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COGNITIVE STYLE AND COGNITIVE MAPPING: EXPERIMENTAL STUDY IN ACCOUNTING DECISION MAKING

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Abstract

The purpose of this study is to examine whether there are differences in performance when groups with a variety of cognitive styles use the same performance report format for tasks that involve identifying problems and formulating responses in detail. Furthermore, this research will test the role of cognitive mapping in reducing cognitive bias in decision making. The experimental design was used through a three by two (3x2) factorial design (betwen-subject). The scenario uses a complex production assignment schedule. Cognitive style instruments are measured using dimensions from the MBTI (Myers-Briggs Type Indicator). There are three working group configurations, the sensors dyad members, the intuitive dyad and the combination member of both. Group decision making performance can be seen from the achievement of optimal production units, optimal profits and speed of time. The test results show that the performance of the pair of sensor-intuitive is higher than sensors dyad. While there is no difference in performance between sensor-intuitive pairs and intuitive-intuitive dyad cognitive styles. The results of the use of mapping model showed that there was no difference in performance between groups of sensor dyad with sensor-intuitive dyad. This result indicate that causal cognitive mapping can reduce the bias or deficiencies that exist in the cognitive style of the sensor. The implication of this study that organizations will benefit from understanding both individual and group cognitive styles.

I. Introduction

To achieve an optimal decision, adequate information is needed, both information from the internal and external environment relating to the decision to be taken. In the decision making process, many decision

makers only base on simple and easy methods [1]. This happens because of the limited capacity of the ability to process information, so they only adopt simple ways by using mental strategies or heuristics to overcome the complexity of the problems that occur [2]. Analysis and high benefits of performance information reports will be influenced by the perception, interpretation, and utilization of information by users of the report [3].

The results of studies in accounting and psychology suspect that different people will process information differently [4]. This depends on the structure of their knowledge, experience, and cognitive characteristics of a person ([5]; [3]; [6]). One of the challenges of a management control system designer is how to understand the differences that influence the use of information feedback contained in performance reports [4].

[7] state that a person's differences in processing information can be traced in a variety of cognitive style literature. Some characteristics of cognitive style are (1) simple versus complex; (2) adapter versus innovator [8]; (3) field-dependence versus field independence [9]; (4) analytic versus intuitive [10]; (5) Sersor versus intuitive [4]; (6) individualist versus collectivist [11]. This study will examine the cognitive dimensions of sensors and intuitive. Sensing decision makers (sensors) are someone who prefers a detailed model for processing information, paying more attention to each element and concentrating on facts and forms. While intuitive decision makers tend to prefer "global types" in processing information, perceiving problems as a whole ([12]; [7]). Differences in the nature of sensors and intuitive will lead to differences in perceptions about information and problems even if given information with an identical format ([13]; [14]).

Differences in cognitive style cause different perceptions in utilizing financial information and performance reports. Thus the organization will face problems in designing and preparing reports [4]. Thus it will raise the question whether the report has met the same standards for various users, it is a problem that is serious enough to overcome cognitive differences. Meanwhile, some authors suggest creating various accounting formats to accommodate various cognitive styles when processing information ([7]; [15]; [16]), but in an organizational approach this raises various problems.

As an alternative approach to improving report design, what is very good for current group orientation is to form a combination of workers consisting of members of different cognitive styles [4]. This group will lead to a variety of cognitive styles in solving complex business problems using accounting performance reporting standards. While analysis of standard performance reports can help users in formulating problems and developing more specific responses, the cognitive style literature assumes that the intuitive force will focus on the formulation of the problem while the sensor force will emphasize specific details. Groups or groups consisting of intuitive and sensor styles have the advantage of using more comprehensive information, and potentially will result in better decision performance. Previous literature suspected

that increasing group diversity would lead to conflict between groups ([17]; [18]; [4]), the study controlled for conflicting tasks in pairs. The results of the study show that there are differences in performance between group pairs, sensors dyad have higher performance than intuitive dyads.

To neutralize the occurrence of cognitive biases on the cognitive style of decision makers, cognitive mapping methods or tools can be used. This cognitive map stems from psychological research developed by [19] in experimental studies of animals and humans. This cognitive map includes concepts about various aspects and human life, namely aspects of environmental decisions and beliefs about causal relationships. This cognitive map can be a lens of interpretation that helps a decision maker choose various important and certain aspects of the problem to be analyzed. As it develops, cognitive maps are increasingly being used in various studies. Axelrod (1976 in [20]) developed methods for presenting cognitive maps diagrammatically. This mapping is often used to present an individual's view of the world, used to present various thoughts among strategic decision-making groups, so it is very useful in studies relating to complex decision-making problems. Causal cognitive mapping techniques have become the most useful way of providing strategic understanding of the environment and industrial strength. Several studies on the use of causal cognitive mapping techniques in determining strategic decisions have been carried out. Causal cognitive mapping techniques are seen as able to overcome these limitations and become useful tools in management studies ([20]; [21]).

Based on the foundation of the literature that has been described previously, researchers are motivated to test the optimal decisions of the group consisting of sensors and intuitive cognitive styles and cognitive mapping to reduce the cognitive influence of decision makers. Some things that distinguish this study from previous studies are researchers incorporate causal cognitive mapping techniques in testing the optimization of decision making. This is to see whether the technique is able to reduce cognitive biases from decision makers both individuals and groups. In addition, modifications were made to the research instruments and statistical analysis methods. Modifications to the research instrument were carried out based on various considerations and after conducting a pilot test to see the weaknesses of the research instrument. The selection of statistical analysis methods was carried out to find a test tool that could better answer the research hypothesis.

The purpose of this study is to test whether there is a positive effect on performance when groups with a variety of cognitive styles use the same performance report format for tasks that involve identifying problems and formulating responses in detail. Next test the role of cognitive mapping in reducing cognitive bias in decision making.

II. Literature Review and Hypothesis

Cognitive Style and Decision Making

A person's cognitive style refers to a person's particular way of obtaining, storing, retrieving and transforming information ([7]; [22]). Previous research indicates that one should prioritize understanding information ([23]; [3]). This study classifies cognitive styles into sensors (detail type) and intuitive ((global type). Sensor style is perceived as someone who is more focused on facts, details, and realistic thinking. Someone with sensor style tends to be oriented to the current condition with the approach is more concerned with benefits, while the intuitive style is more focused and concentrated on understanding meaning and relationships, exploring possibilities, using hunches and speculation, and oriented to the future is also more theoretical approach. Some researchers ([12]; [24]; [25]; [7]; [26]; [27]) describe various characteristics and preferences for these two cognitive styles.

Research in psychology and management has examined the relationship between a person's perception model (sensing or intuitive) and the way a person processes information. Based on a review of previous studies, [24] state that there is enough evidence that managers with sensors preferences tend to receive and process systematically all signs and information, whereas managers who are intuitive tend to process abstract information and perceptual. This shows that someone will receive the information presented to them in the performance report in different ways and the results will also make different decision making.

Some accounting research examines differences regarding information perception in terms of decision making by sensors and intuitive types. Previous research on this subject produced this combination ([28]; [13]). In predicting bankruptcy, [28] found that the intuitive style had higher performance than sensors, and the impact was that intuitive managers were better able to perceive and understand the implications for the levels, trends and trade-offs of various financial ratios presented. In contrast, [13] and [23] failed to find a similar difference and the task of decision making given. The study of [7] seeks to reconcile the differences in findings about information presented to someone. Both [13] and [23] do not give a person information about economics and management. [7] state that by not providing additional information, these authors ignore the benefits of intuitive style in using information to produce performance patterns. Thus [7] suspect that information given to someone must be dissertated with sensitivity to the characteristics of information users.

[3] provide further support for the importance of different perceptions of information among individuals with different cognitive styles. In the context of resource allocation, the authors find support for the proposition that the intuitive style is more focused on broad consequences and considers information holistically. Furthermore, this style prefers to identify opportunity costs that are implicitly associated with various types of expenditure. Research by [4] shows that the way a person responds to information in the form of accounting reports differs

depending on each cognitive style. It also suggests that an accounting report designer needs to be sensitive about how the information provided will be interpreted and processed by someone different. Research by [29] tested cognitive misfit on auditor performance, the results showed that there was a mismatch between a person's cognitive style and auditor assignment characteristics.

The study of [7], show that information givers need to be sensitive to a person's cognitive characteristics, but it also implies that some individuals may be more suitable for completing specific aspects of a task based on cognitive disposition in processing relevant information. Compared with [28] and [13] studies, it shows that someone who is intuitive according to information of a global type not only results in superior performance, but also higher performance than individual sensor styles. This suggests that assigning tasks used in the study requires information processing closer to the intuitive cognitive style. The same conclusion can be drawn from the assignments used by [3]. They study involving decision making at the individual level, the implication is superior results are made by decision makers who receive information according to their cognitive style.

Research conducted by [30] examined differences in cognitive styles in various cultural variations. This study distinguishes the traditional dichotomy between 'intuitive' East and 'analytic' West. The results show that more intuitive style is owned by managers with Anglo, Northern European, and Latin European nationalities. While the analytic style is more widely owned by managers in developing countries and the Arab region. Research conducted by [31] is a replication and extension of research conducted by [30] regarding the size of the Cognitive Style Index (CSI). They research attempts to investigate the construct and validity of CSI. Participants involved more than a thousand people. The results show that the maximum likelihood factor analysis obtained is generally in line with the results of [30]. There is no relationship between CSI measures with other measures (Cognitive Style Analysis / CSA). This shows that cognitive style is free of gender, but related to job level.

Research conducted by [32] show that analytical supervisors are more protective and less dominant than their intuitive counterparts. Research conducted by [33] examines how cognitive styles as measured through MBTI can influence the outcome of strategic decisions. The results show that managers who are intuitive / thinking use their intuition to make cognitive leaps based on information goals to produce higher quality decisions. Instead, managers who are sensing / feeling use time to produce socially acceptable decisions. There is no effect on assertiveness or effectiveness felt in perceiving or judging managers. This result also shows that extraverted managers are more effective than introverted ones. Thus cognitive style affects the outcome of actual decisions as people perceive the performance of one's decisions.

Research conducted by [34] examined the relationship between personality and cognitive style with manager's decision making style. Decision making style uses decision making regarding Inventory and

cognitive style uses the Myer Briggs Type Indicator measure. The results show that the 'intuitive' type of personality is significantly related to the conceptual decision style. Research [4] examine how cognitive style diversity influences the quality of decisions produced by cognitive style pairs on complex assignments. The experimental method was developed by testing differences in cognitive styles based on sensor / intuitive dimensions. Measurements using the MBTI (Myer Briggs Type Indicator) instrument. The results showed a significantly better performance shown by the performance of couples with different cognitive styles (sensor and intuitive) compared to the same cognitive style namely sensors dyad. Task conflict is not significant in explaining differences in performance. They result has implications for designing management control systems and management personnel.

Research [29] examine the role of "cognitive misfit" on auditor performance. Cognitive misfit is a mismatch between cognitive style and the auditor's job characteristics. The results indicate the auditor's cognitive style significantly interacts with the type of assignment. Analytic auditors perform higher on this type of analytical assignment than intuitive assignments. While intuitive auditors perform higher on the type of intuitive assignments than the analytical type.

Research [35] examined the effect of cognitive style and type of feedback on the ability of internal auditors to identify and document audit information through Internal Control Questionnaires (ICQ). The results show what contradicts researchers' expectations. Cognitive style does not significantly affect performance with or without feedback. However, as expected, a significant relationship between cognitive style and post-feedback task performance was found, with the combination of cognitive style and feedback resulting in a positive performance increase.

Causal Cognitive Mapping

Causal cognitive mapping is part of cognitive mapping that emphasizes cognitive presentation as a form of interaction of cause and effect relationships [36]. Of the five map types [20], causality is a type of map that is quite popular to be used in the field of strategic management research. This is because of some advantages of the causality map type especially in the context of understanding decision making. Causality provides great potential for procedural knowledge (how it works or how to do it) compared to other relationships such as association, constructs or categories which are more emphasized in other types of mapping [36]. Causal map shows the causal relationship between various concepts. Concepts that are considered by a decision maker to have an interaction are then linked by arrows. This relationship can be in the form of positive or negative relationships, so to show it is given a sign (+) and (-).

Theory Of Constraints (TOC)

This research instrument is an assignment scenario that utilizes the Theory of Constraints (TOC) theory. Experimental assignments related to the constraints faced by participants when determining targets and performance in dilemmatic production decision makers. TOC is a management philosophy that helps a company increase profits by maximizing its production and minimizing all relevant costs or costs such as saving costs, direct costs, indirect costs, and capital costs. TOC is an approach to process improvement that focuses on elements that are constrained to increase output. This is based on the fact that, like a chain with the weakest links, in some complex systems at a certain time, there is often one aspect of the system that limits its ability to achieve more of its goals.

The application of TOC is more focused on managing operational constraints as a key in improving the performance of the production system, which in turn can affect overall profitability. Theory of Constraint (TOC) recognizes that the performance of each company is limited by its constraints, which then develops a constraint approach to support the goal, namely the continuous progress of a company (continuous improvement).

Research Development

Sensors styles are more likely to identify and classify specific details and apply them in structured patterns (habits) for carrying out tasks. Instead, intuitive styles are more suited for receiving information globally, identifying connections and relationships, conceptualizing nature and problems, and predicting various solutions. Some organizations stated that to carry out more complex tasks, it involved a lot of people.

Previous research identifies several factors that cause group decision performance to differ from individual performance [37]. Specifically, it shows that performance can be moderated when group members vary in terms of personal characteristics, for example gender [38], experience [39], culture ([40]; [41]; [42]; [43]), abilities [44] and personality ([45]; [46]).

Overall there is support for the proposition that there is diversity by respecting various personal characteristics of members, groups will be more effective when solving problems cognitively as they produce high decisions both in quality and quantity ([47]; [45]).

For complex assignments, good performance will depend on information processing both globally/intuitively and in detail/sensing. Based on statements related to the benefits of having personal diversity within the group, it is hoped that the cognitive style sensors will tend to the detailed elements of the information included in the performance report in relation to decision making. Instead, the intuitive style will process information to get a better understanding of the nature of the task in relation to formulating solutions. Thus, the following is proposed that a couple consisting of one sensor and one intuitive person will

prove a better decision performance than a homogeneous sensor or intuitive pair.

Based on the theoretical foundation and reference of relevant research results, the following hypotheses are constructed:

H1 ***:*** *The pair consisting of sensors and intuitive will perform higher than the pair who only sensors for more complex decision tasks.*

H2 ***:*** *A pair consisting of sensors and intuitive will perform higher than couples who are only intuitive for more complex decision tasks.*

Furthermore, to test the decrease in cognitive biases of the cognitive style of decision making, the causal cognitive mapping method was used. The following hypothesis is proposed:

H3 ***:*** *Reduced cognitive bias when decision makers use causal cognitive mapping techniques before making decisions based on cognitive style.*

III. Method

The subjects in this study were students majoring in Accounting. Demographic variables that were asked were age, gender, grade and relevant subjects. This study uses an experimental design to investigate the proposed hypothesis. The research experiment was designed with three by two (3x2) factorial design and between-subject. Participants are conditioned on the composition of pairs of cognitive styles namely homogenous sensors, homogenous intuitive and a combination of sensors and intuitive based on MBTI indicators. The group consisting of the pair carries out experimental tasks by collaborating and discussing to produce the best performance from the group. Assignment performance is measured by unit of production, optimal profit and assignment time of a production case scenario in a company. To test cognitive abilities in completing experimental tasks, the assignment scenario is designed in such a way as to form task complexity.

The experimental task is based on the theory of constraints on the limitations of machine capacity and production capability. This task involves a series of interdependent decisions regarding how much production must be made in order to achieve optimal profits. The limited resources of the number of production machines and the ability of the company to produce in one period are important considerations for members of each pair of experiments. Participants are proxied as production managers and expert staff of production department a manufacturing company. As managers of the production, they need to set production targets for each production machine that can maximize the company's overall production. The production process involves three

types of products, each of which is produced by its own machine (3 machines). The case scenario shows that the company is in financial difficulty so one of the machines is planned not to be operated for efficiency. Participants are asked to make decisions that will produce optimal profits from the removal of one of these production machines. Tasks are designed so that high performance is needed both in identifying and analyzing in detail the problem.

For conditions without mapping, participants are asked to directly conduct an analysis for decision making on a given problem. As for conditions with mapping, participants are asked to map before making a decision based on information provided by researchers. Thus it can be seen the effect or role of mapping on bias in cognitive style.

There are 40 pairs or 120 participants who will work together and discuss the case to be resolved. To provide an understanding of the task of the experiment, the researcher provides an experimental script containing the company profile and production data both the production unit, cost of goods, selling price, machine capacity etc. Then, guided by the researcher, participants are asked to read the case illustrations by perceiving themselves as figures in the case illustrations. Before doing the actual task, participants are given exercises to make it easier to understand the tasks and instructions. Participants are given information about the company's background regarding the production process including the role and capacity of each machine. In addition, participants were given an explanation of the condition of the company and what alternative decisions can be taken by giving some consideration. These considerations relate to production units per period that can be done, the capacity of each production machine, and simulations or examples of decisions taken to achieve optimal efficiency and profit.

For the conditions of treatment with mapping, participants begin by paying attention to instructions or task requests and familiarize themselves with the causal cognitive mapping technique that will be used. Each participant received a booklet containing instructions and experimental material in accordance with their position under predetermined treatment conditions.

Result

Table 1 shows the results of MBTI cognitive style testing for all participants (panel A) and for participants who took part in carrying out the experimental task (panel B).

Table 1. MBTI Test Results

Panel A: All Participants who have completed the MBTI Task (140)

	Cognitive Style	
	Sensors	Intuitive
Theoretical Range	0–50	50 - 100

Actual Range	8,3 – 47	56-98
Mean	25,65	81,33
Standart Deviation	12,33	10,82
Panel B: Participants in the Experiment (120)		
	Sensors	**Intuitive**
Theoretical Range	0–50	50 – 100
Actual Range	8,3 – 42	58-92
Mean	28,69	75,75
Standart Deviation	10,14	9,27

Panel A shows that of the 140 participants involved, the cognitive sensor style received an average score of 25.65 (SD 12.33) while the intuitive cognitive style scored an average score of 81.33 (SD 10.82). Of the 140 participants involved, only 120 people can continue the experimental assignments (see table 1). Panel B shows that of the 120 experimental participants, the cognitive sensor style received an average score of 28.69 (SD 10.14) while the intuitive cognitive style obtained an average score of 75.75 (SD 9.27).

Table 2 shows a description of the performance of the production decision-making of three pairs of both the sensor-pair, the intuitive-intuitive pair and the sensor and intuitive pair. There are 16 pairs of sensors, 18 intuitive pairs and 15 pairs of sensor and intuitive dyad.

Table 2. Descriptive Production Decisions

			Sensor_Intuitive
	Sensors Pairs	**Intuitive Pairs**	**Pairs**
N (Pairs)	**16**	**18**	**15**
Production Unit			
Mean	525,31	650,56	680,00
St. Dev.	158,907	203,223	196,214
Min	250	350	350
Max	850	900	100
Optimal Profit			
Mean	1893645.3125	2318643.3335	2537610.0
St. Dev.	715024.641	835756.491	866709.105
Min	851000	805000	805000
Max	3375000	3770000	3770000
Time			
Mean	42,06	53,06	45,67
St. Dev.	5,543	6,121	5,136
Min	30	38	35
Max	55	60	55

Performance on production decision making can be seen from the unit of production decided to be produced, the optimal profit to be

generated and the length of time in decision making. Based on the average production unit decided, the pair of sensors decides 525 units, the intuitive-intuitive pair is 650, while the sensor-intuitive pair is 680 units. Based on the optimal profit that can be generated, the pair of sensors produces an average of 1893645.3125, while the intuitive-intuitive pair produces an average profit of 2318643.3335. Furthermore, the sensor-intuitive pair produces an average profit of 2537610.0. The time required by the sensor pair is 42.06 minutes, the intuitive pair is 53.06 minutes while the sensor-intuitive pair is 45.67 minutes.

Post Test Results

Post test result of the experimental procedure is to test the chances of conflict in the team and the level of cohesiveness in the team. Conflict is measured by four questions using the likert scale 1-7 which shows the tendency from the absence of conflict (1) to the very vulnerable to conflict (7). In addition to the chances of conflict, the level of cohesiveness in the team was also measured through five questions with a likert scale of 1-7. The scale shows a tendency from not compact (1) to very compact (7).

Table 3 in panel A shows the opportunities for conflict within the team. The sensor pair shows an average of 2.47, while the intuitive pair shows a score at 2.17 while the sensor pair intuitive shows a score of 2.42. The scores on the three pairs indicate the low level of chance of conflict in the decision making process of the three cognitive style pair models. Panel B shows the opportunity for teamwork. The sensor pairs show an average of 4.60, while the intuitive pair shows a score at 4.49 while the sensor pair intuitive shows a score of 4.93. The scores on the three pairs show the tendency of team cohesiveness in the decision making process on the three models of cognitive style pairs.

Table 3. Descriptive Post Test

Panel A: Conflict Opportunities in Teams

Question	Total	Sensors Pairs	Intuitive Pairs	Sensor_Intuitive Pairs
1.	2,00	2.19	1.97	1.83
2.	2,35	2.44	2.19	2.43
3.	2,15	2.19	2.03	2.27
4.	2,88	3.06	2.50	3.13
Total (Mean)	9,38 (2,35)	9,88 (2,47)	8,69 (2,17)	9,66 (2,42)

Panel B : Team Opportunities for cohesiveness

Question	Total	Sensors Pairs	Intuitive Pairs	Sensor_Intuitive Pairs

1.	4.84	4.78	4.64	5.13
2.	5.05	5.06	5.06	5.03
3.	4.39	4.12	4.14	4.97
4.	4.51	4.53	4.19	4.87
5.	4.53	4.53	4.44	4.63
Total (Mean)	23,32 (4,66)	23,02 (4,60)	22,47 (4,49)	24,63 (4,93)

Hypothesis Testing Results

Hypothesis one (H1) which states that a pair consisting of sensors and intuitive will perform higher than couples who only sensors for more complex decision tasks. Hypothesis two (H2) which states that a pair consisting of sensors and intuitive will perform higher than couples who are only intuitive for more complex decision tasks. To test the two hypotheses, a one way anova analysis tool was used. The test results can be seen in table 4.

Table 4. Hypothesis Test Results Without Mapping

Cognitive Style	N	Descriptive		Hypothesis	
		Mean	Std. Dev.	Sig	St. Eror
Panel A: (H1)					
Sensors Pair	16	525,31	158,907	0,026	67, 443
Sensor_Intuitive	15	680,00	196,214		
Panel B: (H2)					
Intuitive pair	18	650,56	203,223	0,656	65,605
Sensor_Intuitive	15	680,00	196,214		

* Signifikansi pada level 0,05

Table 4 panel A shows that the results of performance testing between sensor pairs and sensor-intuitive pairs are significantly different (0.026). This shows that the performance of the sensor and intuitive pair is higher than the sensor and sensor pair which can be seen from the mean value. Thus first hypothesis is supported. Panel B shows that second hypothesis not supported with a significance value of 0.656, which means that there is no difference in performance between the sensor-intuitive pair and the intuitive-intuitive pair. The result of both hypothesis test shows that intuitive cognitive style is better able to show performance in complex decision making and requires a lot of consideration.

Third hypothesis is tested by comparing the decisions of the sensor groups with the sensor-intuitive group. The sensor groups were compared between those who did not use mapping and the groups that did the mapping. The sensor-sensor group is the group that produces the lowest decision score among the three groups of pairs. One way anova analysis is used to test third hypothesis. Table 5 shows the results of hypothesis testing.

Table 5. Hypothesis Test Results with Mapping

Cognitive Style	N	Descriptive		Hypothesis	
		Mean	Std. Dev.	Sig	St. Eror
Panel A: Without Mapping					
Sensors Pair	16	525,31	158,907	0,026	67, 443
Sensor_Intuitive	15	680,00	196,214		
Panel B: With Mapping					
Sensors Pair	16	573,44	173,481	0,119	65,419
Sensor_Intuitive	15	680,00	196,214		

* Signifikansi pada level 0,05

Table 5 panel B shows that there is no significant difference between the sensor-sensor and sensor-intuitive group decisions (sig 0.119). This shows that the process of causal cognitive mapping has a different impact on the outcome of decisions when participants process information more deeply and map the causal relationship of each information in decision making. Thus the bias generated from the information processing in the cognitive mapping sensor groups has decreased bias (debiasing).

Analysis of Conflict and Cohesiveness

At the end of the experiment session, participants were given a debriefing question, namely regarding conflict and cohesiveness in the team. It aims to see whether in addition to cognitive style, the level of conflict and team cohesiveness are factors that influence the performance of participants in group decision making. To test this, a covariate analysis was performed, which included the metric independent variable as covariate in the model. The aim is to reduce error variance by eliminating the influence of non-categorical variables (metrics or intervals) that we believe bias the results of the analysis. In this case the covariate variable is the level of conflict and team cohesiveness, while the independent variable is the cognitive style. Table 6 shows the results of covariate testing.

Table 6. Ancova - Production Decisions

Source	SS	df	MS	F	p
Main Effect					
Cognitive Composition	183437.145	2	91718.573	2.490	0.018
Covariate					
Task Conflict	4369.883	1	4369.883	0.119	0.731
Error	3463062.329	94	36841.089		

The Ancova test results in table 6 show that the composition of cognitive styles has an influence on production decision making (p = 0.018) while task conflict does not directly influence the production decision making process (p = 0.731). Thus testing hypotheses on cognitive style variables can be directly tested against production decision making.

Discussion

This study uses the Theory of Constraints (TOC) in developing research instruments. TOC is a management philosophy that helps a company increase profits by maximizing production and minimizing all relevant costs such as savings, direct costs, indirect costs, and capital costs. Experimental assignment scenarios relate to the constraints faced by participants when determining targets and performance in dilemmatic production decision making. The case scenario shows that the company is in a state of financial difficulties which causes one of the planned machines not to be operated. There are three production machines with different capacities that should be taken into consideration in making production unit decisions.

The results of studies in accounting and psychology suspect that different people will process information differently [4]. This depends on the structure of their knowledge, experience, and cognitive characteristics of a person ([5]; [3]; [6]). Likewise in this study grouping homogeneous and mixed cognitive styles to see if there are differences in production decision making between groups of cognitive style pairs.

Theoretically, the intuitive cognitive style is able to make decisions more optimally than the sensor style ([7], [3], [32], [33], [4] and [29]). This is because the intuitive cognitive style is more focused and concentrated on understanding meaning and relationships, exploring various possibilities, using hunches and speculation, and oriented to the future is also more theoretical approach. The research scenario shows the need for more in-depth considerations from participants regarding production constraints, financial considerations and consideration of limited production capacity.

The results showed that the performance of the sensor and intuitive pair is higher than the sensor and sensor pair which can be seen from the mean value. Thus first hypothesis is supported. The results of testing of second hypothesis show that there is no difference in performance between the sensor-intuitive pair and the intuitive-intuitive pair. The both result of testing the hypothesis shows that intuitive cognitive style is more capable of showing performance in complex decision making

and requires a lot of consideration than cognitive sensor style. However, the bias or deficiencies that exist in the cognitive style of the sensor can be reduced through a debiasing tool, namely causal cognitive mapping tested. The results show no difference in performance between the sensor-pair pair with the sensor-intuitive pair when participants use the mapping model in decision making process. In this case participants are asked to consider all the possibilities that can be found to achieve optimal performance through mapping the opportunities and constraints faced by the experimental scenario.

The results of this study imply that organizations will benefit from understanding both individual and group cognitive styles. This can be one of the considerations for many companies to test psychologically when recruiting and training their employees. The availability of information that will be managed by groups and individuals in their cognitive processes becomes one of the considerations that will help the organization in making complex decisions. Organizations or companies can manage groups to solve problems in the company. Weaknesses in groups with a homogeneous cognitive style can be overcome by providing more and more detailed information such as qualitative and quantitative information in the form of reports, graphs and others. In addition this becomes one of the challenges of a management control system designer for how to understand the differences that influence the use of information feedback contained in performance reports [4].

This research contributes scientific research into accounting by increasing cognitive style testing from the individual level to testing at the group level. This research builds unique instruments related to complex assignments for decision making. The instrument is built with complicated scenarios by providing data as well as limitations that will be considered by participants. The instrument was built with several tests to produce the suitability of the cognitive style of decision makers. This instrument was also built by giving a time limit in decision making which was not done in previous studies [4].

Further research can be done in the form of more complex and unbalanced groups such as two sensors and one intuitive person or vice versa. This is to see the dominance of cognitive style in decision making. Future studies can provide target instructions and an incentive system that will be given to participants when they are able to achieve the targets set. In addition, researchers can then consider a number of moderation factors such as experience, abilities, and personal knowledge of the participant's cognitive style.

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