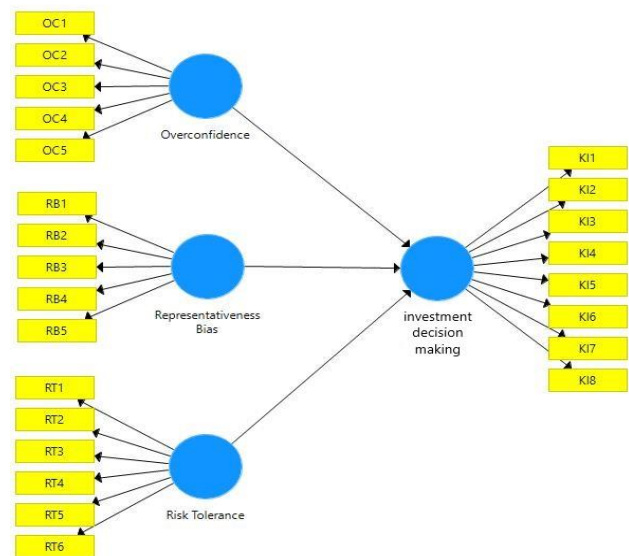

Fig. 1 Research model

In Fig. 1, the Overconfidence (OC) variable is measured by five indicators, five indicators measure the Representativeness Bias (RB) variable, six indicators measure the Risk Tolerance (RT) variable, and eight indicators measure the Investment Decision Making (KI) variable.

The cross-loading test is carried out to strengthen the validity test using Convergent Validity. The indicator is declared valid if it has the highest cross-loading value in the intended construct compared to other constructs. According to [37], this indicator must be greater than the same indicator from other variables in one line.

Table 1 Validity test with cross loading

	Overconfidence	Representativeness Bias	Risk Tolerance	Investment Decision
OC1	0.792	0.267	0.298	0.386
OC2	0.828	0.365	0.371	0.399
OC3	0.843	0.391	0.311	0.397
OC4	0.781	0.456	0.435	0.467
OC5	0.841	0.356	0.297	0.349
RB1	0.321	0.863	0.114	0.297
RB2	0.371	0.842	0.116	0.312
RB3	0.371	0.837	0.108	0.319
RB4	0.348	0.783	0.143	0.405
RB5	0.428	0.845	0.121	0.510
RT1	0.287	0.117	0.783	0.264
RT2	0.337	0.142	0.817	0.401
RT3	0.347	0.128	0.782	0.307
RT4	0.331	0.138	0.819	0.412
RT5	0.321	0.171	0.807	0.317
RT6	0.307	0.112	0.787	0.253
KI1	0.484	0.421	0.307	0.749
KI2	0.353	0.345	0.261	0.719
KI3	0.371	0.373	0.317	0.717
KI4	0.472	0.121	0.413	0.732
KI5	0.402	0.201	0.194	0.709
KI6	0.342	0.371	0.343	0.771
KI7	0.436	0.431	0.303	0.798
KI8	0.347	0.421	0.365	0.766

Cronbach's alpha, Rho_A, and Composite Reliability tests are examples of reliability tests. According to [39], the suggested construct value is> 0.7. The following is the reliability test presented in Table 2.

Table 2 Reliability test results

	Cronbach's Alpha	Rho_A	Composite Reliability
Overconfidence	0.832	0.861	0.897
Representativeness Bias	0.879	0.878	0.907
Risk Tolerance	0.837	0.838	0.885
Investment Decision	0.857	0.863	0.889

In Table 2, the variable OC (Overconfidence), RB (Representativeness Bias), RT (Risk Tolerance), and KI (Investment Decision Making) declared reliable because it has a value of Cronbach's Alpha and Composite Reliability above 0.7.

Inner Model Test. Determination Coefficient Test, Q Square, and Hypothesis testing obtained the following results are obtained:

Table 3 The result of R-square and Q-square (Own research with Smart PLS 3.2.8)

	R. Square	R Square Adjusted	Q^2
Investment	0.472	0.467	0.215

Table 3 shows that the R-Square Adjusted value of the Investment Decision Making variable is 48.70% and the remaining 51.30% is explained by other variables not examined in this study. The Q Square Test, also known as Stone-Geisser's, is used to know predictive capabilities. Q Square is considered large if the value is above 0.35, moderate if it is 0.15, and small if it is 0.02. In the table above, the value of the Q Square is 0.215. It means the prediction obtained is considered moderate.

To test the hypotheses, a t-statistic test is carried out. The criteria for accepting the hypothesis in this study must have a t-statistic value greater than 1.96, and the P values must be less than 0.05. The following hypothesis test results in this study are presented in Table 4.

Table 4 Hypothesis test results

	Original Sample	t-Statistic (O/STDEV)	P Values
OC -> KI	0.328	2.822	0.005
RB -> KI	0.278	2.601	0.017
RT -> KI	0.272	3.327	0.001

Table 4 shows the value of the overconfidence original sample of Investment Decision Making, which is 0.328. By looking at the t-statistic value of 2,839 and P-Values of 0.005, it can be seen that the overconfidence variable has a significant influence on Investment Decision Making. Therefore, the first hypothesis is not rejected.

Table 4 shows the value of the original sample of Representativeness Bias variable on Investment Decision Making, which is at 0.278. Representativeness Bias variable significantly influences Investment Decision Making with a t-statistic value of 2.561 and P-Values of 0.017. Therefore, the second hypothesis is not rejected.

Table 4 clearance variable for Investment Decision Making, which is at 0.272. The Risk Tolerance variable significantly influences Investment Decision Making with a t-statistic value of 3,327 and P-Values of 0.001. So thus, the third hypothesis is not rejected.

5. Discussion

Overconfidence is an exaggerated belief that can be explained as an unwarranted belief in an individual's judgment, reasoning, and cognitive abilities. In this study, overconfidence has a significant influence on Investment Decision Making. That means that the more confidence investors have, the more willing they are to choose investments with a higher risk because investors who have overconfidence will be more confident in investment decision-making. That shows that in making decisions, investors are influenced by overconfidence bias. The majority of respondents in this study consisted of young investors. Young investors could be affected by overconfidence bias because young investors have high enthusiasm and motivation to study the world of investment. The higher the level of overconfidence bias, the more confident the investors think that the investment plan will succeed because they feel they can predict and identify stocks that will be profitable in the future. The results of this study are in line with research by [40-44]. However, the results are different from the studies conducted by [30], which state that overconfidence does not affect individual investment decision-making.

Representativeness bias is the tendency of investors to make decisions based on tangible characteristics and past experience. The results of this study indicate that representativeness bias has a significant influence on Investment Decision Making which means they assume that past performance will be able to determine future performance, do not analyze deeply, and the only judge based on its characteristics, such as the term "good company means good investment ". In addition, it can also cause investor behavior to extrapolate past returns to future returns. That can happen because investors are encouraged by past stock performance. When investors have problems in investment, they will analyze based on the situation or experience they have in the past. Investors will think that the problems faced today are relatively the same as those experienced in the past. They will try to solve the current problem with the previous way without further analysis. In addition, investors are unwilling to invest in shares owned by companies that produce products or services where the morale is inappropriate or inappropriate (for example,

adult entertainment companies, tobacco, or using child labor). This behavior also makes investors in Indonesia behave rashly in making investment decisions. This rash behavior reduces the complexity of analyzing investment information because investors will not think long in analyzing information relating to the purchase of shares. Information about the stock price is not analyzed, but the investors immediately decide that the stock is worth buying without looking at fundamental or technical analysis. From experience, the concept and mindset of an investor can change quickly. That is what makes investors think stereotypically. If they think the investment is good, then forever it will be good. The results of this study are supported by research conducted by [14], [42], [45-49]. However, different research results are conducted by [16], who state that representativeness bias has a negative effect on investment decision making.

Risk Tolerance is a benchmark or level of an investor's ability to accept investment risk and is considered a factor influencing investors in making investment decisions. This study indicates that Risk Tolerance has a significant influence on Investment Decision Making, which means that if investors can determine themselves to have risk tolerance based on instruments, investment objectives, profits, and investment funds, investors will be easier to make investment decisions. Risk tolerance is related to emotional factors towards investment decisions. The feeling of investors who are afraid of losses will affect their decisions in determining risk tolerance. Investors should find it easy to determine appropriate risk tolerance if investors have determined risk tolerance based on instruments, investment objectives, profit potential, and investment funds. Therefore, it is very important to understand the loss incurred to get the profit following expectations. That way, investors can adjust the investment portfolio in accordance with the specified risk tolerance. Therefore, investors need to understand the extent of their ability to accept risks in investment decision-making so that the benefits and risks borne are in line with expectations. Researches with the same results are also conducted by [24], [50].

6. Conclusion

Based on statistical tests, hypothesis tests, and discussion, the research can be concluded that overconfidence has a significant influence on investment decision making. Potentially, overconfidence can cause investors to make investment mistakes. Representativeness bias has a significant influence on investment decision-making, which can cause investors to increase the intensity and amount of investment and be more courageous in taking investment risks. Risk tolerance has a significant influence on investment decision-making; thus, investors need to understand the extent of their ability

to accept risks in investment decision-making. The benefits and risks borne are in line with expectations.

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