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The Relationship Between Thinking Ability, Emotional Intelligence, and Decision-Making

Thuc Duc Tran [1*], Thong Van Pham [2]

[1] *Ho Chi Minh University of Banking, 56 Hoang Dieu 2, Thu Duc, Ho Chi Minh City, 70000, Viet Nam.*

[2] *Faculty of Basic Sciences, Thu Duc College of Economics and Technology, Viet Nam.*

Abstract

Despite a significant amount of research on decision-making, academics find it difficult to explain the decision-making process. The purpose of this paper is to examine the relationship between emotional intelligence, thinking ability, and decision-making, as well as develop measurement instruments for thinking ability to better model decision-making. By following a deductive research approach associated with positivist philosophy, a cross-sectional study was conducted and surveyed 547 respondents in South Vietnam via email sent randomly by Google Forms using a convenience sampling method. To avoid common method bias, the reliability and validity of all items were assessed by Cronbach's alpha and using the SPSS program. Then, to assess the structural model and test hypotheses, partial least squares structural equation modeling was applied using the SmartPLS program. The findings not only have proven the significantly positive effects of emotional intelligence and thinking ability on decision-making but also highlight the suitability of the measurement instruments related to thinking ability in explaining decision-making that no research has ever built before. Based on the findings, this research opens up a novel research approach to decision-making and provides the foundation for policymakers and managers to improve decision-making efficiency and human resource quality.

Keywords:
Thinking Ability;
Emotional Intelligence;
Decision-Making;
TED Model.

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1- Introduction

The fifth industrial revolution, with a focus on humans and robots working together, was the trend that many firms needed to consider regarding their company strategy. Nevertheless, humans are still at the center of decision-making, requiring effective and high-quality decisions [1]. Recognizing the significance of decision-making, over the last two decades, numerous scholars have focused their emphasis on cognitive science, behavioral economics, academic marketing, and organizational behavior to clarify the decision-making process. Most previous studies focused on emotional and rational aspects to show how emotions or rationality impacted the decision-making process [2–6]. Despite this, few studies have examined whether rationality and emotions should be used while making decisions [6]. As a result, the first aim of this research is to examine the effects of emotions and rationality on decision-making.

In terms of the relationship between emotions and decision-making, former researchers indicated that emotional intelligence played an important role in shaping decision-making as well as having a strong effect on decision-making [2, 5, 7–12]. However, if addressed in specific situations (e.g., within organizations or under time constraints), decisions based on emotions continue to have significant limitations [13], since emotions are powerful, ubiquitous, and foreseeable, sometimes detrimental, and sometimes helpful decision-making drivers [14]. In line with this, Lerner et al. [14] revealed that emotion and decision-making research was still in its initial stages, and the majority of research was conducted in laboratory settings. Hence, the second aim of this study is to identify the components of emotions that are able to make effective and useful decisions and apply them in operation.

* **CONTACT**: thuctd@hub.edu.vn

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In essence, decision-making is an unstable, convoluted process that involves emotional and rational aspects [2, 3, 13]. Additionally, decision-making based on emotional intelligence is not optimal, and other factors need to be considered in the process of understanding the situation, such as cognitive factors [2, 6]. Bruch & Feinberg [2] indicated that cognitive factors played a significant role in shaping decision-making; specifically, the final decision would be made when going through cognitive processes, which involved consideration of irrelevant or unattainable options [15]. In addition, Taleb [16] asserted that traditional intelligence measures (e.g., general intelligence, reasoning ability, understanding of alternatives and their implications) commonly failed to predict or assess "Black Swan" occurrences, which were unusual and unpredictable but extremely significant. The intellect was frequently limited in recognizing and dealing with unusual events [17]. It is challenging to discover a scale that is both practical and highly general for evaluating human cognitive aptitude in a certain sector. Therefore, the third aim of this research is to develop a new set of scales to assess cognitive competency (thinking ability) in an operational setting and in any specific sector to better provide high-quality decisions.

On the other hand, decision-making is frequently regarded as complicated individual behavior since it is influenced by a variety of personal characteristics such as attitudes, beliefs, and behaviors [18]. Similarly, Sahu et al. [3] considered that decision-making behavior was a result of factors affecting the intentions after receiving the beliefs and values (behavioral beliefs, normative beliefs, control beliefs) through the reasons (reasons for and reasons against) and global motives (attitude, subjective norm, perceived behavioral control). In this approach, numerous studies have been conducted based on behavioral theories such as field theory (FT), cognitive dissonance theory (CDT), theory of reasoned action (TRA), spreading activation theory (SAT), expectancy-value theory (EVT), decisional balance theory (DBT), theory of planned behavior (TPB), theory of explanation-based decision-making (TEBDM), technology acceptance model (TAM), reason theory (RT), unified theory of acceptance and use of technology (UTAUT), and behavior reason theory (BRT) to explain decision-making. Nevertheless, this approach has four fundamental gaps, including context (primarily limited to marketing and consumer behavior areas), study design (a lack of causality and common method biases), mediation and moderation effects in SEM, and external influences [3]. Besides, most previous studies concentrated on factors (subjective norms and perceived behavioral control) impacting attitudes and intentions in the decision-making process [19–22]; however, the emotional and rational aspects of attitudes and intentions were not strong enough to make the final decision and corresponded to remembering or knowing levels [23, 24]. Based on these arguments, the last aim of this research is to build up a research model that combines both emotional and rational factors in explaining decision-making and considers the mediating role of rational factors in the relationship between emotions and decision-making.

Based on the research aims and gaps linked to decision-making in this field, the research approach was identified, and it will be explained in detail in the section of the literature review to show how this research was more distinctive than others. To improve the limitations of previous studies related to emotions and rationality in explaining decision-making, the ability model by Salovey & Grewal [25], the theory of emotional intelligence by Goleman [5], and the taxonomy of educational objectives by Bloom et al. [26] were applied. By constructing the research model from the ability model, the theory of emotional intelligence, and the taxonomy of educational objectives, this research model can enhance the process of individual reaction to an emotional situation and then adapt the appropriate behavior to resolve this situation. Furthermore, through the mediating role of thinking ability in the relationship between emotions and decision-making, the components of emotions will go through a cognitive process to make an effective and quality decision. Based on the findings, practical and theoretical implications will be proposed for policymakers and managers to improve decision-making efficiency regarding future policies and strategies.

The remainder of this research is organized into five sections. Section 2 synthesizes the available literature in order to adopt the theoretical framework of the research and develop the research hypotheses. Section 3 describes the research methodology, including data collection and analytic methodologies. Section 4 will provide the findings, and Section 5 will go through them in depth. The last section will discuss the limits and future research.

2- Literature Review and Hypothesis Development

2-1- Literature Review

Decision-making is the process by which a person, group, or organization recognizes a choice or judgment to be made, gathers and evaluates information regarding alternatives, and then selects from among the options [27]. According to Bruch & Feinberg [2], making decisions requires a significant amount of cognitive work. In other words, the cognitive process is the first stage in the decision-making process before assessing the acquired information, and the greatest degree of this process is creation. In line with this, according to Sevdalis et al. [11], while empirical research has emphasized the importance of emotions in decision-making processes, individual variations in emotion perception and experience have been largely disregarded. In other words, when individuals make decisions, they frequently consider the emotions that the consequences are likely to elicit [11].

To provide a strong explanation for this study approach, the authors carefully evaluated various papers in this area and identified four major findings linked to the interaction between cognitive competency, emotions, and decision-making:

- Most previous studies indicated a relationship between cognition and decision-making [4, 28, 29]. Although these studies demonstrated several aspects of cognitive competence (general intelligence, working memory, etc.) in relation to decision-making, they were not able to show how the cognitive process worked when receiving information.
- A large number of former scholars have identified the relationship between emotions and decision-making [2, 25, 30, 31]. As mentioned above, in this approach, the outcomes of a decision may be detrimental or helpful, and they are hard to control. As a result, the objective to consider is how to make decisions that are helpful rather than harmful under the influence of emotions.
- Numerous studies have demonstrated the relationship between emotions and cognition (e.g., attitude, intention, etc.) [19, 20, 22, 32, 33]. These studies emphasized the effect of emotional components (such as emotional states, fear, sadness, etc.) on attitudes or intentions. Nevertheless, attitudes or intentions were regarded as a low extent of the cognitive process (e.g., remembering or knowing) that could make a decision (applying). In line with this, Miles [34] indicated that TPB theory also assumed a behavioral approach in one's environment that induced intentions and behaviors, ignoring individual processes and perceptions such as personality and outcome expectations [35].
- Few studies have recognized the relationship between cognition, emotions, and decision-making [2, 36]. These studies highlighted the role of cognitive factors in conjunction with the relationship between emotions and decision-making [2]. However, cognition in these studies was limited to recognition (knowing) and recall (remembering), as well as being absolutely inadequate for making critical choices (such as choosing a life partner or implementing a company strategy) that required humans to analyze and evaluate [2].

According to these findings, this study approaches decision-making by examining the relationship between cognitive competency (thinking ability), emotions (recognizing emotions, using emotions, understanding emotions, and managing emotions), and decision-making. The attributes of cognition here are the results of learning and life experiences corresponding to the taxonomy of educational objectives [26]. The emotions here are the four-branch model of emotional intelligence of Goleman [5] and Salovey [25]. The unique aspect of this approach is that the components of emotions will go through a cognitive process from low to high (remembering to evaluating), and the outcome is an effective decision.

The cognitive domain of the original taxonomy of educational objectives contains six levels structured in a hierarchy: knowledge, understanding, application, analysis, synthesis, and evaluation. Then, the revision released in 2001 [37] by Lorin Anderson and his associates, A Taxonomy for Learning, Teaching, and Assessing: A Revision of the Taxonomy of Educational Objectives, received the most acceptance. As a result, objectives developed using the revised taxonomy now explain cognitive processes rather than behavior. The updated Taxonomy of Educational Objectives includes the following categories: remembering, understanding, applying, analyzing, evaluating, and creating.

Regarding the theory of emotional intelligence (EI), Goleman [5] provided five fundamental features or abilities, including: knowing one's emotions; managing emotions; motivating oneself; recognizing emotions in others; and handling relationships. Then, Goleman [38] continued to develop a performance-based EQ model to measure employee emotional intelligence for identifying possibilities for development by making up five parts of the model, such as self-awareness, self-regulation, social awareness, and relationship management. Besides, to evaluate one's emotion-related abilities, Salovey & Grewal [25] provided the four-branch model of emotional intelligence and its usefulness as a guiding framework for emotion research. The four-branch model of emotional intelligence by Salovey & Grewal [25] addresses the following components: perceiving emotions, using emotions, understanding emotions, and managing emotions.

Recognizing the significant contributions of the theory of emotional intelligence [5] and ability model [25], this study proposes four main components of emotional intelligence that will be examined in relation to thinking ability and decision-making, including recognizing emotions (REC), using emotions (USE), understanding emotions (UND), and managing emotions (MAN).

2-2- Hypothesis Development

Alkhatib [39] defined thinking as the ability to challenge and eventually improve acquired information to a higher level of attainment. These processes begin with the stages of learning and retaining fundamental knowledge, which is a basic precondition to assisting the human cognitive process in moving to a higher level of applying the information to solve issues, matching the taxonomy of educational objectives [26]. This is the basic ability of the mind to receive information from its surroundings and produce consciousness, cognition, and problem-solving. People may make their

decisions based on the consequences of this cognitive process [11]. People can make decisions based on the outcomes of this cognitive process [15, 40, 41]. Therefore, the first hypothesis is proposed:

H1: *Thinking ability has a positive effect on decision-making.*

Recognizing emotion is the capacity of humans to recognize their emotional states in order to aid in the processes of analysis, thinking, judgement, and control, with emotions being used to lead to understanding and problem solutions [5, 42]. According to Mayer & Salovey [42], emotion recognition enables people to recognize and input information from their emotional systems, both verbally and nonverbally. These fundamental information-gathering mechanisms are required for the later generation of emotional information for problem-solving. Typically, the physiological origins of an emotion occur before a person is cognitively aware of the experience itself [5]. Based on the above arguments, the proposed hypotheses are as follows:

H2: *Recognizing emotions has a positive effect on decision-making.*

H3: *Recognizing emotions has a positive effect on thinking ability.*

According to Yates and Zukowski [43], each individual can select or integrate various signals in a similar circumstance. To reach a final choice, each individual must utilize emotions to analyze, interpret signals, and examine all sides of the situation [11]. Besides, Schutte et al. [31] indicated that students had the capacity to employ emotions intentionally to help the thinking process, considering, judging, and making decisions. Mellers et al. [44] concluded that emotions people expected or had experienced as a result of their decisions were major predictors of their current and future behavior. On that basis, the following hypotheses are proposed:

H4: *Using emotions has a positive effect on decision-making.*

H5: *Using emotions has a positive effect on thinking ability.*

Emotional understanding is defined as the ability to comprehend emotions and interior states, in addition to the reasons for and development of emotions, to deduce the operating laws of emotions in oneself and others [31, 42]. According to Goleman [5], understanding others' feelings and accepting their perspective, as well as appreciating variances in how others feel about things, are all important social skills. Acquiring knowledge to be an effective listener and question-asker; distinguishing between what an individual says or does and your own responses and judgments; being assertive rather than angry or passive; and learning the arts of cooperation, conflict resolution, and negotiating compromise are all priorities [5]. Hence, the following hypotheses are proposed:

H6: *Understanding emotions has a positive effect on decision-making.*

H7: *Understanding emotions has a positive effect on thinking ability.*

Emotional management refers to students' capacity to control and self-regulate their emotions in order to encourage and assist the attainment of a certain work objective; it also refers to students' ability to control or affect the emotions of others [42]. In the study of Salovey & Grewal [25], the capacity to regulate emotions in ourselves and others is referred to as emotion management. Lerner and Shonk [45] investigated the impact of residual anger on decision-making and discovered that decision-makers who had to be responsible for their judgments were better at regulating the consequences of their anger. In other words, being aware of one's feelings and regulating them in difficult circumstances can allow one to make more effective decisions. Thus, the following hypotheses are proposed:

H8: *Managing emotions has a positive effect on decision-making.*

H9: *Managing emotions has a positive effect on thinking ability.*

Based on the proposed hypotheses and research approach, the following research conceptual model was proposed:

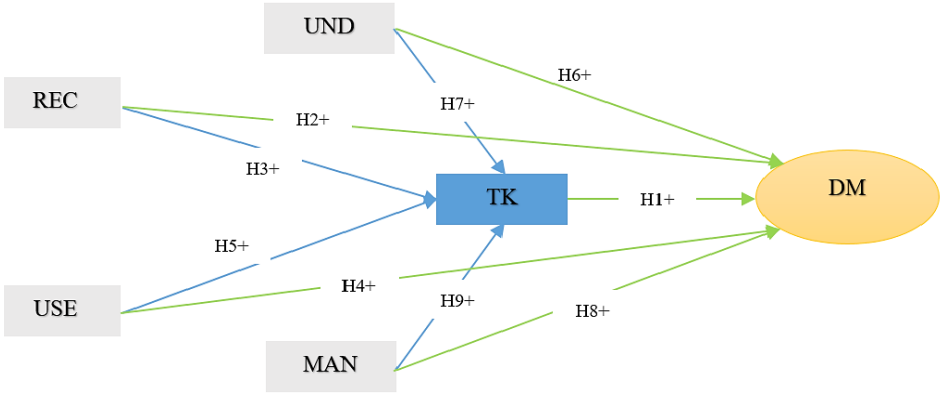

Figure 1. Conceptual framework of emotional intelligence, thinking ability and decision-making *(TK: Thinking ability; REC: Recognizing emotions; USE: Using emotions; UND: Understanding emotions; MAN: Managing emotions; DM: Decision-making)*

3- Research Methodology

3-1- Respondents and Procedures

As the approach of this study was to examine a model constructed from the ability model by Salovey & Grewal [25], the theory of emotional intelligence by Goleman [5], and the taxonomy of educational objectives by Bloom et al. [26], a deductive approach was deemed most appropriate for method creation [46]. The technique of this study was separated into two parts, which incorporate qualitative and quantitative methods.

Phase 1 consisted of qualitative research to construct the theoretical framework as well as the measuring tools based on the literature review. The assessment scales were developed in collaboration with a group of focus specialists (6 participants, including 5 doctors and 1 PhD student in this subject). The authors performed a survey with 30 university students to test the clarity and understanding of questions after they were translated into Vietnamese by a Bachelor of English, then changed based on the input and used structured questionnaires for the main study (Appendix I).

In Phase 2 (the quantitative research), to prevent common method bias, Cronbach's alpha and the SPSS programme were used to analyse the reliability and validity of all items (presented in part 3-2-Measurement Instruments). The collinearity test was then performed, and all VIF values were less than 3.3 [47]. As a result, the common method bias was avoided. After checking the common method bias, the assessment of the measurement model will be conducted (convergent validity, composite reliability, and discriminant validity) following the conditions of Hair et al. [48] by SmartPLS software. The authors next propose using Partial Least Squares Structural Equation Modelling (PLS-SEM) to evaluate the structural model and test hypotheses because it pertains to analysing the intricate relationships between the numerous indirect and direct consequences [48].

Regarding the respondents in the main study, the authors propose that the study focuses on university students due to the consistency in some characteristics (such as age, knowledge, skills, life experience, and source of income primarily dependent on the family due to only graduating from high school). Furthermore, the respondents were chosen in part using the Invitro approach, which allows for the simple elimination of additional bias variables when surveying a large number of samples that fit the overall research parameters. A total of 2000 questionnaires were issued at random to university students in Ho Chi Minh City through Google Forms, and 620 responses were collected, of which 547 were valid and utilized in the study.

3-2- Measurement Instruments

The construct measurement scales of this study were developed from the literature. Following the results after testing reliability, the scales to measure thinking ability (seven items, $\alpha = 0.895$) were adapted from the taxonomy of educational objectives [26]. The scales to measure recognizing emotions (seven items, $\alpha = 0.828$), using emotions (six items, $\alpha = 0.835$), understanding emotions (six items, $\alpha = 0.822$), and managing emotions (six items, $\alpha = 0.833$) were adapted from Goleman [5] and Salovey & Grewal [25]. The scales to measure decision-making (seven items, $\alpha = 0.838$) were adapted from Carroll & Johnson [27] and Elwyn & Miron-Shatz [18]. The responses ranged from strongly disagree (1) to strongly agree (5) on a five-point Likert scale. A detailed description of the measurement instrument is shown in Appendix I.

4- Research Results

4-1- Respondent Profile

The brief respondent profile for this study is presented in Table 1. Most respondents were female (82.1%) and studied for 1 year (58.7%). Regarding the place of birth and university, many students came from Regions 2, 3, and 4 (78.2%), and all studied at HUB (Ho Chi Minh University of Banking), accounting for 100%.

Table 1. Demographic characteristics

Indicator	Value	N/647	Percentage
Gender	Female	449	82.1
	Male	98	17.9
Student	Freshman	321	58.7
	Sophomore	112	20.5
	Junior	76	13.9
	Senior	36	6.6
	Graduate student	2	0.4
Place of birth	Region 1	119	21.8
	Region 2	260	47.5
	Region 3	130	23.8
	Region 4	38	6.9
University	HUB	547	100

4-2-Assessment of the Measurement Model

In terms of variable reliability and validity, Cronbach's Alpha and composite reliability (0.7) standards [49] were used. The minimum α and CR values were 0.801 and 0.871, respectively. After evaluating the measurement model, the initial scales with 39 items have been eliminated with 10 items (REC1, REC2, REC7, USE1, UND1, MAN4, MAN5, DM1, DM3, DM5) due to the outer loading < 0.7. As a result, 29 components were used in the structural model analysis (Table 2).

Table 2. Outer loadings, reliability and convergent validity

Variables	Items	Loading	α	CR	AVE
Thinking ability	TK1	0.716	0.896	0.919	0.619
	TK2	0.749			
	TK3	0.832			
	TK4	0.839			
	TK5	0.824			
	TK6	0.718			
	TK7	0.823			
Recognizing emotions	REC3	0.832	0.801	0.871	0.628
	REC4	0.817			
	REC5	0.788			
	REC6	0.730			
Using emotions	USE2	0.785	0.820	0.874	0.581
	USE3	0.765			
	USE4	0.762			
	USE5	0.768			
	USE6	0.733			
Managing emotions	MAN1	0.812	0.839	0.892	0.675
	MAN2	0.840			
	MAN3	0.844			
	MAN6	0.788			
Understanding emotions	UND2	0.790	0.835	0.884	0.603
	UND3	0.737			
	UND4	0.760			
	UND5	0.809			
	UND6	0.784			
Decision-making	DM2	0.730	0.806	0.873	0.633
	DN4	0.819			
	DM6	0.782			
	DM7	0.846			

Related to convergent validity, the threshold of the average variance extracted (0.5) and the minimum outer loadings (0.6) were commonly applied [50, 51]. In this study, the factor loadings were higher than 0.7 and the AVE values were above 0.5; hence, the convergent validity was assured (Table 2).

In addition, the Fornell-Larcker criterion and the Heterotrait-Monotrait ratio (HTMT) were used to examine the measurement model's discriminant validity. Garson [52] states that the HTMT number should be less than 1. Therefore, this study's discriminant validity was assured, and all values were less than one (Table 3).

Table 3. Heterotrait-monotrait ratio (HTMT) – Matrix

Items	1	2	3	4	5	6
1. DM						
2. MAN	0.794					
3. REC	0.653	0.649				
4. TK	0.720	0.614	0.715			
5. UND	0.762	0.766	0.788	0.771		
6. USE	0.688	0.692	0.767	0.782	0.824	

4-3-Assessment of the Structural Model

Regarding the hypothesis testing and structural directions, the findings are shown in Table 4. Most path coefficients are found to have significant levels of 1%, except for the relationships between managing emotions → thinking ability, recognizing emotions → decision-making, and using emotions → decision-making. Therefore, all the hypotheses will be accepted apart from H2, H4, and H9. Particularly, H1, H3, H5, H6, H7, and H8 were accepted with a significant level of 1%. Hence, the positive influences of thinking ability on decision-making (β = 0.263), recognizing emotions on thinking ability (β = 0.193), using emotions on thinking ability (β =0.313), understanding emotions on decision-making (β = 0.155), understanding emotions on thinking ability (β = 0.289), and managing emotions on decision-making (β = 0.361) were confirmed.

Table 4. Hypothesized structural paths

Hypotheses	Path relationships	Estimate	SD	T -value	P value	Result
H1	Thinking ability → Decision-making	0.263	0.047	5.598*	0.000	Accepted
H2	Recognizing emotions → Decision-making	0.050	0.047	1.056	0.291	Rejected
H3	Recognizing emotions → Thinking ability	0.193	0.043	4.447*	0.000	Accepted
H4	Using emotions → Decision-making	0.044	0.052	0.852	0.394	Rejected
H5	Using emotions → Thinking ability	0.313	0.050	6.254*	0.000	Accepted
H6	Understanding emotions→ Decision-making	0.155	0.053	2.924	0.003	Accepted
H7	Understanding emotions→ Thinking ability	0.289	0.053	5.442*	0.000	Accepted
H8	Managing emotions → Decision-making	0.361	0.043	8.416*	0.000	Accepted
H9	Managing emotions → Thinking ability	0.065	0.044	1.499	0.134	Rejected
$R^2_{\text{Decision-making}} = 0.548$, $R^2_{\text{Thinking ability}} = 0.555$						

Note: SD = standard deviation; *significant at p<0.01; **significant at p<0.05; ns = not significant.

In terms of the mediating role of thinking ability, the findings indicated that thinking ability mediated the relationship between understanding emotions and decision-making; recognizing emotions and decision-making; and using emotions and decision-making (see Table 5). Particularly, the p-values of UND -> TK -> DM, REC -> TK -> DM, and USE -> TK ->DM were under 1%. The total impacts of understanding emotions on decision-making, recognizing emotions and decision-making, and using emotions and decision-making via the mediating role of thinking ability were 0.076, 0.051, and 0.082, respectively. Additionally, the mediating effect of thinking ability on managing emotions and decision-making was rejected because the p-value was higher than 10% (0.166).

Table 5. The results of indirect effects

Relationships	Estimate	SD	T -value	P value	Result
MAN → TK → DM	0.017	0.012	1.386	0.166	Rejected
UND → TK → DM	0.076	0.019	3.923*	0.000	Accepted
REC → TK → DM	0.051	0.015	3.443*	0.001	Accepted
USE → TK → DM	0.082	0.019	4.273*	0.000	Accepted

Note: SD = standard deviation; *significant at p<0.01; **significant at p<0.05; ns = not significant.

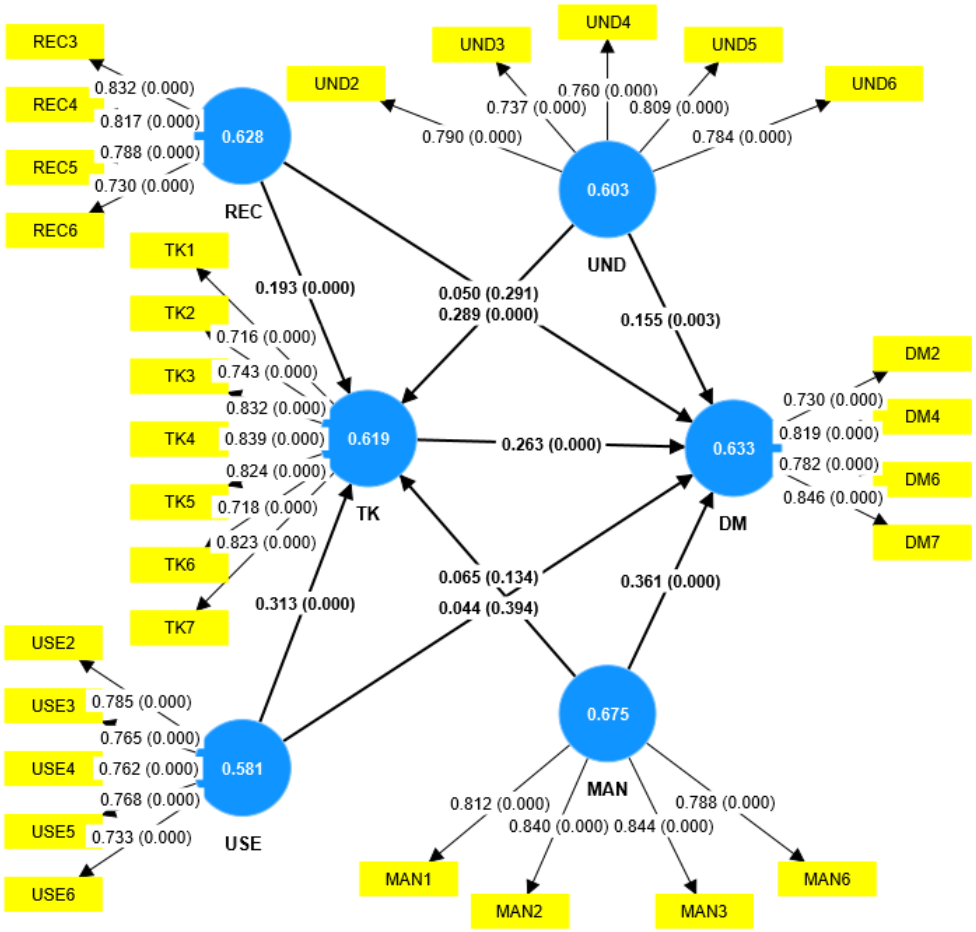

Figure 2. The final path model

5- Discussion

As mentioned above, humans are still at the center of decision-making, but a desire for efficient and high-quality decisions requires much cognitive effort. The findings of this study demonstrated the importance of explaining the relationship between thinking ability, emotional intelligence, and decision-making. In other words, thinking ability is what people can learn and gain during the learning and working process, then control emotional stages before making effective decisions. This study also offers a holistic research model to explain decision-making under the influence of both emotions and cognition (R^2 $_{\text{Decision-making}}$ = 0.548). This emphasizes the significant roles of both emotional and rational aspects when making decisions and is consistent with Simon [53] and Hess and Bacigalupo [6] ideas that emotion and rationality are inexorably interconnected and that emotional intelligence may function as the required connection between the two.

In terms of the direct impacts of emotions on decision-making and thinking ability, understanding and managing emotions both have greatly positive impacts on decision-making; however, recognizing and using emotions have no impacts on decision-making ($p > 0.1$). Similarly, recognizing, using, and understanding emotions have strongly positive effects on thinking ability; in contrast, managing emotions has no effect on thinking ability ($p>0.1$). Although recognizing and using emotions has no impact on decision-making, via thinking ability, recognizing and using emotions has positive effects on decision-making. As a result, the mediating role of thinking ability underlines that the research approach is entirely feasible and conveys robust justification for the decision-making model, particularly through the cognitive process of coming up with effective and helpful decisions (R^2 $_{\text{Thinking ability}}$ = 0.555). Hence, the findings of this study not only extend significant contributions to theoretical material but also offer the foundation for practical implications.

Related to the contributions to theoretical material, this study opens up a novel research approach to decision-making theories in which the components of emotions are reaffirmed for their critical roles in decision-making and is consistent with the results of previous studies [5, 25, 36]. Besides, the combination of emotions and thinking ability refers to the cognitive process before making decisions, in which the components of emotions have gone through a cognitive process from low to high (remembering to evaluating). Therefore, the expected outcomes would be easily predicted and brought to the benefit. Compared to the previous studies, these results match the conclusions of [2, 4] regarding the recognition of the roles of emotions and cognition in shaping decision-making behavior. Nevertheless, Bruch & Feinberg [2] insisted that most previous models, for example, were built to capture mundane decisions like grocery shopping, where qualities

were known, options were ready, and stakes were modest. Therefore, this study distinguished itself from earlier research by demonstrating and developing a cognitive competency scale to maximize the benefits of decision-making based on low-level cognitive processes compared to high-level cognitive processes.

On the other hand, as the initial aim was to develop a scale to assess cognitive competency, the results of this research have proven not only the stable operation but also the high meeting levels of requirements of a cognitive measurement scale (such as reliability, convergence, and discriminant validity). Additionally, almost all existing behavioral theories or models have taken into account both emotional and cognitive aspects involved in the decision-making process; however, as mentioned, most cognitive scales in behavioral theories and models only indicate a low cognitive level (e.g., remembering, knowing, or applying), such as attitudes, intentions, perceived usefulness, etc. Although the research is only at the beginning of building the relationship between emotions, thinking ability, and decision-making through the Invitro method, this will be an ideal theoretical model for future research. Moreover, the process of developing and perfecting this scale will be continued, with all cognitive attributes being integrated and considered in a specific context to evaluate the scale's stability.

In addition to the considerable theoretical contributions, the practical contributions have been recognized. In conjunction with the significant positive effects of understanding and managing emotions on decision-making, several management implications were proposed:

- Develop training plans and intervention measures to help employees understand their own emotions as well as manage their own emotions in making decisions.
- Improve knowledge-sharing activities for managing emotions, such as how to deal with depression as well as stress at work and in life.
- Build up a friendly working environment and support opportunities for individuals to express their strengths and weaknesses to receive sharing from colleagues and the community.

Regarding the positive impacts of recognizing, using, and understanding emotions on thinking ability as well as thinking ability on decision-making, the following practical implications were proposed:

- Target input information to a specific audience (e.g., students, employees, consumers, smokers) in order to improve cognitive competency and optimize judgments.
- Pay attention to aspects related to personal self-perception as well as the influence of relationships around the subjects to improve their thinking ability in the decision-making process.
- Be flexible in the way of conveying and sharing information related to emotional aspects, as well as always considering and evaluating emotional situations that need to be addressed related to relationships between individuals and organizations.

Listen to the individuals frequently and encourage them to reveal periods in which they are unable to manage or understand their own emotions, then review and offer appropriate messages to this audience (e.g., victims, smokers, etc.).

6- Conclusion

Based on the findings, this study has proved the great significance of examining the interaction between emotions, rationality, and the decision-making process. The role of cognitive ability (e.g., thinking ability) is extremely critical in making a decision. Whether emotional factors may have a direct impact on decision-making or not, when going through the thinking process, they all influence decision-making. The research findings also addressed all of the objectives that were initially set out. First, the positive effects of emotional and rational aspects on decision-making were confirmed, both directly and indirectly. Second, the significant positive effects of understanding and managing emotions on decision-making provide evidence for the components of emotions to make effective and useful decisions. Third, this study is successful in developing a new set of scales to assess cognitive competency (thinking ability) in an operational setting and any specific sector to better provide high-quality decisions. Finally, this study has demonstrated a unique and novel research approach through the relationship between emotions, cognition, and decision-making, in which the components of emotions undergo a cognitive process from low to high levels.

On the other hand, this study has faced certain limitations. First, although current research protocols were strictly followed, this was a cross-sectional study, so some biases may have occurred. Second, even though the extent of the explanation of the model is quite good for an exploratory study, there will be other factors affecting the variables in the model that have not yet been identified. This is also an interesting direction for future research. Third, the attributes of cognition have not yet been fully exploited in this study, so future research can follow this direction to further perfect the cognitive ability scale. Finally, since this research model is still in the early stages of research, using the Invitro method related to respondents, future studies can apply this model to specific contexts to consider the stability of the model.

7- Declarations

7-1- Author Contributions

T.D.T. and T.V.P. contributed to the design and implementation of the research, to the analysis of the results and to the writing of the manuscript. All authors have read and agreed to the published version of the manuscript.

7-2- Data Availability Statement

The data presented in this study are available on request from the corresponding author.

7-3- Funding

The authors received no financial support for the research, authorship, and/or publication of this article.

7-4- Institutional Review Board Statement

Not applicable.

7-5- Informed Consent Statement

Informed consent was obtained from all subjects involved in the study.

7-6- Conflicts of Interest

The authors declare that there is no conflict of interest regarding the publication of this manuscript. In addition, the ethical issues, including plagiarism, informed consent, misconduct, data fabrication and/or falsification, double publication and/or submission, and redundancies have been completely observed by the authors.

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Appendix I

Table A-1. A brief report of discussion questions with experts' and students' groups

Discussion questions with experts	Experts' answers	Results
1. Do the indicators of the Thinking ability scale reasonably represent the nature of self-awareness of Thinking ability? In your opinion, do you need to add, remove, or adjust any indicators?	Need to adjust: TK1: When asked to name the events and phenomena that occurred in a story that was just told/heard, I have the ability to remember and recount the details I heard. TK3: I always have a good mind-set when approaching problem solving.	Add 2 ideas: TK1: I always remember well and can restate events that have just happened. TK3: I always have good logical thinking when approaching problem solving
2. In your opinion, is it reasonable to divide emotional intelligence into 4 groups? - REC: Recognizing emotions; - USE: Using emotions; - UND: Understanding emotions; - MAN: Managing emotions.	No idea	
3. Do the indicators of the REC - Recognizing emotions scale reasonably represent the nature of self-awareness of Recognizing emotions? In your opinion, do any indicators need to be added, removed or adjusted?	Need to adjust: REC1: When my feelings towards work change (from excitement to boredom or vice versa...), I know clearly why my feelings change like that.	Add 1 idea: REC1: When my feelings towards work change (from excitement to boredom or vice versa...), I clearly understand the reason for the change.
4. Do the indicators of the USE-Using emotions scale reasonably represent the nature of self-awareness of Using emotions? In your opinion, do any indicators need to be added, removed or adjusted?	No idea	
5. Do the indicators of the UND-Understanding emotions scale reasonably represent the nature of self-awareness of Understanding emotions? In your opinion, do any indicators need to be added, removed, or adjusted?	Need to adjust: UND6: I often help others feel better when they are in a bad mood (sad/lonely...)	Add 1 idea: UND6: I often help others feel more secure when they are in a bad mood (sad/lonely...)
6. I Do the indicators of the MAN-Managing emotions scale reasonably represent the nature of self-awareness of Managing emotions? In your opinion, do any indicators need to be added, removed, or adjusted?	No idea	
7. In your opinion, do the indicators of the DM-Decision-making scale reasonably represent the nature of self-awareness of the benefits of Decision-making? In your opinion, do you need to add, remove, or adjust any indicators?	Need to adjust: DM3: I decided because I got extra training points during my participation	Add 1 idea: DM3: I decided to participate because I got extra training points
8. According to you, the proposed research model includes: decision-making (a dependent variable); thinking ability (a mediating variable); and four independent variables: REC: Emotions Recognition; USE: Using Emotions; UND: Understanding Emotions; MAN: Managing Emotions. Is this model meaningful and reasonable? In your opinion, do you need to add, remove, or adjust any indicators?	No idea	
Discussion questions with a group of 30 students	**Students' answers**	**Results**
1. In your opinion, are there any indicators in this survey questionnaire that cause confusion or confusion? If so, how should it be adjusted?	Adjust the statement: DM1: I decided because there was an influencer.	Adjust: DM1: I make decisions because of other people's influence
2. Do you think the survey questions are difficult to read and answer?	No idea	

Table A-2. Description of items of the survey

Theoretical Constructs	Item Code	Items/Indicators
Thinking ability	TK1	I always remember well and can restate events that have just happened.
	TK2	I always try to reason and think accurately when solving difficult problems.
	TK3	I always have good logical thinking when approaching problem solving.
	TK4	I always grasp quickly and clearly understand the context of situations that occur.
	TK5	I quickly get prioritized issues that need to be addressed.
	TK6	I always try to look at things and phenomena objectively.
	TK7	I have the ability to evaluate and choose optimal solutions.
Recognizing emotions	REC1	When my feelings towards work change (from excitement to boredom or vice versa...), I clearly understand the reason for the change.
	REC2	I easily recognize my true emotions instantly (happy/ uncomfortable/ stressed...).
	REC3	I always recognize the hidden meaning behind other people's gestures and actions towards me (for example, whether they are feeling confident/ disappointed/ indignant/ scared...).
	REC4	Just by looking at a person I can know how they are feeling.
	REC5	I can tell how people are feeling by listening to their tone.
	REC6	I am clearly aware of the messages/implications I am conveying when communicating with others (e.g. I am feeling confident/ uncertain/ apprehensive...)
	REC7	I always believe that I will do everything well.
Using emotions	US1	I know when to share my private matters with others.
	US2	When I experience a positive emotion (joy/ optimism...), I know how to prolong that mood.
	US3	I always look for jobs that bring me joy and excitement.
	US4	I always control my emotions in every situation
	US5	I motivate/ promote myself by imagining a good outcome to the task I am undertaking.
	US6	I am always calm (not panicked) when facing difficulties/challenges.
Understanding emotions	UND1	I like sharing my feelings with others.
	UND2	When you need to express yourself to someone, I always know how to make a good impression on that person.
	UND3	I often compliment others when they do something well.
	UND4	People often find it easy to confide in me.
	UND5	When communicating, I know how to arrange events to make others happy.
	UND6	I often help others feel more secure when they are in a bad mood (sad/lonely...).
Managing emotions	MAN1	Emotions are one of the things that make my life meaningful.
	MAN2	When I am in a positive mood, problem solving is easy for me.
	MAN3	When I'm in a positive mood (happy/excited...), I can come up with new ideas.
	MAN4	When someone tells me about an important event in their life, I almost feel as if I have experienced the situation myself.
	MAN5	Whenever I face obstacles/difficulties at work, I often remember the times when I faced similar obstacles that caused emotions in me and how I overcame them.
	MAN6	When my mood changes (from sad to happy...), I find myself more enthusiastic about work.
Decision-making	DM1	I decided because of the influence of others.
	DM2	I decided because I had already planned to participate.
	DM3	I decided to participate because I got extra training points.
	DM4	I decided because I see the long-term benefits for my future work.
	DM5	I am willing to spend time and money to study/ participate in extracurricular classes
	DM6	I decided to participate because it helps improve my personal skills
	DM7	I decided to participate based on the reputation of the organizer.