

Integrated Fuzzy Screening in KM-Model towards the Organizational Diagnostics

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Abstract:

Many organizations fail to implement their strategies due to the inability of stakeholders in managing their knowledge in order to address the problems associated with it. Knowledge Management (KM) Model as one of measurement tool provides a solution in diagnosing the organizational situation whether it is known, knowable, complex or chaos (Cynefin framework). This paper applied Multi Criteria Group Decision Making-Fuzzy Screening as a technique to analyze the aggregation of individual perspectives from the two group decision makers. As a group, top and middle managers provided the collective information by forming fuzzy or linguistic estimates through KM-Model measurement. Fuzzy Screening analyzed KM-Model criterions including Initiatives, Organizational Communication, Organizational Strategic Planning, Organizational Objectives, Problem Recognition, Knowledge Production, Knowledge Utilization and Knowledge Integration towards the classification of alternatives from two by two quadrants of Cynefin framework into three by three quadrant alternatives as advancement. Therefore, the organization explicitly can classify their situation. Moreover, the dominant criterions that formalized it would be diagnosed too. It was useful in conducting corrective actions for their strategy. A case study in Universiti Teknologi Malaysia (UTM) was used for illustrating the proposed approach. The results were promising and showed the potential of Fuzzy Screening application.

Key words: Knowledge Management, Fuzzy Screening, Group Decision Making, Cynefin Framework, Organizational Diagnostics.

1. Introduction

Strategy implementation provides a high contribution in judging organizational performance. Measuring the success of strategy implementation based on knowledge management view is difficult to describe. Based on the observation, the expertise or knowledge of top and middle managers as internal stakeholders in an organization is significant [1-4]. These are caused directly or indirectly by their engagement in developing and implementing the strategic decision or initiatives. Moreover, their roles have wider implications on many other functional areas in the implementation process. They must be able to study the phenomena during the implementation process in order to produce the right decision to solve problems. Herein, the role of organizational knowledge in individuals or groups will generally influence the performance of strategy implementation. The importance of knowledge management which provides new creation of decision making has been studied and applied in previous researches within different context studies, including French [5]; government policy-making [6]; increasing the capabilities

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of Information System (IS) research [7]; enhancing military capabilities within network-enabled operation [8] and knowledge management metrics in higher education institution [9]. For the scope of non profit organization Okfalisa et al [9] studied 33 possible indicators that can be used in measuring the achievement of strategy implementation. Afterwards, by applying the Gauss Normal Distribution the indicators provided are mapped into the analysis of organizational situation. This paper tries to discuss the application of fuzzy screening to compliment the previous technique in mapping the knowledge management metrics. Fuzzy screening as one of multi criteria decision making screens the information given by multiple experts from top and middle managers in higher education institution. The aggregation of individual experts' evaluation in linguistic values was used to obtain the overall evaluation function and the best alternatives. This technique provides the evaluation that rating each alternative on each of the criteria with the different level of importance [10 and 11] that were missed by Gauss Normal Distribution. Therefore, fuzzy screening is suitable applied in mapping KM-Model indicators as criterions into the organizational situation as possible alternatives. The analysis of each criterion in supporting the form of alternatives is also discussed. Therefore, the management administration will know their strengths and weaknesses regarding on their strategy implementation achievement.

2. Materials and Method

2.1. KM-Model

2.1.1. The Conceptual Development of KM-Model

The basic concept of KM-Model development is as the combination of Balanced Scorecard (BSC) measures and Knowledge Process measures. During the transformation of strategy from formulation into its implementation, there are some considered indicators that show the success of its achievement. BSC as a strategy control system concerns on the achievement of Key Performance Indicators (KPIs) through measures, targets and objectives of the strategic blueprint [12]. Meanwhile, the efforts towards the strategy implementation achievement are receded by them. The emergence of problems, the complexity and uncertainty environment cannot be avoided. Herein, the role of knowledge process in knowledge life cycle [13] will take a place. The stakeholders explore their knowledge and expertise that trigger the development of knowledge process in order to solve the problems. The level of this knowledge process together with BSC will impact on the organizational situation [14] whether they are known, knowable, complex or chaos (See Figure 2.1).

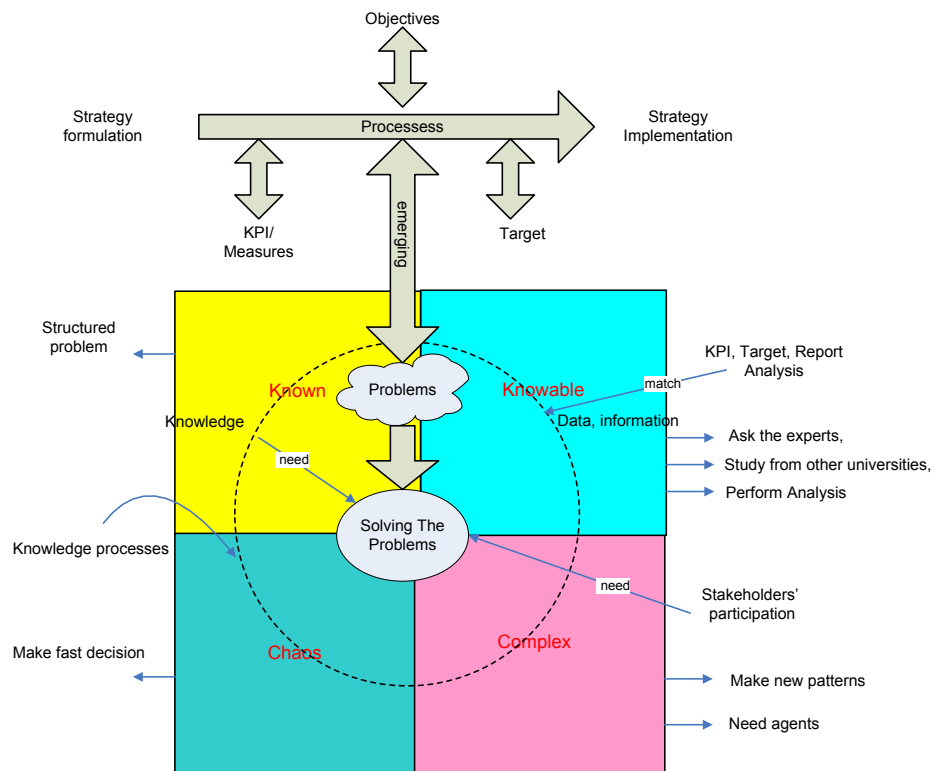


Figure 2.1: The Basic Concept of KM-Model

2.1.2. The Construction of KM-Model

As mention before, there are 33 indicators that constructed KM-Model. A Quantitative Method - Confirmatory Factor Analysis has been conducted to statistically investigate the relevancy and significance of each indicators and each constructs. By applying the stratified random sampling strategy, the sample from 422 respondents that came from 121 top and 301 middle managers in 20 Public of Higher Education Institution in Malaysia are obtained. The model can be seen in Figure 2.2. The values of this indicator measurement reflect to the diagnostic of organizational situation from two by two metrics of Snowden into three by three metrics. The analysis of each group is given based on the scoring and values of the indicators measurement in KM-Model.

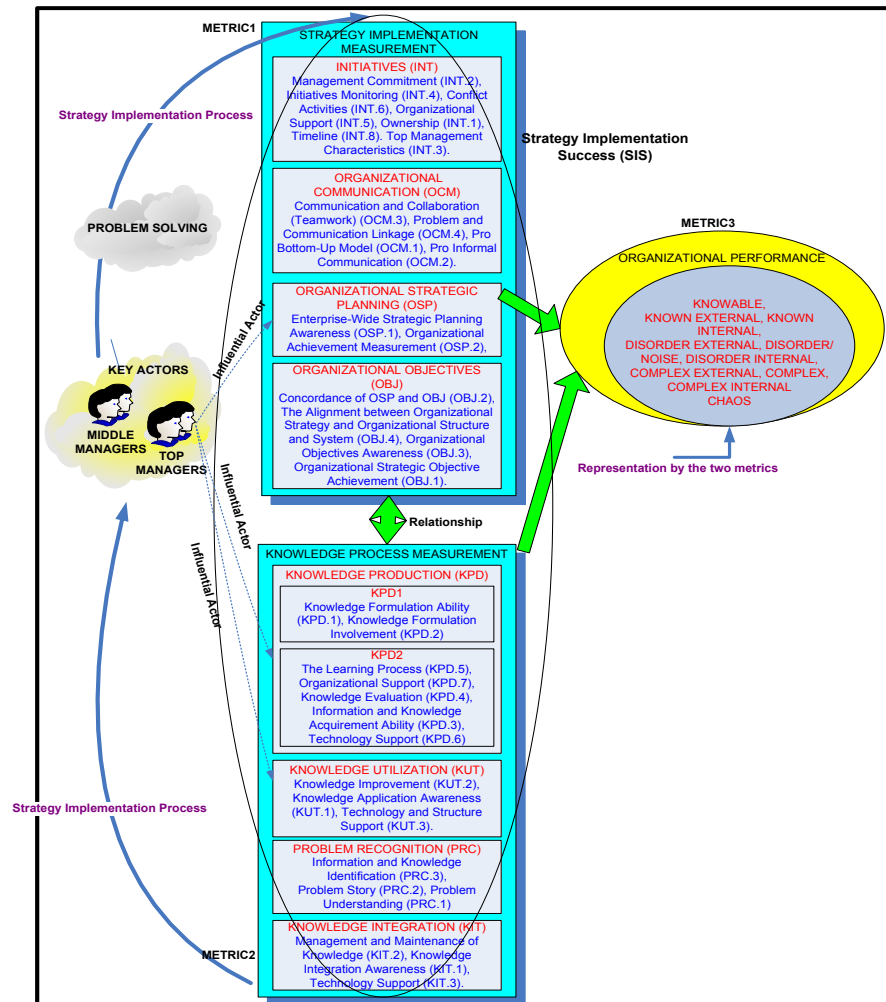


Figure 2.2: The KM-Model

2.2. Fuzzy Screening

Fuzzy Screening is one of Multi Criteria Group Decision Making which selects from a large class of alternatives, a small subset to be further investigated [15]. This method was applied in this paper as it is found to be very flexible with potential to include the information provided by multiple experts [10]. Herein, top and middle managers as experts answered the questionnaires and gave evaluation for each alternative on each of the criteria based on the KM-Model. The evaluation values will be rated and drawn into a linguistic scale without dismiss the different level of significance in each criteria. Afterward, this method is used to aggregate the individual experts' evaluation from top and middle managers to obtain an overall linguistic value for each object. Herein, OWA (Ordered Weighted Averaging) is applied as combining operator [16-18]. This overall evaluation will be used to aid in diagnosing and selecting the organizational situation group. Detailed process can be seen in Figure 2.3

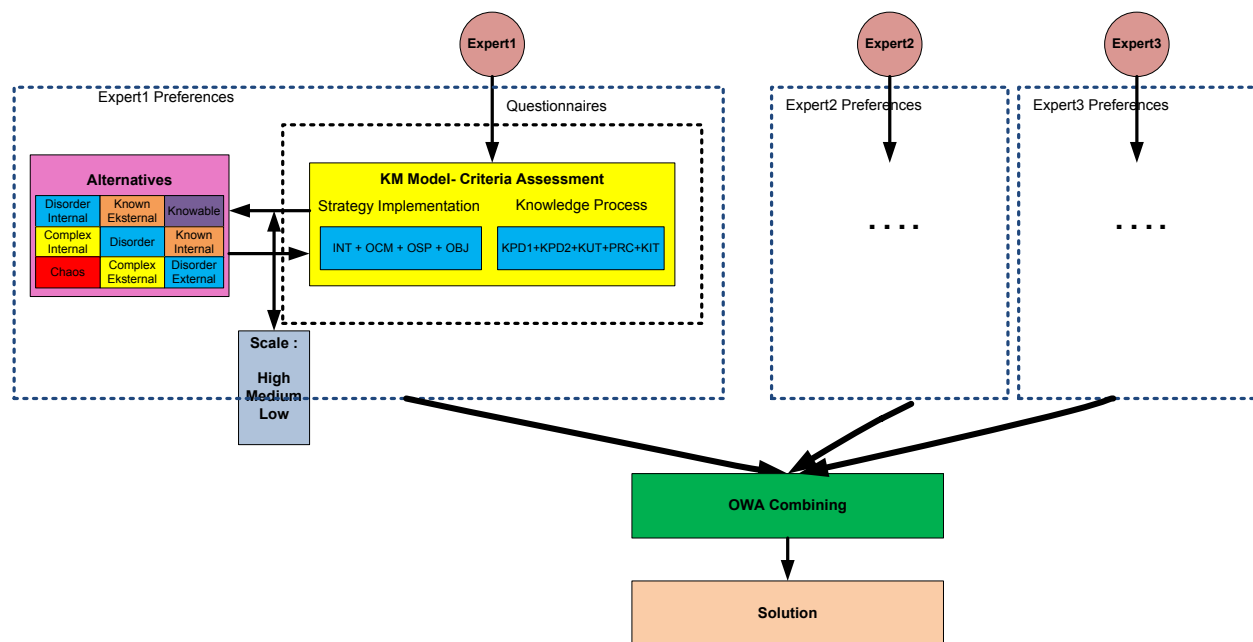


Figure 2.3: Fuzzy Screening Model

The advantages of fuzzy screening approach by Yager [15] in this paper is effective and efficient in screening alternatives because it allows requisite aggregations and this technique will only require the preference opinion of the experts which will be expressed in a linguistic scale in linear order.

3. Results

3.1. Problem Formulation

The problem is formulated into three main components. First is a collection of alternatives solution. It can be stated in Fuzzy Screening model into $X = \{X_1, \dots, X_p\}$. Regarding on the KM-Model analysis, there are nine (9) possible groups of organizational situation as alternatives including Disorder Internal, Disorder, Disorder External, Complex Internal, Complex External, Known External, Known Internal, Chaos, and Complex. The characteristics of these groups were determined based on the achievement of two main criteria i.e. Strategy Implementation and Knowledge Process. The analysis of characteristics for each alternative was determined in linguistics form as seen in Figure 3.1. For example, the organization will perform the Chaos situation when the measurement of Strategy Implementation is “Low” and the Knowledge Process is “Low” [14]. The “Low” performance of Strategy Implementation is triggered by the low achievement of its supporting criteria, including OSP (Organizational Strategic Planning), OBJ (Organizational Objectives), OCM (Organizational Communication) and INT (Organizational Initiatives). Meanwhile, the supporting criteria form Knowledge Process that performs unsatisfied i.e. PRC (Problem Recognition), KPD (Knowledge Production), KUT (Knowledge Utilization) and KIT (Knowledge Integration).

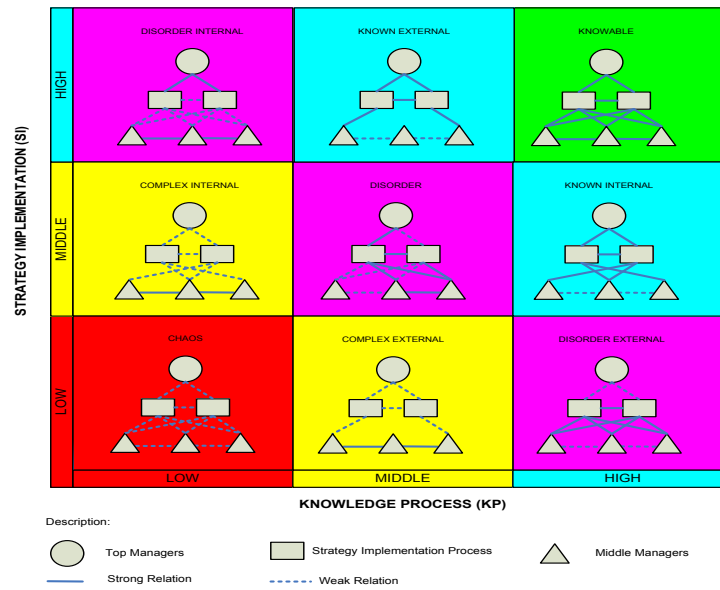


Figure 3.1 : Organizational Situation Mapping Diagram

In this group, the role of top and middle managers are weak thus triggers the emergence of crisis management and complex problems. The organizational situation is turbulence or chaos and any problems cannot be solved. The analytical techniques are useless and the patterns of problem solving can be perceived but not predicted. Therefore, the decision model in this space is conducted by acting fast and responds immediately. This situation needs an intervention from an outside organization to bring its stability back through the emergence of new possibilities and innovation actions. Proceed to the second component is a group of experts whose opinions solicited in screening the alternatives, $A = \{A1, \dots, Ar\}$. In this paper, the administration group is separated into top and middle managers. The classification regards to their roles, skills and decision making involvement during the strategy implementation process [19]. They screened forty three (43) questions in the questionnaires which indicate the evaluation of 33 indicators in supporting the criteria. The third component is collection of criteria $C = \{C1, \dots, Cn\}$ which are considered relevant in the choice of object.

3.2. Fuzzy Screening Process

The questionnaire as an instrument provided closed-ended question within six point scales [20 and 21]. This scale represents the assessment of criteria against alternatives in their organizational situation. The fuzzy screening interpreted and converted this scale into the following scale [15 and 10]: {Outstanding-OU (S7), Very High-VH (S6), High-H (S5), Medium-M (S4), Low-L (S3), Very Low-VL (S2), None-N (S1)}. This scale performed will consider the level significance of each criterion. For alternatives an expert provides a collection of n values $\{P1, \dots, Pn\}$ where Pj is the rating of the alternative on the j -th criteria by the expert. Each Pj is an element in the set of allowable scores S . Then the unit score of each alternative by each expert, denoted by U , is calculated as follows

$$U = \min_j \{Neg(I_j) \vee P_j\} \quad (1)$$

where I_j denotes the importance of the j -th criteria. The operations \max , \min and Neg are defined by $\max(S_i, S_j) = S_i$ if $S_i \geq S_j$, $\min(S_i, S_j) = S_j$ if $S_j \leq S_i$, $Neg(S_i) = S_8 - i$. Formula (1) indicates the degree of criteria against alternative are “satisfied”. In this case, S- implication $x \rightarrow y = \min\{1 - x + y, 1\}$ (Łukasiewicz) and $x \rightarrow y = \max\{1 - x, y\}$ (Kleene-Dienes) are used as operator. As a result of this stage, we have for each alternative a collection of evaluations $\{X_{i1}, X_{i2}, \dots, X_{ir}\}$ where X_{ik} is the unit evaluation of the i -th alternative by the k -th expert. In the next stage, the expert’s evaluation was combining based upon OWA operator to obtain an overall evaluation for each alternative. The function Q which emulates the average is denoted as $QA(k) = Sb(k)$ where $b(k) = \text{Int}[1 + (k \times (q - 1)/r)]$ for all $k = 0, 1, \dots, r$. Herein, q be the numbers of points on the scale and r be the numbers of experts participating. To find the overall evaluation for the i th project, denoted X_i , we calculate

$$X_i = \max_j \{Q(j) \wedge B_j\} \quad (2)$$

This final evaluation will be mapping based on the organizational situation diagram. The above Fuzzy Screening process stages can be seen in Figure 3.2.

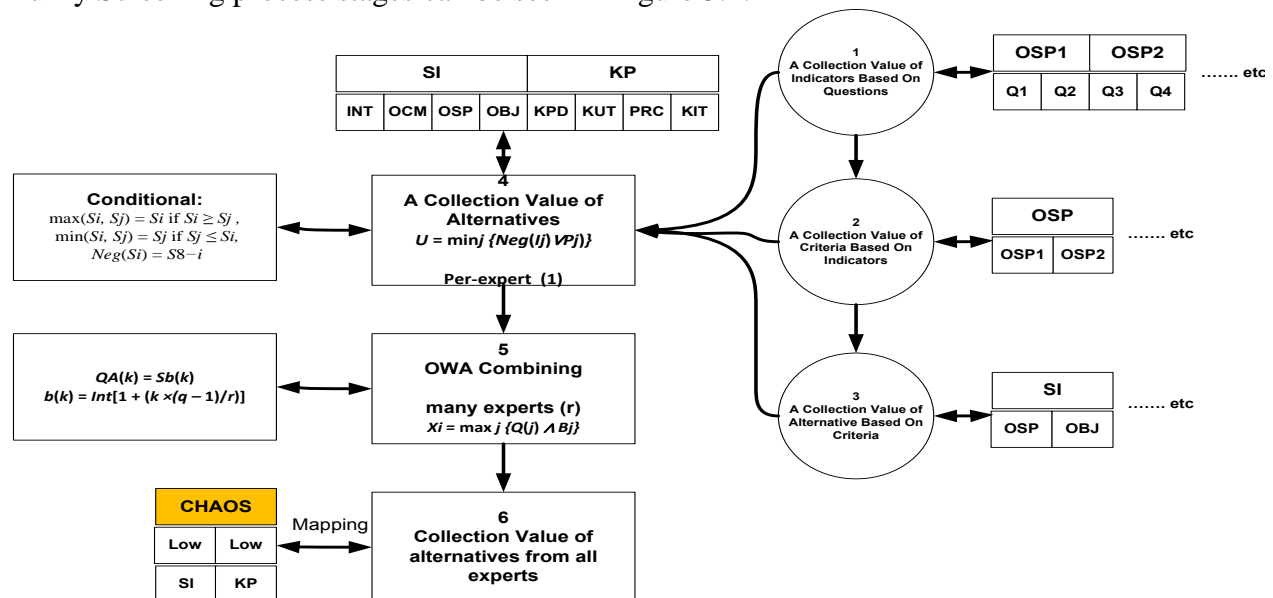


Figure 3.2 : Fuzzy Screening Process Stages

3.2. Case Study – Universiti Teknologi Malaysia

To test the fuzzy screening model in this paper, a set of data from Universiti Teknologi Malaysia was collected and analyzed. The questionnaires were disseminated to ten (10) top managers and forty six (46) middle managers. Following the Fuzzy Screening Process, Figure 3.3 is obtained.

Stage 1,2 and 3

Domain		Strategy Implementation (SI)				Knowledge Process (KP)			
Criteria		OSP	OBJ	OCM	INT	PRC	KPD	KI T	KUT
Level Significance		H	H	L	L	H	L	H	L
Id	Position								
1	TOP	H	H	H	H	H	H	H	H
2	TOP	H	H	H	H	H	M	H	H
3	TOP	M	M	M	H	H	M	M	M
4	TOP	H	H	M	M	H	H	H	M
5	TOP	H	H	H	H	H	M	H	M
6	TOP	H	H	H	H	H	H	H	H
7	TOP	H	H	H	H	H	H	M	H
8	TOP	H	H	H	H	M	H	H	H
9	TOP	H	L	H	M	H	M	H	H
10	TOP	H	H	H	H	H	H	M	M

Stage 4

Domain		SI	KP
Id	Position		
1	TOP	H	H
2	TOP	H	M
3	TOP	M	M
4	TOP	M	M
5	TOP	H	M
6	TOP	H	H
7	TOP	H	H
8	TOP	H	H
9	TOP	M	M
10	TOP	H	M

Figure 3.3: Collection Value Process Diagram

Herein, the level significance for evaluation criteria is defined as follows: $S = \{H, H, L, L, H, L, H, L\}$. Referring to Eqs. (1) in Stage 4, A Collection Values of Strategy Implementation is obtained from the values of OSP, OBJ, OCM and INT.

$$\begin{aligned}
 OSP - X_{11} &= \min[Neg(L) \vee H, Neg(L) \vee H, Neg(H) \vee H, Neg(H) \vee H] \\
 &= \min[H \vee H, H \vee H, L \vee H, L \vee H] \\
 &= \min[H, H, H, H] \\
 &= H
 \end{aligned}$$

As the result, Fuzzy Screening of Strategy Implementation (SI) is “High (H)” and Knowledge Process (KP) is “High (H)”. Then the preferences from 56 experts will be combined through OWA Eqs.2 as follows:

$$\begin{aligned}
 X_1 &= \max_j \left\{ \begin{array}{l} S_1, S_1, S_1, S_1, S_1, S_1, S_1, S_1, S_1, S_1, S_1, S_1, S_1, S_2, \\ S_2, S_2, S_2, S_2, S_2, S_2, S_2, S_2, S_2, S_2, S_2, S_2, S_2, S_2, \\ S_2, S_2, S_2, S_2, S_2, S_2, S_2, S_2, S_2, S_2, S_2, S_2, S_2, S_2, \\ S_2, S_2, S_2, S_2, S_2, S_2, S_2, S_2, S_2, S_2, S_2, S_2, S_2, S_2, \end{array} \right\} \\
 &= S_2(Middle)
 \end{aligned}$$

and

$$\begin{aligned}
 X_2 &= \max_j \left\{ \begin{array}{l} S_1, S_1, S_1, S_1, S_1, S_1, S_1, S_1, S_1, S_1, S_1, S_1, S_1, S_2, \\ S_2, S_2, S_2, S_2, S_2, S_2, S_2, S_2, S_2, S_2, S_2, S_2, S_2, S_2, \\ S_2, S_2, S_2, S_2, S_2, S_2, S_2, S_2, S_2, S_2, S_2, S_2, S_2, S_2, \\ S_2, S_2, S_2, S_2, S_2, S_2, S_2, S_2, S_2, S_2, S_2, S_2, S_2, S_2, \end{array} \right\} \\
 &= S_2(Middle)
 \end{aligned}$$

It means that OWA's SI is "Middle (M)" and KP is "Middle (M)". Then, this result is mapped into the Organizational Situation as "Disorder". Referring to KM-Model, this situation explains that the activities towards the strategy implementation success are sensed but the achievement values of them are not maximal. The conflict activities among the decision makers in this situation are critical and hard to be solved. Both top and middle managers think they are with their individual capabilities and perspectives as the most empowered in the organization. They run the activities of strategy implementation by their own perspectives. This triggers to the emergence of a disorder situation. To reduce the disorder of this situation, the collaboration of top and middle managers through an agreement is required as a significant step in response.

Conclusions

In this paper, Fuzzy Screening process has been successfully mapped KM-Model. An organization can diagnose their organizational situation based on the achievement of strategy implementation (SI) and Knowledge Process (KP) by considers the level significance of each criteria. It is shown from the case study. This paper contributes the utilization of Yager Fuzzy Screening approach in solving the Multi Criteria Group Decision Making (MCGDM). It identified the experts' preference based on the collection values of alternatives and OWA combination. Organizational Situation Diagram from KM-Model justified the final result of this measurement and mapped it into 9 group of Organizational Situation. The characteristics of each group are described based upon the expert's evaluation thus the organization knows their detail strategy implementation performance. From this, the recommendation or corrective action for their strategy is given. It helps the decision maker in making the right choice for their organization. Due to KM-Model is applied for the Higher Education Institution Environment that this Fuzzy approach is restricted into it. However, the changing environment can enhance the utilization of this approach.

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