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Cognitive Competency, Problem-Solving Skills and Decision-Making: A Case Study of Students' Extracurricular Activities in The Distribution Chains Sector

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Abstract

Purpose: Despite significant research on decision-making, researchers struggle to comprehend the decision-making process. This paper aims to not only examine the relationship between problem-solving skills, cognitive competency, and decision-making but also develop measurement instruments for cognitive competency and problem-solving skills to better model decision-making. **Research Design, Methodology and Approach**: A cross-sectional study was conducted by surveying 292 university students in HCM City, Vietnam, via email sent randomly by Google Forms. This study identifies the conceptual framework and tests the hypotheses using a deductive approach. The SPSS program was used to evaluate the scales' reliability, and the SmartPLS program was used to assess the measurement and structural models. **Results:** The results show that the research model better modelled the relationship between problem-solving skills, cognitive competency, and decision-making. Although thinking ability has no direct impact on decision-making, both creativity and problem-solving skills have a positive impact on decision-making. The mediating role of problem-solving skills is also determined by the positive relationship between cognitive competency and decision-making. **Conclusions:** This study highlights decision-making efficiency through the cognitive process from low to high levels and provides for policymakers and managers to explain the decision-making process in a variety of sectors, such as distribution chains, marketing, and human resource distribution.

Keywords: Decision-making, Cognitive competency, Problem-solving skills, Creativity, CPD model, Distribution.

JEL codes: C38, M12, O15, P36

1. Introduction

Globalization and worldwide economic integration are unavoidable tendencies, and each country has to deal with several obstacles while simultaneously acquiring numerous opportunities. In order to catch up with global progress, quality human resources are the determinants of the sustainable development of countries (Briggs Jr, 1987), especially those with emerging economies. Nevertheless, the most significant impediment to developing human

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resources in the contemporary economy is a shortage of knowledge, education, and motivation (Briggs Jr, 1987). Despite the fact that many studies about cognitive science, behavioural economics, academic marketing, and organizational behaviour have been conducted, they still limit the measurement instruments to a specific sector (Skagerlund et al., 2022).

Regarding cognitive competency, the intelligence quotient (IQ) is frequently mentioned to assess an individual's cognitive abilities and intellectual potential. It's designed to provide a numerical representation of a person's general intelligence, which includes reasoning, problem-solving, memory, mathematical ability, and linguistic skills. According to Kovacs and Conway (2019), human intelligence is connected to fluid thinking (Gf): the capacity to answer issues in fresh settings without relying on previously learned abilities or information (Cattell, 1963). In other studies, intelligence is a fundamental quality that leads to faster acquisition of experience and advanced problem-solving skills (Vincent et al., 2002). Despite the significant contribution of IQ in exploring human competency, IQ still has limitations (Duckworth, 2016; Kohn, 2000; Taleb, 2007; Verma, 2019). According to Duckworth (2016), intelligence quotient (IQ) and academic knowledge do not completely reflect a person's ability to succeed. Besides, Taleb (2007) emphasized that traditional intelligence measures frequently fail to foresee or assess "Black Swan" occurrences, which are unusual and unpredictable but very significant. The intellect is frequently constrained in recognizing and dealing with uncommon circumstances (Klaczynski et al., 2001). In addition, Kohn (2000) argued that traditional intelligence measurements might overly standardize schooling while restricting students' individual development. Based on these arguments, there is a gap in building a better conceptual model to model decision-making from a cognitive perspective and be able to apply it in many sectors. Hence, the first aim of this study is to build up a research model that can better explain decision-making and apply it in many sectors.

Numerous academics are now interested in developing cognitive measuring instruments (Skagerlund et al., 2022), however cognitive competency scales of human intelligence are frequently accomplished through tests. This approach primarily serves educational purposes (Masia & Bloom, 1964) and these methods aid in evaluating the cognitive talents attained by learners that are shared by the entire community. Another cognitive competency scale other than IQ commonly used in education is the taxonomy of educational objectives (Bloom et al., 1956), which mentioned the six levels of the cognitive domain of original taxonomy of educational objectives such as knowledge, comprehension, application, analysis, synthesis, and evaluation. In spite of the significant contributions of the cognitive domain of taxonomy of educational objectives (Bloom et al., 1956), it was only applied to learning and training processes without focusing on other specific sectors. In operations, it is challenging to discover a scale that is both practical and highly general for evaluating human cognitive aptitude in a certain sector. As a result, an endeavour to create a new set of scales to test cognitive competency in an operational setting is critical. In line with this, the second aim of this study is to develop a novel set of scales to test cognitive competency and provide the foundation for making effective decisions based on the cognitive process.

A number of studies on decision-making as well as cognitive factors influencing decision-making behaviour have been conducted during the past two decades, of which two basic approaches have significantly contributed to our understanding of cognitive and behavioural science. Previous studies have indicated that decision-making is related to aspects of the social environment that impact individual outcomes rather than people's fundamental decision processes (Bruch & Feinberg, 2017). Others have found that decision-making behaviour is a result of factors affecting the intentions after receiving the beliefs and values (behavioural beliefs, normative beliefs, control beliefs) through the reasons (reasons for and reasons against) and global motives (attitude, subjective norm, perceived behavioural control) (Sahu et al., 2020). Although decision-making is the foundation of operational success (Mullakhmetov, 2016) and brings practical benefits to individuals or organizations, only a few authors mentioned cognitive factors (factors created via the learning process and life experiences) that influence decision-making as well as the quality and efficacy of decisions.

Despite the fact that the studies that followed the previous approaches revealed significant insights into decision-making, traditional cognitive competency measures (e.g., general intelligence, reasoning ability, understanding of alternatives and their implications) frequently fail to predict decision-making (Klaczynski et al., 2001). As a result, most of the previous studies developed and combined several theories to explain decision-making behaviour, 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 behaviour (TPB), Theory of explanation based decision making (TEBDM), Technology acceptance model (TAM), Reasons theory (RT), Unified theory of acceptance and use of technology (UTAUT), Behaviour reason theory (BRT). However, the two main gaps in those studies are related to theory

building and testing (Sahu et al., 2020). Furthermore, Sahu et al. (2020) indicated that the majority of previous research has focused on the relationships between BRT components. However, in order to provide a more comprehensive picture of the consumer decision-making process, other external observations, in addition to the core components of BRT, must be included. Similarly, Bruch and Feinberg (2017) found that judgment and decision-making (JDM) research had mostly concentrated on determining when and how heuristics fell short of a proper or optimal solution. Sociology, on the other hand, often lacked a valid metric for decision optimality; while some decisions might be worse than others, it was hard to tell whether one had picked the correct spouse or peer group or how to put up adequate counterfactual situations as yardsticks against which individual actions might be objectively evaluated. Based on the above arguments, the importance of examining the relationship between cognitive competency (such as thinking ability and creativity), problem-solving skills, and decision-making was identified.

In response to those gaps and previous research limitations, our research team concentrates on developing the conceptual framework model related to cognitive competency (such as thinking ability and creativity) as well as the essential variables (problem-solving skills) required to make an effective decision in this study. To examine the relationship between cognitive competency (such as thinking ability and creativity), problem-solving skills, and decision-making, this study applied and developed the research model from three main theories: taxonomy of educational objectives (Bloom et al., 1956), cognitive skills and leadership performance: the nine important skills (Mumford et al., 2017), and problem-solving process (Basadur & Basadur, 2013). This study then provides four significant contributions to existing cognitive competency and decision-making studies. First, because of the lack of a valid metric for decision optimality, this research model can be applied to many fields of human behaviour research related to decision-making behaviour such as distribution management, human resources, marketing, business administration, etc… Second, examining the relationship between the components of cognitive competency, problem-solving skills, and decision-making, will answer the question of which factors determine the quality and efficacy of operational decisions. Third, the results of the study lay the foundation for a deeper explanation of the decision-making process. Finally, by using the Likert scale in this study, cognitive competency can be measured indirectly by respondents.

The rest of this paper is divided into five sections. Section 2 synthesizes the available literature to adopt the research ‘s theoretical framework and build up the research hypotheses. Section 3 presents the research methodology with the process of data collection and analysis methods. The results will be presented in Section 4, and Section 5 discusses the findings in detail. The conclusions, limitations and future research will be placed in the final section.

2. Literature Review and Hypotheses

2.1. Literature Review

Decision-making is the process through which a person, group, or organization recognizes a choice or judgement to be made, obtains and assesses information about alternatives, and then chooses from among the possibilities (Carroll & Johnson, 1990). In line with this, Bruch and Feinberg (2017) indicated that making decisions required a great deal of cognitive effort. In other words, in the process of decision-making, the cognitive process is the prior step to evaluating the received information, and the highest level of this process is creating.

To give a robust justification for this research approach, authors also reviewed carefully numerous studies in this field and recognized three significant considerations related to the relationship between cognitive competency, problem-solving skills and decision-making:

- Most previous models, for example, were built to capture mundane decisions like grocery shopping, where qualities are known, options are ready, and stakes are modest (Bruch & Feinberg, 2017).
- Previous studies have focused largely on relationships such as problem-solving skills and decision-making (Singh & Chaudhary, 2015; Yurtseven et al., 2021), or confirmed the relationship between cognition and decision-making (George, 2007; Gigerenzer, 2004; Skagerlund et al., 2022), emotion and decision-making (Goleman, 1995; Salovey & Grewal, 2005; Schutte et al., 1998), creativity and decision-making (Bloom et al., 1956; Runco, 2010), and contextual influences and decision-making (Bruch & Feinberg, 2017; Ciranka & Van den Bos, 2019).
- Former scholars focused on decision-making as the outcome of the effect of beliefs, reasons, and motives on intentions (Sapiri & Awaluddin, 2023; Skagerlund et al., 2022).

Based on these findings, this study approaches decision-making by examining the effect of cognitive nature on problem-solving skills when making a decision. The attributes of cognition here are the results of learning and life experiences corresponding to the taxonomy of educational objectives (Bloom et al., 1956). Despite mainly focusing on educational purposes, the taxonomy of

educational objectives (Bloom et al., 1956) is still considered a fundamental tool for building goals, systematizing questions and exercises used for testing, and evaluating learning outcomes for learners. This scale has been utilized for more than six decades, confirming the benefits of teaching techniques that stimulate and enhance students' high-level thinking skills. The cognitive domain of the original taxonomy of educational objectives has six levels organized in a hierarchy: knowledge, comprehension, application, analysis, synthesis, and evaluation. But then, the revision published by Lorin Anderson and his collaborators in 2001 (Munzenmaier & Rubin, 2013), a taxonomy for learning, teaching, and assessing: A revision of taxonomy of educational objectives, has gained the widest acceptance. The updated taxonomy no longer places "evaluation" at the top of the pyramid but instead "creating." "Synthesis" requires creative behaviour since learners produce newly invented and, frequently, unique products; but now, it changes into "evaluating." Another notable difference is that category names are now verbs rather than nouns. For example, "understanding" has replaced "knowledge". As a result, objectives created with the updated taxonomy now explain learners' cognitive processes rather than behaviour. The revised version of the Taxonomy of educational objectives includes: remembering, understanding, applying, analyzing, evaluating, and creating.

An alternative approach for predicting and understanding decision-making bahaviour stems from the "heuristics and biases" school of research (Kahneman, 1979; Tversky & Kahneman, 1981). Heuristics are "problem-solving techniques that are likely to come up with efficient solutions for challenging problems by restricting the search through a variety of potential remedies based on some assessment of the problem's structure" (Braunstein, 1972). In line with this, Mumford et al. (2017) indicate nine critical skills to solve a problem: problem definition, cause/goal analysis, constraint analysis, planning, forecasting, creative thinking, idea evaluation, wisdom, and sensemaking/visions; in which creative thinking skills appear to be crucial to leader effectiveness throughout their careers, and the metric usually used to assess creative thinking skills, fluency, or the total number of ideas created in response to novel issues (Merrifield et al., 1962), is positively associated with leadership problem-solving ability. Additionally, Basadur et al. (2013) presented a four-stage process with eight steps to solve problems, and this process started with finding the problem, understanding the current situation, clearly defining the problem, finding solutions, evaluating options, formulating plans, proposals, and actions.

2.2. Hypotheses Development

2.2.1. The relationship between thinking ability and decision-making, problem-solving skills

Thinking ability is the ability to explore and eventually expand knowledge to achieve higher levels of achievement (Alkhatib, 2019). These processes begin with the steps of acquiring and storing basic information, which is a basic prerequisite to help the human cognitive process move to a higher level of applying the information to solve problems, corresponding to levels 1, 2, and 3 of the taxonomy of educational objectives (Bloom et al., 1956). This is the mind's fundamental ability to process information from its surroundings and generate consciousness, comprehension, and problem-solving. People can make decisions based on the outcomes of this cognitive process (Howard & Sheth, 1969; Roberts & Lattin, 1991, 1997; Swait, 1984). According to Howard and Sheth (1969), in terms of an individual perspective, potential decisions can be divided into options that they know about and options that they do not know about. This "cognitive set" is also divided into options that the person considers or options that the person finds irrelevant or impossible. As a result, the final decision will be made within this set of considered options. On the other hand, in the study of Braunstein (1972), "heuristics" are "problem-solving techniques that generate effective solutions to complex issues by narrowing the search space of viable answers based on some appraisal of the problem's structure". In other words, thinking ability is considered a receptive process to come up with a method to solve problems before making a decision (Gigerenzer, 2004). Based on these findings, the following hypotheses are proposed:

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

H2: Thinking ability has a positive effect on problem-solving skills

2.2.2. The relationship between creativity and decision-making, problem-solving skills

Creativity is an inventive effort that aims to develop results that are both unique and valuable (Sternberg, 2003). In other words, creativity is commonly considered an important aspect of thinking and cognitive ability. Mumford et al. (2017) mentioned creativity skills as one of the important skills of management. Besides, Bloom et al. (1956) indicated that creativity is the highest level of human cognitive ability, and thanks to creativity, people create new knowledge and new ways to solve problems that are more effective. On the other hand, Sternberg and Lubart (1999) indicated that creative individuals often make novel and valuable decisions as a part of their

creative process. In line with this, creative thinking can lead to innovative solutions and better decision outcomes (George, 2007). In addition, the role of creativity in problem-solving and decision processes has also been emphasized in previous studies (Dane & Pratt, 2007; Mumford et al., 2010). Hence, the following hypotheses are proposed:

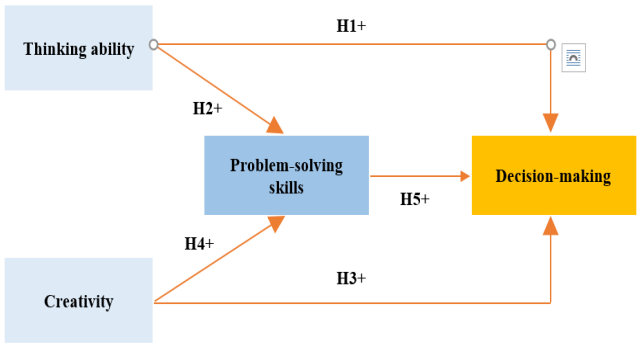
H3: Creativity has a positive effect on decision-making
H4: Creativity has a positive effect on problem-solving skills

2.2.3. The relationship between problem-solving skills and decision-making

Individual variations in problem-solving abilities, according to Heppner et al. (1982), are significant. The capacity to solve problems and make creative judgements has become critical for college students since it allows them to recognize and analyze circumstances in an efficient way (Lindeman, 2000). Effective problem-solving abilities are also related to learning behaviours and attitudes, as well as increased confidence in decision-making abilities (Elliott et al., 1990). Based on the research of Yurtseven et al. (2021), students have to be able to solve problems in order to make effective and correct judgements and attain their learning objectives. As a result of this, the following hypothesis is proposed:

H5: Problem-solving skills have a positive effect on decision-making

Based on the problem-solving process of (Basadur & Basadur, 2013), as well as referencing previous research models, our research team proposes a model with hypotheses that were presented in the previous section.



*Note: TK: Thinking ability; PS: Problem-solving skills; CR: Creativity; DM: Decision-making

Figure 1: Conceptual model of cognitive competency, problem-solving skills and decision-making (CPD model)

3. Methods

3.1. Respondents and procedure

Since this study aimed to test a model developed from the Taxonomy of educational objectives (Bloom et al., 1956), cognitive skills and leadership performance: the nine critical skills (Mumford et al., 2017), and problem-solving process (Basadur & Basadur, 2013), a deductive approach was regarded as the most acceptable for method development (Persson, 2010). By using the mix-methods, which combine qualitative and quantitative methods, the procedure of this study was divided into two phases.

In Phase 1, qualitative research was conducted to develop the theoretical framework as well as the measurement instruments from the literature review. The measurement scales were built up with a focus experts' group (6 participants, including 5 doctors and 1 Ph.D. student in this field). In order to check the clarity and understandability of questionnaires after being translated into Vietnamese by a Bachelor of English, the authors conducted a survey with 30 university students, then adjusted from the feedback and applied structured questionnaires for the main study (Appendix A.2).

In Phase 2 (quantitative research), in order to analyze the measurement model validation, the authors analyze the following contents: reliability, convergent value and discriminant value of the scales. The structural model uses the partial least squares structural equation modelling (PLS-SEM) method to test the research hypothesis, shown through a path diagram showing the structural relationships in the model (Chin, 1998). In the PLS structural model, the smallest sample size is supposed to be 10 times the greatest number of arrows in the hidden variable at any given position (Barclay et al., 1995). A total of 1000 questionnaires were distributed randomly online via Google Forms to the university students in Ho Chi Minh City (the biggest city and highest population), and the total received answers were 337, of which 292 were valid and used for the analysis.

Regarding the respondents in the main study, the authors suggest that the study should focus on university students due to the uniformity in some characteristics (such as age, knowledge, skills, life experience, and source of income mainly depending on the family due to just graduating from high school...). Additionally, the selection of respondents was partly based on the Invitro method, which allows for the easy elimination of other bias factors when surveying a large number of samples that meet the overall standards for the study.

3.2. Measures

In this study, the measurement scales of the construct were adapted from the literature. Following the results after testing reliability of the scales, the scales to measure thinking ability (eight items, α = 0.848) and creativity (eight items, α = 0.887) were adapted from Bloom et al. (1956), problem-solving skills (eleven items, α = 0.892) were adapted from Mumford et al. (2017), decision-making (nine items, α = 0.862) were adapted from Elwyn and Miron-Shatz (2010) and Carroll and Johnson (1990). 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 A.1.

4. Research Results

4.1. Respondent Profile

The brief respondent profile for this study is presented in Table 1. Most respondents were female (74.3%) and studied from 2 to 4 years (60.9%). Regarding the place of birth and university, many students came from Regions 2, 3, and 4 (88.4%), and almost all studied at HUB (Ho Chi Minh University of Banking), accounting for 88%.

Table 1: Demographic characteristics

Indicator	Value	N/292	Percentage
Gender	Female	217	74.3
	Male	75	25.7
Student	Freshman	1	0.3
	Sophomore	111	38
	Junior	67	22.9
	Senior	33	11.3
	Master student	71	24.3
	Graduate student	9	3.1
Place of birth	Region 1	34	11.6
	Region 2	103	35.3
	Region 3	99	33.9
	Region 4	56	19.2
University	HUB	257	88
	LHU	24	8.2
	UEH	3	1.1
	Others	8	2.7

4.2. Assessment of Measurement Model

Regarding the reliability and validity of variables, the thresholds of Cronbach's Alpha and composite reliability (0.7) (Hair et al., 2014) were applied. The results of scale accuracy (i.e., reliability and validity) are presented in Table 2. The minimum α and CR values were 0.832 and 0.880, respectively. The initial items were 35, and after analyzing the reliability and validity of the measurement model by the SmartPLS program, the total eliminated items were 9. Hence, 26 items were applied to the structural model analysis.

Related to convergent validity, the threshold of the average variance extracted (0.5) and the minimum factor loadings (0.6) were commonly applied (Chin et al., 2003; Hair et al., 2019). In this study, the factor loadings were higher than 0.7 and the AVE was above 0.5.

Additionally, to assess the measuring model's discriminant validity, the Fornell-Larcker criteria and the Heterotrait-Monotrait ratio (HTMT) were all applied. According to Garson (2016), the HTMT value should be smaller than 1. Hence, the results of this study were assured (shown in Table 3). Overall, the measurement model's reliability and validity were confirmed.

Table 2: Factor loadings, reliability and convergent validity

Variables	Items	Loadings	α	CR	AVE
Thinking ability	TK2	0.720	0.847	0.884	0.521
	TK3	0.722			
	TK4	0.704			
	TK5	0.757			
	TK6	0.721			
	TK7	0.712			
	TK8	0.716			
Problem-solving skills	PS1	0.735	0.870	0.900	0.561
	PS2	0.751			
	PS3	0.756			
	PS4	0.749			
	PS5	0.735			
	PS6	0.758			
	PS7	0.760			
Creativity	CR1	0.781	0.884	0.909	0.590
	CR2	0.785			
	CR3	0.719			
	CR4	0.813			
	CR6	0.746			
	CR7	0.729			
	CR8	0.797			
Decision-making	DM1	0.785	0.832	0.880	0.596
	DM2	0.792			
	DM7	0.748			
	DM8	0.779			
	DM9	0.754			

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

Items	1	2	3	4
1. CR				
2. DM	0.507			
3. PS	0.793	0.583		
4. TK	0.819	0.492	0.924	

4.3. Assessment of Structural Model

Based on the guidelines for assessing the structural model as proposed by Hair et al. (2014), the collinearity issues among each set of predictor variables have been examined first. All VIF values were smaller than 5 (see Table 4), indicating that collinearity was not a problem to be considered.

Table 4: The results of inner VIF values

Relationships	VIF
TK → DM	3.140
TK → PS	2.047
CR → DM	2.294
CR → PS	2.047
PS → DM	3.084

Regarding the hypotheses testing and structural paths, results comprised of direct effects, and mediating effects, were presented in Tables 5 and Figure 2. Most path coefficients are found to have significant levels of 1% and 5%; therefore, all the hypotheses will be accepted apart from H1 ($p = 0.867 > 0.1$). Particularly, H2, H4, and H5 were accepted with a significant level of 1%. Hence, the positive influences of thinking ability on problem-solving skills ($\beta = 0.595$), creativity on problem-solving skills ($\beta = 0.283$), and problem-solving skills on decision-making (0.380) were confirmed. Next, H3 was accepted with a significant level of 5%. The impact of creativity on decision-making was positive ($\beta = 0.194$).

Table 5: Hypothesized structural paths

HYP	Paths	Estimate	SD	T -value	P	Result
H1	TK → DM	-0.017	0.099	0.167	0.867	Rejected
H2	TK → PS	0.595	0.055	10.889*	0.000	Accepted
H3	CR → DM	0.194	0.083	32.331**	0.020	Accepted
H4	CR → PS	0.283	0.054	5.266*	0.000	Accepted
H5	PS → DM	0.380	0.115	3.320*	0.001	Accepted

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

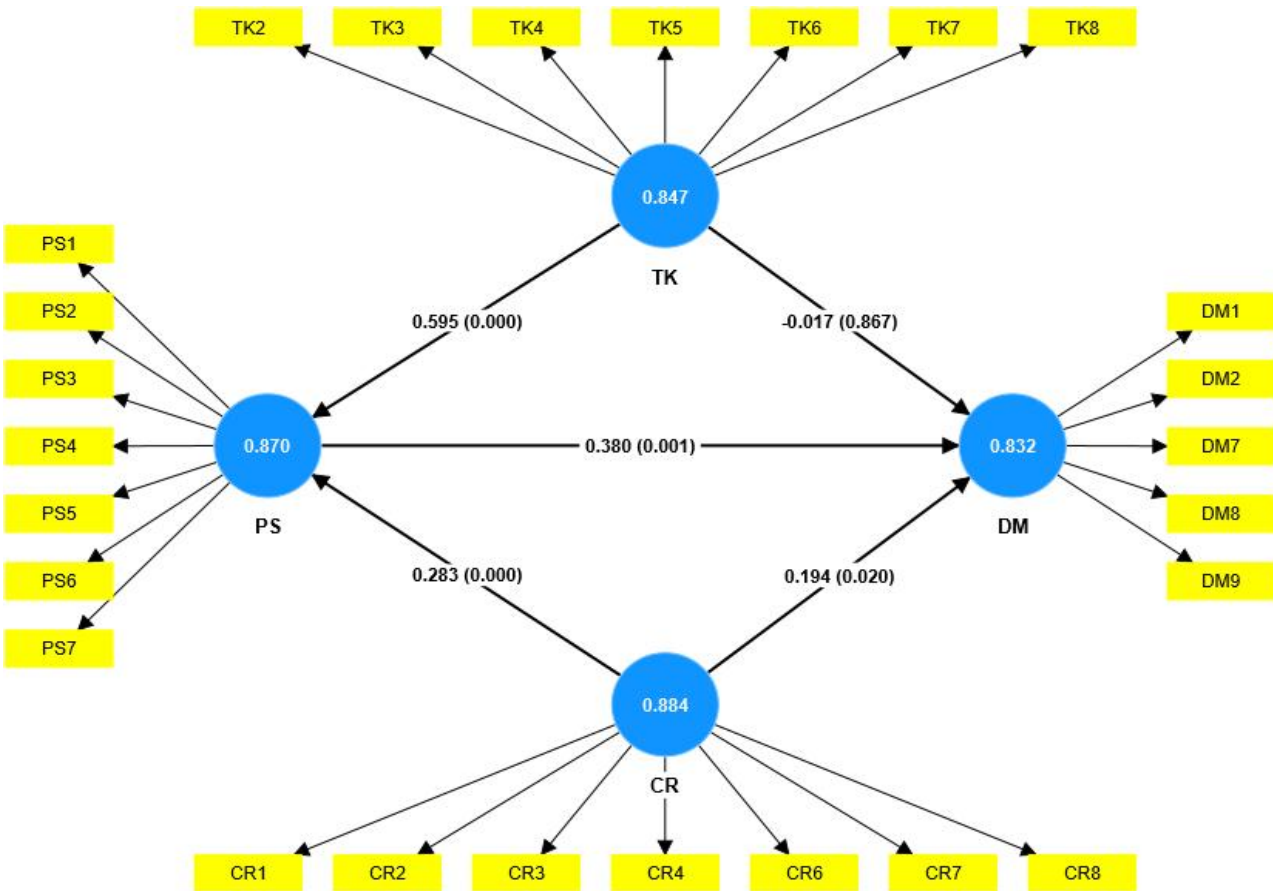


Figure 2: Presenting the final path model

Regarding the mediating role of problem-solving skills, the findings indicated that problem-solving skills mediated the relationship between thinking ability, creativity and decision-making (Table 6). Particularly, the p-values of **CR -> PS -> DM and TK -> PS -> DM** were 0.007 and 0.002, respectively. The total impact of creativity on decision-making via the mediating role of problem-solving skills was 0.108. The impact of thinking ability on decision-making via problem-solving skills was 0.226.

Table 6: The result of mediating effecting of problem-solving skills

Relationships	Estimate	SD	T - value	P value	Result
CR → PS → DM	0.108	0.040	2.694*	0.007	Accepted
TK → PS → DM	0.226	0.074	3.073*	0.002	Accepted

5. Discussion

The findings of this study indicated that the model explained well the relationship between cognitive competency (thinking ability and creativity), problem-solving skills, and decision-making. Cognitive competency has a positive impact on problem-solving skills and decision-making. Specifically, creativity has a positive influence on decision-making, both directly and indirectly. Although thinking ability has no impact on decision-making directly, through problem-solving skills, thinking ability has a positive impact on decision-making. Besides, problem-solving skills have a significantly positive influence on decision-making. Hence, to make an effective decision, through the cognitive process, this study successfully demonstrates the order or process of making a decision, including thinking ability, creativity, and problem-solving skills.

Former scholars have demonstrated the important role of cognitive competency and problem-solving skills in decision processes; however, there are still limitations in building a theoretical model from a cognitive perspective regarding high explanation (Bruch & Feinberg, 2017). The results of this study not only contribute to solving the above problems but also show the suitability of the research model findings compared to previous studies (Bruch & Feinberg, 2017; Dane & Pratt, 2007; De Dreu et al., 2011). According to the results, this study indicates that decision-making can be well explained by cognitive factors (thinking ability and creativity) via the mediating role of problem-solving skills. This study also provides a foundation model for research on decision-making in this field and can be developed in a lot of sectors. Although the research is being developed in the initial stages using the Invitro method, further research applying this model in practice will be carried out to test the suitability and academic value of the above theoretical model.

Furthermore, the results of this study suggest an approach to developing a scale of core human competency concepts, which are highly abstract, like cognitive competency, with a scale of self-awareness, self-assessment, and self-answering for the respondents. In addition, scholars can use these results to evaluate cognitive competency in many sectors as well as develop for future research. Besides, this study provides measurement instruments that can be used to quickly answer the specific competencies that individuals/groups need to meet the requirements of the dependent variable's targeted benefits (such as thinking ability, creativity, and problem-solving skills). In management, on the other hand, this study can be utilised to orient the workforce's knowledge and problem-solving skills by offering information about the employers' expertise and goals.

Based on the literature review, decision-making behavioural studies have been conducted by numerous scholars (Bruch & Feinberg, 2017; Ciranka & Van den Bos, 2019; Sahu et al., 2020). However, there are few studies that approach decision-making behaviour from a cognitive perspective, especially using measurement instruments with five-point Likert scales. On the other hand, up to now, there has not been any research to develop a cognitive scale from the Taxomony of educational objectives (Bloom et al., 1956) as well as apply and test it in a specific context or sector. Therefore, this study is a practical experiment and has great value in building a measurement scale for cognitive competency and decision-making behaviour.

In addition, these results are also useful findings that can not only be applied to teaching students but also affect society. In fact, in Vietnam, only some majors have problem-solving skills programmes, while some other majors do not. To enhance cognitive competency and the ability to make effective decisions in the future, problem-solving skills are an element that needs attention in current teaching programmes. Besides, the results of the study lay the foundation for a deeper explanation of the decision-making process and, thus, minimize risks and take advantage of opportunities in operational activities such as distribution management, marketing, and human resource distribution when making decisions.

6. Conclusions, Limitations and Future Research

The outcomes of the study highlight the importance of two factors: thinking ability and creativity, both of which have a strong direct influence on problem-solving skills. Although thinking ability has an indirect influence on

decision-making, creativity has an impact on decision-making both directly and indirectly. Decision-making is influenced directly by problem-solving skills. As a result, in order to create an effective decision, this study successfully displays the sequence or process of making a decision, including thinking ability, creativity, and problem-solving skills. Furthermore, all the objectives of the study were addressed. First, the study is successful in building up a research model that can better explain decision-making and apply it in many sectors. Second, a new cognitive measurement instrument has been completely developed and well applied to explain the decision-making process. Finally, the importance of making effective decisions has been recognized once again based on the results.

Besides significant contributions in terms of academic and practical significance, the research also has certain limitations. This study was conducted through a cross-sectional research method, so there will be some bias. Besides, the target population of the current study is limited due to sample selection using the Invitro method. Therefore, other studies are needed in the future that will expand the survey subjects in specific fields. Future research can expand this model and consider other factors that impact decision-making behaviour such as emotional factors and demographic factors.

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Appendix

A.1: Description of items of the survey

Theoretical constructs	Item code	Items/Indicators
Thinking ability	TK1	I can list 3-5 problems that I need to solve in the near future
	TK2	I always remember well and can restate events that have just happened
	TK3	I always grasp quickly and clearly understand the context of situations that occur
	TK4	Accumulated knowledge helps me recognize and solve problems in life
	TK5	I am confident when facing difficult problems
	TK6	I always try to reason and think accurately when solving difficult problems
	TK7	I always try to look at things and phenomena objectively
	TK8	I often answer questions with highly logical reasoning
Problem-solving skills	PS1	When I encounter difficulties, I always find a way to solve problems in a clear, logical order
	PS2	I quickly identified the issues that needed to be prioritized to be resolved
	PS3	I always clearly define the goals to be achieved when planning my actions
	PS4	I always clearly distinguish what is relevant and what is not relevant to the situation under consideration
	PS5	When analyzing the situation, I try to discover the main causes of the problem
	PS6	I always look for different ways to solve problems
	PS7	I always carefully consider options when coming up with solutions
	PS8	I always try to identify the criteria used to evaluate and choose options
	PS9	I visualize the possible consequences/possibilities when choosing an option to solve a problem
	PS10	When I encounter a difficult problem that needs to be solved, I try to seek opinions from experienced people
	PS11	Practical experience helps me quickly and accurately solve problems in life
Creativity	CR1	I always know how to flexibly apply knowledge and experience to real-life situations
	CR2	I always feel flexible and creative in the problem solving process
	CR3	I always have backup plans when making decisions
	CR4	I always feel that I am quick and handle complex situations well
	CR5	I prioritize using reason in my decisions
	CR6	I have the ability to evaluate and choose optimal solutions
	CR7	The more difficult the problems I have to solve, the faster I feel like I can handle the situation
	CR8	I find I often get accurate results when solving difficult problems
Decision-making	DM1	I decided to join because of the benefits for my current job
	DM2	I decided because I see the long-term benefits for my future work
	DM3	I decided to participate because I enjoyed participating in extracurricular activities
	DM4	I decided to participate based on the reputation of the participating organization
	DM5	I decided because my friends were also participating.
	DM6	I am willing to spend time and money to study/participate in extracurricular classes
	DM7	I decided to participate because it helps improve my personal skills
	DM8	I decided to participate because it brings many community values
	DM9	I will introduce my friends to participate in extracurricular activities with me

A.2: A brief report of discussion questions with experts and student groups

I. Discussion questions with experts	Experts' answers	Results
1. According to you, cognitive domains can be divided into how many representative groups?	- Need to add indicators related to the two lowest cognitive levels (remembering and understanding) - Need to add indicators of knowledge and Problem-solving skills	Add 2 ideas: - I always remember well and can restate events that have just happened - Accumulated knowledge helps me recognize and solve problems in life
2. In your opinion, is it reasonable to divide Thinking ability, Creativity and Problem-solving skills into 3 groups?	Why did the authors divide cognitive domains into two groups?	Explain: - Thinking ability: Awareness of Thinking ability - Creativity: Perception of being able to solve problems flexibly and creatively. - Problem-solving skills: Awareness of Problem-solving skills
3. 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?	No idea	
4. Do the indicators of the Creativity scale reasonably represent the nature of self-awareness of Creativity capacity? In your opinion, do you need to add, remove or adjust any indicators?	Need to adjust the content of this statement: I find myself always creative in solving problems through the process of analyzing, synthesizing and applying theory, as well as combining it to suit practice.	Adjust: I always feel flexible and creative in the problem-solving process
5. In your opinion, does the Problem-solving skills scale reasonably represent the self-awareness of Problem-solving skills? In your opinion, do you need to add, remove or adjust any indicators?	Adjust and convert the following sentence to the Creativity scale: - When I have to solve difficult problems, I feel confident and make faster decisions	Adjust the content and switch to the Creativity scale: - The more difficult the problems I have to solve, the faster I feel like I can handle the situation
6. In your opinion, do the indicators of the Decision-making scale reasonably represent the self-perceived nature of the benefits of Decision-making? In your opinion, do you need to add, remove or adjust any indicators?	Suggest adding an indicator of value for the benefit and responsibility of the community	Add: - I decided to participate because it brings many community values
7. According to you, the proposed research model including 2 independent variables (Thinking ability and Creativity), 1 intermediate variable (Problem-solving skills) and 1 dependent variable (Decision-making) is meaningful and appropriate. reasonable or not? In your opinion, do you need to add, remove or adjust MHNC?	Agree	
II. 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: When I encounter a problem, I always find a way to solve the problem in a logical order and with clear thinking	Adjust: When I encounter difficulties, I always find a way to solve problems in a clear, logical order
2. Do you think the survey questions are difficult to read and answer?	No idea	