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EXPLORING LEARNING EXPERIENCE IN A TOTAL ENTERPRISE SIMULATION BASED ON MEANS-END THEORY

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ABSTRACT

The primary purpose of this study was to obtain empirical evidence and provide a methodological alternative for helping understand how simulation serves to learning. Well-structured system design and unstructured learning implementation bring complexity to dealing with learning in total enterprise simulation, specially, how to investigate learning emanated from the simulation game's structure and decision-making requirements has studied very few. Due to the multiple aspects of individual learning situation and the inevitable structural design differences in simulations, student authored reports were used as data source to analyze the connections of learning-performance based on means-ends theory and the model was constructed with the components, namely Attributes, Consequences, and Values. With limitations of research, the study provides practical evidence and student insight into logic and structure of the simulated firm experienced, as well as demonstrates the use of means-ends approach for research on the issue of simulation-based learning and performance.

Contribution/Originality: The paper contributes the first means-ends analysis of the connections of in-class simulation-based learning-performance by using the learning setting and participant-authored reports. Contrasted with previous studies which were essentially oriented in product/service decision-making, this study was built on the efforts to enhance the understanding of how the virtual management practices contribute to generation of personal values, rather than to focus on simulation system's external validity.

1. INTRODUCTION

Different with *simulation* known in the area of management science in pursuit of improvement and/or prediction of the simulated system behavior (Simon, 1996) business simulation epitomizes experiential learning (Keys and Wolfe, 1990). Total enterprise simulation (TES) is commonly used for research community and employed in business and management education (Vance and Gray, 1967; Keys and Wolfe, 1990; Anderson and Lawton, 1992). As provided by Keys and Wolfe (1990) TES is one that includes decisions in most of the main functions of business: marketing, production, finance, and personnel. Such simulation games require integrative decision-making with respect to the overall operation of company for achieving corporate profit and market share objectives. In addition, environmental factors, such as general economic conditions and interest rates also are simulated as important components of the learning experience. Precious studies have suggested that TES enriches the learning experience, enhances cognitive learning, for instance, effectively understanding strategic management and marketing concepts (Faria and Whiteley, 1990; Wolfe, 1997; Wolfe and Rogé, 1997; Faria *et al.*, 2009).

Consequently, participating in a TES can be beneficial in terms of goal-orientation, systems thinking, developing strategic view, practicing analytical skills and so forth.

This research is intended to develop a better understanding of the linkages between TES experiences and outcomes using means-ends analysis. The study focuses on how learning emanates from the experience, rather than what is learned. Given TES brings a different mix of participants with different goals, attitudes, and expectations, participants authored reports are scrutinized for depicting the cognitive and value structure model of learning by the simulation performance. Recently, it is shown, but very few, that means-end approach has been used for examining teaching value of business simulation e.g. (Anitsal and Cadotte, 2007; Lin and Tu, 2012) however, means-ends analysis has not been used to explore in-class experience on the basis of the learning setting.

2. BACKGROUND

Research in business simulation and experiential learning has expanded over the past decade and there has been an increased emphasis on examining learning experience from participating in simulation games. Faria *et al.* (2009) studied the literature of 40 years and revealed that research with respect to *learning experience* has surfaced since 2000s, and gained most significant concerns than others: followed in order by *strategy formation and implementation*, *learning objectives and outcomes*, *decision-making skill* and *teamwork*. In this study, means-ends analysis goes beyond looking simply at the benefits from simulation performance and learning.

Means-ends analysis (MEA) is one of most fundamentals of problem-solving, best-known from the area of *Artificial Intelligence*, one of fundamental design methods well-documented in most of engineering textbooks. As Simon (1996) states in his book: *The sciences of the artificial*, that "the activity [in any goal-seeking system] called human problem solving is basically a form of means-ends analysis that aims at discovering a process description of the path that leads to a *desired goal*." and recapitulates, "…Much of the activity of science is an application of that [the general] paradigm: Given the description of some natural phenomena [a blueprint], to find the differential equations for processes that will produce the phenomena [the corresponding recipe]".

MEA as theory Simon (1996) examines the linkage among desired goals and actions, where goals as ends represent the state of the world (wished-for end), and actions as means refer to ability to achieving the goals (ends). For attaining the end goals, the problem solver initiates to concentrate on the end or the final goal starting from his/her current situation, and then determines a plan, or a strategy. Plan construction herein is emphasized at the core of the goal-oriented processes, going on with two main activities of information processing: (i) is "afferent, or sensory", relating to making decisions on *what to do*, such as considering preferences, choosing goals, etc., that may lead to generating intention; (ii) is about *how to act*. In contrast to (i), it is "efferent, or motor" about "how elements of the one relate to elements of the other", for example, it could be such activities as thinking about suitable actions, resources or how to organize activity (Newell and Simon, 1972; Simon, 1996).

MEA as application, pioneered by e.g.Young and Feigin (1975); Gutman (1982) in advertising and consumer behavior research, integrates consumer's perception and evaluation in an ideographic means-end chain model (MECM). In accordance with Gutman (1982) MECM is attribute-based linking the product with the consumer and illustrates the way personal values affect individual behavior. It depicts the relationship among 'the means' and 'the ends' by using three components: *attributes*, *consequences* and *personal values*, i.e. product/service attributes represent means by which consumers obtain desired consequences/benefits or avoid undesired consequences/costs and achieve personal values (ends).

More specifically, *Attributes* refer to the characteristics of products, services or scenarios. For learning-by-business simulation gaming, some of the attributes involve the organizational structure of the enterprise, functional operations, and teamwork among others. *Consequences* accrue to people from experiencing the products, services or events. Consequences for this study are the desired outcomes from the simulation-based learning setting, and may be that participants learn to work together, skills that are required to run the virtual enterprise while gaming, or learn limitations and strengths as an individual or team. *Personal values* refer to desired end-states. Values that may be important for participants in this study include a sense of accomplishment, self-fulfillment, fun/enjoyment and others.

MECM and its associated measurement methodology known as laddering have been applied to better understand pedagogical effectiveness of business simulation in management education, but as described previously, there is very few research published to date. Contrasted with previous studies, which were essentially oriented in product/service decision-making, the present study was unique in that it was the first application of means-end theory to investigate in-class TES experiences using participants authored reports, also and it was unique in that it applied means-end theory to understand how TES serves to learning rather than what has been learned from the participation.

3. REVIEW OF RELEVANT LITERATURE

Research on evaluation of simulation-based learning and performance is a challenging task, due to the lack of well-defined constructs with which to assess learning outcomes, a need of an integrative and systematic framework for proceeding the evaluative process (Feinstein and Cannon, 2002). In their literature study, Feinstein and Cannon (2002) differentiates two patterns of simulation validation as illustrated in figure 1. Representational validation, on one hand, guides developers during development and implementation of simulation. Evaluating representational validity is accomplished by if it is put into practice with the logic and structure of the simulation. Thus, the evaluation delivers information for improving the simulation's implementation. Educational validation, on the other hand, is to explain why a given simulation brings forth its effects to education.

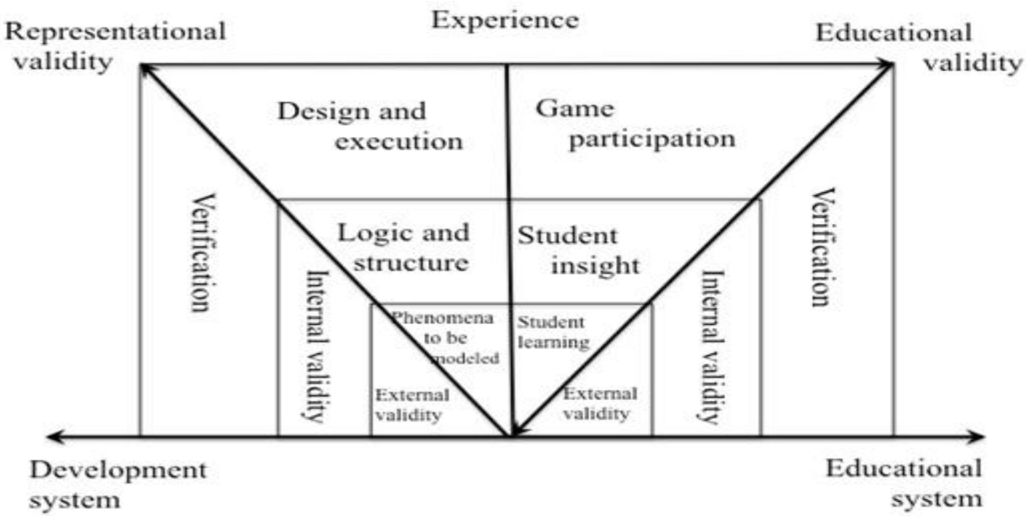

Figure-1. Simulation validation adapted from Feinstein and Cannon (2002)

Many studies have reported that there seems no kind of statistical linkage exiting between learning outcomes and such game-facilitating factors in terms of team size, simulation complexity, game administration (Wolfe, 1976a; 1976b; Wolfe and Chacko, 1983; Faria, 2001). Washbush and Gosen (2001) studied learning as a consequence of participating in TES by using a method built on objective evidence (Anderson and Lawton, 2009) e.g. market share, cash flow, return on sales, and others. Their result supported the argument of learning validity conducted by (Wolfe, 1997) however they pointed out that learning-performance issue and effectiveness of individual learning deserve further research. As a response to the commonsense suggestion: *those who perform the best learn the most*, some suggested that simulation-based learning correlates to performance positively (Teach, 1989; Wolfe and Deloach, 2009) but they are not linearly dependent. Numerous empirical outcomes indicate that the relationship between learning and performance seems weak (Anderson and Lawton, 1992; Wellington and Faria, 1992;

Washbush and Gosen, 2001). Much evidence says that high performance maybe results in luck (Thorngate and Carroll, 1987; Burns *et al.*, 1990). It seems like that [students often say in the course] "we made it, it just happened, but we don't know exactly why/how we got to the end". On the other hand, some explained that performers who struggled a lot learned more than high performers who struggled less (Washbush and Gosenpud, 1993; Wolfe and Chanin, 1993; Washbush and Gosen, 2001). From a pragmatic point of view this can be put another way: given simulation learning in a university setting is a means of attaining grades, the grade-seeking motivation, e.g. learning for exam (versus learning for knowledge acquisition), may hide any relationship that inherently exist between performance and learning.

Moreover, various studies have employed student perception as process measure for simulation-based learning assessment. Corner and Nicholls (1997) used the concept of involvement to examine the associations between the degree of student involvement and simulation performance and learning. Their findings suggested that learning and performance were related positively, specially, enjoyment of the simulation associated with high involvement, however, not reversely. In addition, Gosenpud and Washbush (2010) conducted a study on the basis of organizational learning model in which students' reports were first used for examining simulation learning and performance. The result gave support to the positive learning-performance suggestion of Wolfe and Deloach (2009).

4. RESEARCH METHODOLOGY

The research was built on 15-week business simulation course in a TES environment. The course is an elective in curriculum registered every year by 3rd-year students of business administration major at a university in Japan. The study is to examine the connections between experiences mediated by the simulation and the benefits and personal values obtained or reinforced by the learning setting. For doing so, this study is the first attempt to apply means-end theory to contribute MECM using students' reports, and goes further to explore how simulation serves to learning.

The simulation used in the course is a conceptual TES with 18 decisions per round (quarter), and usually terminated in 36th-40th round, around 9-10 years. Each student is required to submit a report as a routine task at the end of the course while the students are announced that their game activities are being analyzed, and the results will not influence the final grade. All of students' reports were required to be written more in detail more better, at least including the answers to the following open-ended self-questions: what did you do?, how well or not did you do?, so what do you think that you should've done?, and what do you think about the simulation-based learning?. By doing so, it assumes that students can think critically about how rules and requirements embedded in the simulation system aroused his/her efforts and personal values, for example, what made you feel enjoyable, and why. Moreover, the reason for requiring students to report also are (1) we intend to investigate how the simulation serves to student learning as mentioned already; (2) we assume that students authored reports can provide us much rich data on the 'why's (see figure 1) pertaining to the individual cognitive structure and the relationship among means-end elements in comparison to the data collected from questionnaire or interview in our pragmatic educational situation; and (3) the data gathering is cost-free and time-saving.

For building up an instrument for this study, we first analyzed the contents of manual of the simulation to determine design attributes of the simulation system. The output of this process serves as the starting point of connection to personal values. Then, rules and scenarios involved in the virtual management requirements were confirmed and several attributes of performance outcomes are extracted as the expected consequences. Finally, generic end-states were obtained by referencing previous research outcomes (Anitsal and Cadotte, 2007) as well as the reports provided by students. Table 1 displays data collection schema in this study, where *Attributes* is a component referred to as system design attributes, representing what students are supposed to do in the TES environment where students incorporate; column *Consequences* is the consequences of the simulation-based learning, the outcomes of performance that students are expected to achieve; *Values* are generic value factors, the desired end-states. Table 1 serves as a base to discovering linkages of the elements of *Attributes*, *Consequences* and *Values*. The rationale behind this is to make us think systemically about the ways students link the rules, scenarios and requirements embedded in the simulation to the perceived consequences of his/her performance, also to link the system attributes to the personal values.

Table-1. Schema for Data collection

Attributes	Consequences	Values
A1 Teamwork	C1 Assertive/cooperative	V1 Helpfulness
A2 Play as functional manager	C2 Communication	V2 Fun/enjoyment
A3 Business planning	C3 Stereotype maintenance	V3 Self-fulfillment
A4 Functional operations	C4 Strategy formation/implementation	V4 Feeling of reality
A5 Safe environment	C5 Systems thinking	V5 Self-development
A6 Decision-making	C6 Continuous improvement/effort	V6 Accomplishment
A7 Financial statements	C7 Strategic management control	V7 sense of comradeship
A8 Market diversity	C8 Financial statements analysis	
A9 Competition among others	C9 Using decision support software	

Source: From the manual, reports and papers

As such, next the associations among elements of *Attributes*, *Consequences* and *Values* were analyzed based on means-end theory. each report was graphed into a MECM with direct/indirect relations among nodes on the chain. Due to the differences in the reported individual learning performance, there is no doubt that individual MECM is partial in nature, that is, as shown in figure 2, one attained to the end-states, another not. Furthermore, all of the individual MECMs were integrated by using the measurement method provided in Reynolds and Gutman (1988) resulting in an aggregate implication matrix. Finally, based on the matrix, a network diagram termed as hierarchical value map (HVM) (Reynolds and Gutman, 1988) was derived at a threshold level.

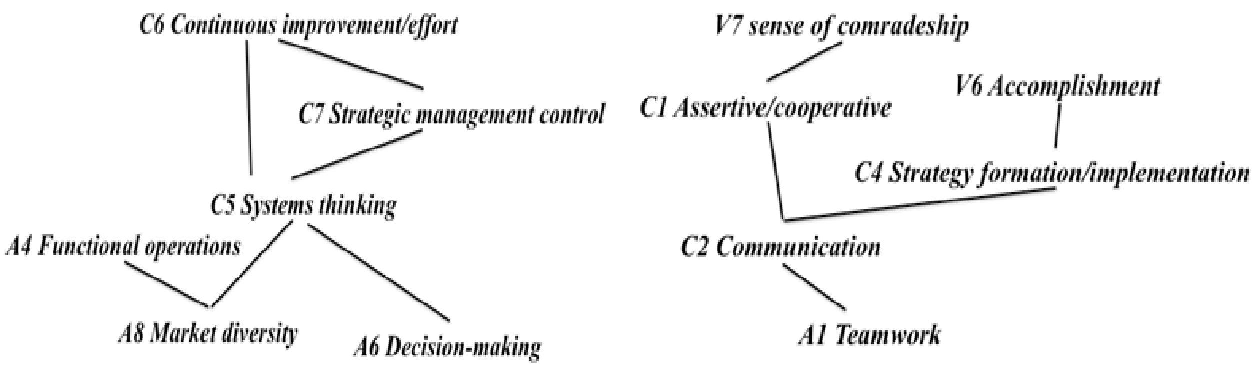

Figure-2. Two instances of individual MECM

Source: The results from the study

5. DATA ANALYSIS AND RESULTS

Reports submitted by 86 students were carefully confirmed whether or not they were available for this study. two reports were too short to be involved because simulation performance of the student was not explained, and hence the reports used were 84 in total.

As stated, a series of *Attributes-Consequences-Values* (A-C-V)s, that provided a graphical summary of the relationship and links among *Attributes*, *Consequences*, and *Values*, was then constructed. Each A-C-V summarized the key linkages among system design, perceived outcomes and personal values in accordance with our analysis procedures. The relationship among the elements on the A-C-V represented student insight into the outcomes and values associated with the experience of participating in the TES course.

Table 2 demonstrates the aggregate summary matrix obtained by using Reynolds and Gutman (1988)'s measurement method, and further, an aggregate HVM was generated for the entire individuals, based on threshold 3.00 resulting in 78% out of total associations among means-end nodes, ranging in 75%-85% (Gengler and Thomas, 1995). The graphical illustration of the HVM is shown in figure 3. The outcomes at the bottom of the HVM are the key aspects that help arouse the performance outcomes and create the value outcomes shown at the top of the model. Due to the threshold value, the attributes not included on the map were *Safe environment* and *Decision-making* and *Competition among others*. 6 of the 9 consequences appeared on the map. The consequences that did not appear included *Stereotype maintenance* and *Continuous improvement/effort*. Also, 5 of the 7 values appeared on the HVM. The values not included in the map were *sense of comradeship* and *self-development*.

Specially on the HVM, the primary attributes of system perceived by students included teamwork(*A1*), role playing(*A2*), business planning(*A3*), functional operations(*A4*), financial statement(*A7*), and market diversity(*A8*). The significant consequences included management control(*C7*), strategy forming/implementation(*C4*), systems thinking(*C5*), using decision support software(*C9*), financial statement analysis(*C8*), communication(*C2*), assertive/cooperative(*C1*) action. The significant values were a sense of accomplishment(*V6*), fun/enjoyment(*V2*), self-fulfillment(*V3*), reality feeling(*V4*), and helpfulness(*V1*).

Strong associations cross the model components linked *A3* and *C4* and *V6*. Another strong link on the map was *A3-C4-C7* and then up to three ends: *V3, V4, and V6*. Within *Attributes component*, except the isolated *market diversity*, *business planning* seems to be perceived as a hub of activities. There were several links from *business planning* to various consequences that associate with *strategy formation and implementation*. More specially, up to *Consequences*, except *planning*, it is seen that interpersonal skills (*C2-C1*) and analytical decision-making(*C9-C8*) are also beneficial to forming and implementing strategy. Additionally, it seems to say that students came to recognize that *management control* is a primary key of achieving success in the virtual competition in the process of formation/implementation of corporate strategy. To sum up, it can be said that the inter-associations within *Consequences* component reflected the logic and structural requirements embedded in TES system used. That is, the course overall led to expected outcomes based on the teaching and learning setting to some extent, however, although *systems thinking* appeared in the map, it seems that there were no strong association between the two key consequences (*C4*, *C7*). This can be understood that student perceived *systems thinking* is a key factor to attain success, however which had not yet been reflected into their practices. This phenomenon may call a need to develop new scenario or technique to respond to this issue. Finally, at the top of the HVM, it shows that the *Values* perceived can be seen in two ways. It seems that the more student insights involved in the nodes of *C4*, the more making them feel *accomplishment* and feeling more *fun and enjoyment* from the course. On the other hand, practicing more *management control* may help student have an intention to challenging further as students commenced in their reports, for instance, "I expect to have more learning chance like this course; I like to add the course experience in job application/interview; I want to use the experience in the future" and others.

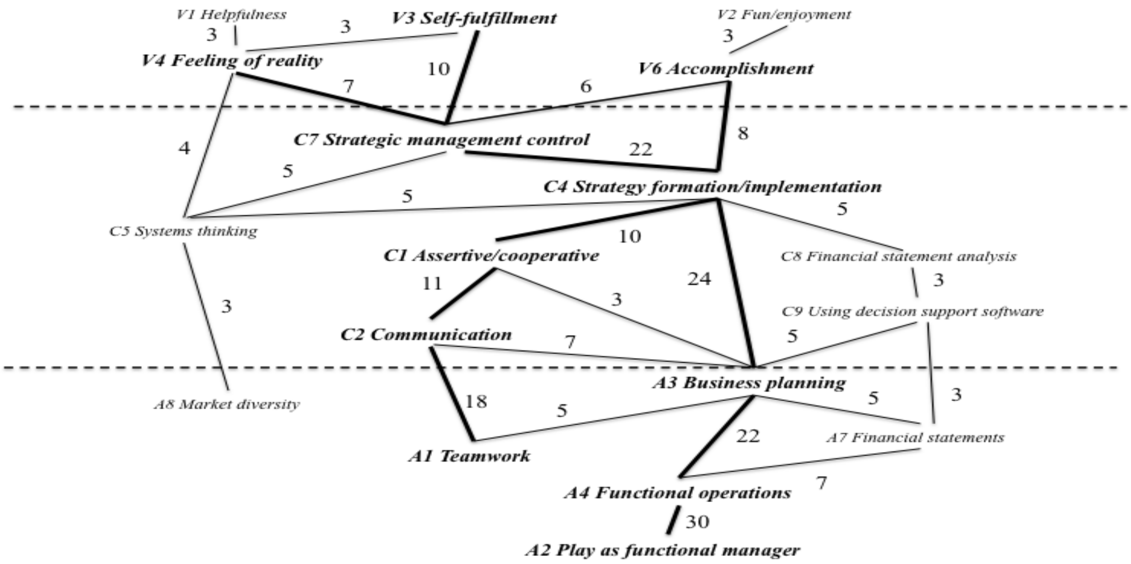

Figure-3. The hierarchical value map

Source: The results from the study

6. CONCLUSION AND IMPLICATIONS

As evidenced in the present research, means-end theory provides another useful and intuitive framework for investigating simulation-based learning experience in management education. The present means-end investigation was built on the efforts to enhance our understanding of how simulation serves to learning, specially, how the virtual management practices contribute to generation of personal values, rather than to focus on simulation's external validity. Future research could be conducted to examine the outcomes associated with other forms of learning such as learning by entrepreneurial simulation.

In addition to the theoretical contributions, the present investigation holds useful implications for educators and practitioners. Particularly, the study results can provide knowledge of how the elements of the three components of MECM are interrelated, and can help instructors develop a better understanding of the relationship and links of attributes-consequences-values chain and participant perception.

Furthermore, as with any investigation, the present study also can serve as a feedback that is an important factor of formation of cognitive learning connected to the desired ends. Lastly, as an extension, future research could be conducted to explore the issue about how to help participants perceive the internal logic and structural requirement of simulation, not just let them go through to the end with the 'luck'.

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Table-2. The aggregate implication matrix

Ele.	1	2	3	4	7	8	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	Total
1	–		5.10			0.01	1.00	18.02		2.21	0.04		0.05	1.00	1.00	0.03	0.08	0.03	0.04	0.02	0.08		28.71
2	1.00	–	0.28	30.00	0.07		0.02	0.02	0.01	0.20	0.03	0.01	0.15	0.09	0.07	0.03	0.01	0.07	0.03		0.09	0.01	31.119
3			–			1.00	3.02	2.01	1.00	24.11	3.03	0.03	1.21	4.05	5.01	0.04	0.05	0.10	0.05	0.04	0.15	0.02	44.92
4			22.04	–	7.00		0.01	0.01	0.01	0.16	0.03	0.01	0.13	0.09	0.08	0.02		0.07	0.03	0.01	0.09		29.79
7			5.00		–			0.01		0.05			0.01	0.06	3.00			0.03			0.02		8.18
8			2.00			–	0.01	1.00	2.00	0.06	3.04		2.05	0.01	0.01	0.01	0.01	0.03	0.05		0.01		10.29
10			2.00				–			10.02	0.02	0.01	0.02			0.04	1.05	0.01	0.01	1.00	2.06	0.01	16.25
11			7.02				11.01	-	1.00	2.17	0.03		0.04	2.00		0.02	0.06	0.03	0.02		0.09	0.01	23.50
12			1.00						-	0.02	2.00		0.01				0.01	0.01	1.01	0.01	0.01		4.08
13										-	5.02	2.00	22.04	4.00		1.06	1.07	1.12	0.09	0.01	8.09		44.50
14										4.00	-	0.01	5.05	1.00		0.04	0.02	1.08	4.04	0.01	0.01		15.26
15												-				0.02			1.00	0.01	2.00		3.03
16											1.00	1.00	-			0.05	2.01	10.03	7.02	0.02	6.01		27.14
17							1.00			5.02	1.01	0.01	2.02	-	1.00	0.04	0.01	1.01	1.02	0.01	0.05		12.20
18							0.01	2.00		5.04	0.02		0.04	3.01	-	0.03	0.01	0.04	0.01		0.03		10.24
19																-				1.00			1.00
20																	-						0.00
21																1.01	1.00	-					2.01
22																3.01	2.00	3.00	-	1.01	1.00		10.02
23																				-			0.00
24																2.01	3.00				-		5.01
25																						-	0.00
Total	1.00	0.00	45.44	30.00	7.07	1.01	16.08	23.07	4.02	52.106	15.27	3.08	32.82	15.31	10.17	7.46	10.39	16.66	14.42	3.15	19.79	0.05	323.632

A–C–V	Code
A1 Teamwork	1
A2 Play as functional manager	2
A3 Business planning	3
A4 Functional operations	4
A5 Safe environment	5
A6 Decision-making	6
A7 Financial statements	7
A8 Market diversity	8
A9 Competition among others	9
C1 Assertive/cooperative	10
C2 Communication	11
C3 Appreciation of stereotype	12
C4 Strategy formation/implementation	13
C5 Systems thinking	14
C6 Continuous improvement/effort	15
C7 Strategic management control	16
C8 Financial statements analysis	17
C9 Using decision support software	18
V1 Helpfulness	19
V2 Fun/enjoyment	20
V3 Self-fulfillment	21
V4 Feeling of reality	22
V5 Self-development	23
V6 Accomplishment	24
V7 sense of comradeship	25

Source: The results from the study