

Using Multi Criteria Decision Making Methods for Evaluation the Entrepreneurship and Innovation Indicators

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Abstract. This paper offered a procedure for ranking the entrepreneurial and innovative indicators using Multi Criteria Decision Making (MCDM), taking into account three individual, organizational and cultural dimensions simultaneously in decision making procedure. Henceforward, by using the Meta synthesis framework, the form of group classification of indicators from a finding's combination was suggested and recognized. After that, the entrepreneurship and innovation specialists' sight were congregated

based on Meta-analysis. Then, the indicators were arranged using Analytical Network Process (ANP) and the Decision-Making Trial and Assessment Laboratory (DEMATEL). The outcomes found from Meta-analysis and MCDM methods were used as input and output data, respectively, to describe the methodology of evaluating and prioritizing entrepreneurial and innovative criteria in smart international companies.

Keywords: Entrepreneurial;Innovative;MCDM; ANP;DEMATEL

1. Introduction

Since innovation is the creator and developer of new ideas and its consistency leads to the increasing success of the organization, entrepreneurship has increasingly become dependent on innovation in organizations in today's world. As the innovation creation process acts as a system, entrepreneurship depends on innovation, and innovation in turn, depends on knowledge and awareness; in other words, its input is knowledge and the correct understanding of the conditions and its process is able to achieve the proper result and output along with the scientific prioritization of the activities. Hence, knowledge and scientific prioritization are one of the important factors in the firms' innovation performance. In order to achieve entrepreneurship with innovative features, the present study firstly attempts to create knowledge base that is done through considering and identifying the main indices. Since the innovation creation and achieving proper performance is the basis for prioritization of activities and processes, the scientific prioritization of these indicators is included in the research procedure.

2. Literature review

The purpose of Meta-synthesis is to integrate multiple studies and create comprehensive and interpretive-adaptive findings. Meta-synthesis focuses on qualitative studies that do not necessarily involve a broad literature, and provides an interpretative composition of the findings instead of providing a comprehensive summary (Korhonen et al., 2013). Innovation is a prerequisite for the emergence of entrepreneurship and entrepreneurship is realized by human resources; meanwhile, individual capabilities are a fundamental category in human resources that value this

resource in terms of efficiency. Many criteria have been introduced in literature to enhance this capability, some of which are common to most resources including Job motivation that is an important issue in the field of individual capabilities that organizations always pay attention to, since it facilitates the achievement of the goal and makes it possible for the individual to manifest and develop the capabilities. The importance of the relationship between emotional intelligence and job motivation in staff is one of the topics discussed by (Gorji et al.,2017). Encouragement based on merit (Gong et al.,2017) examined four types of feedback between the individual and the environment, including the employer organization and the community, one of which was negative self-analysis. Mone & London (2018) provide a practical guidance for managers to increase employee engagement. Meanwhile, one of the important criteria in their work is the proper position of the reward system based on efficiency. So, it can be found that individual capabilities will not grow unless with job motivation, and this will not occur unless considering the need for Learning and training capability according to time and space necessity, and these are realized in the light of the Competency-based encouragement system (C3) scientifically based on a researcher database (Sha'ari et al., 2018). Organizational capabilities ensure the emergence and continuity of individual capabilities in supplying human resource requirements, and these requirements depends on the efficiency of organizational capabilities. Resource integration and reconfiguration capabilities: The integration and reconfiguring capability of resources is one of the most important indicators referred to in literature as the organization's growth indicators (Vargo and Lusch, 2010). (Huang & Li ,2017) have demonstrated the importance of coordinating and integration among the dynamic capabilities of an organization to reinforce the green innovation. Agility is one of the key characteristics in leading and entrepreneurial organizations, because agility is imperative in the rapidly changing world. In a logical argument in this regard, (Battistella et al.,2017) showed that strategic agility is one of the key elements of the concepts raised in the business models. The role of information sharing has become increasingly important to achieve organizational agility (Salehzadeh et al., 2017). Inter-organizational cooperation and coordination is one of the most important organizational indicators that lead to inter-organizational desirable

interactions (Wu, 2018). In the transportation sectors as one of the organizational units, integration and coordination between logistics service providers and shipping companies will have important consequences such as reducing harmful effects on the environment, speeding up service and reducing costs (Sallnäs, 2016). Therefore, according to the literature, it is necessary for the organization with enabling capabilities to have change management in order to correctly manage the resources so that its indicators include the Resource integration capability, Resource reconfiguration capability, Ability to respond to the rapidly changing environment which are changing rapidly, keep up-to-date the coordination capability with these changes (Huang and Jim Wu, 2010; Huang and L, 2017). Culture is the common ground that enables the two sets of individual and organizational capabilities to exploit the maximum of their abilities. Therefore, cultural capabilities in an organization, with a meritocratic structure along with a strong culture, make it possible for an individual to implement his innovations in the context of organizational capabilities. Distinctive indicators in the field of cultural capabilities in the organization can be summarized in the following items: Affect-based Trust and Cognition-Based Trust: It is management that defines the fields and orientation of innovation and the ideal interaction between management and employees depends on trust; however, trust has different types; it can be based on feelings (emotional) or based on the previous recognition. These two criteria direct the organizational behaviors. Studying affect-based and cognition-based trust was developed by (Van Knippenberg's ,2018) and examined in the form of short-term or long-term relationships. Knowledge is a critical and fundamental feature to achieve business success in the organization. (Matthews et al., 2017) know that process improvement in the small and medium industries dependent on organizational learning. Hence, cultural capabilities should be measured by criteria that will create a strong cultural context in the organization, and such context will increase the Likelihood to Share New Insights at the organizational levels and, consequently, among employees and as a result, interactions are formed in the organization which durability depends intensely on interdependent trust or Affect-based Trust and Cognition-based Trust.

3. Method

Multiple assessment scales have been developed in this paper that is formed in a regular framework of the dimensions and criteria of each of them. This framework utilizes quantitative and qualitative assessment criteria simultaneously and includes 3 dimensions and 10 criteria, all of which are gathered and aggregated based on literature. The proposed framework allows experts in the field of entrepreneurship and innovation to identify priority options using Linguistic expressions and proposed prioritization, and efficiently and effectively ensure the reliability of programs to promote entrepreneurship and innovation and to address the progressive problems more than ever. (Tseng ,2011) also developed the ANP and DEMATEL combined method developing fuzzy variables to assess the knowledge management capabilities of companies.

4. Findings

The analyses were conducted in this research at the lowest level of its hierarchy on the three international companies Keison, Sabir International and Mapna as alternatives. The international companies of Mapna, Keison and Sabir International will be hereafter displayed with the abbreviations A1, A2 and A3, respectively. It is tried in this section to use the hybrid approach of DEMATEL and ANP to assess the three dimensions and ten criteria in the field of entrepreneurship and innovation. The process of implementing this hybrid approach has been accomplished through an interactive relationship with the expert group in five phases. Focusing on the direction of the research was always considered in the process of gathering information. It is tried to select experts with at least 5 years of experience in the field of entrepreneurship and innovation. Respondents were requested to complete their checklist by their mental judgments on the importance of each criterion based on the assessment criteria and hierarchical structure of the company. Given the quantitative and qualitative data collected, which are different in terms of the measurement unit type, we normalized the data for their comparability to allow

comparison between all the criteria. The proposed method considered the study decision making objectives for the purpose of analysis. The un-weighted super-matrix is formed by normalized data. The inner dependence matrix is obtained after applying the different steps of the DEMATEL method.

Table1. Summary of the DEMATEL results

Criteria	D	R	D-R	D+R	Wight	Rounded Wight
<i>C1</i>	0.282	0.155	0.126	0.437	0.1471612	0.15
<i>C2</i>	0.291	0.104	0.186	0.395	0.1328637	0.13
<i>C3</i>	0.148	0.109	0.038	0.257	0.0865332	0.09
<i>C4</i>	0.055	0.096	-0.04	0.151	0.0509806	0.05
<i>C5</i>	0.125	0.104	0.021	0.229	0.0772014	0.08
<i>C6</i>	0.178	0.136	0.041	0.314	0.1057522	0.11
<i>C7</i>	0.204	0.15	0.054	0.353	0.1189640	0.12
<i>C8</i>	0.066	0.169	-0.1	0.234	0.0788435	0.08
<i>C9</i>	0.069	0.234	-0.17	0.303	0.1019640	0.10
<i>C10</i>	0.069	0.227	-0.16	0.296	0.0997361	0.10

Furthermore, based on the superiority and relational axis in Table 1, the causal diagram is shown in terms of criteria in Figure 1. By observing Figure 1, which shows the data pair graph (D + R, DR), it can be clearly seen that the cause group consists of criteria C1, C2, C3, C5, C6 and C7, while the effect group is consisted of C4, C8, C9, and C10 criteria. Another important note is the weight of each criterion calculated by $\frac{(D+R)_i}{\sum_{i=1}^n (D+R)_i}$ and reported in Table 1. Hence, the vector $W_1 = (C_1, C_2, C_3, C_4, C_5, C_6, C_7, C_8, C_9, C_{10})$ represents the weight of each of the indicators relative to the purpose of the research, which the weights values can be represented as rounded $W_1 = (0.15, 0.13, 0.09, 0.05, 0.08, 0.11, 0.12, 0.08, 0.1, 0.1)$.

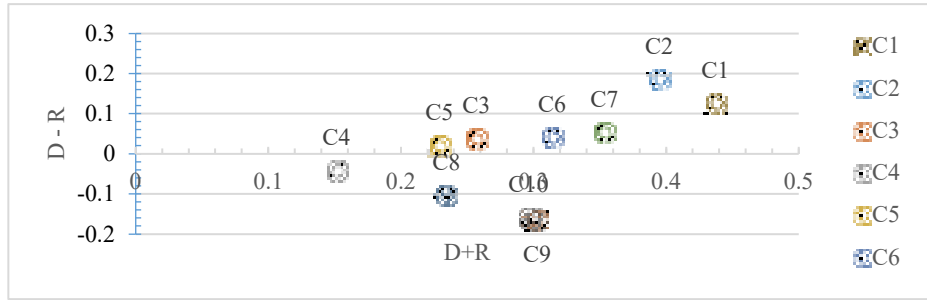


Figure1. The causal diagram of the DEMATEL results

Table2. The un-weighted super-matrix

	G	D ₁	D ₂	D ₃	C ₁	C ₂	C ₃	C ₄	C ₅	C ₆	C ₇	C ₈	C ₉	C ₁₀	A ₁	A ₂	A ₃
G	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1
D1	.24	.08	.07	.11	0	0	0	0	0	0	0	0	0	0	0	0	0
D2	.43	.33	.23	.31	0	0	0	0	0	0	0	0	0	0	0	0	0
D3	.33	.59	.70	.58	0	0	0	0	0	0	0	0	0	0	0	0	0
C1	0	.10	.10	.10	.30	.31	.30	.27	.28	.32	.30	.32	.33	.33	0	0	0
C2	0	.09	.10	.10	.20	.20	.20	.20	.21	.18	.21	.20	.18	.21	0	0	0
C3	0	.10	.09	.08	.13	.12	.14	.14	.12	.13	.12	.12	.13	.12	0	0	0
C4	0	.10	.09	.12	.12	.11	.10	.12	.12	.09	.12	.11	.10	.09	0	0	0
C5	0	.10	.08	.08	.07	.07	.06	.07	.09	.09	.06	.06	.05	.06	0	0	0
C6	0	.10	.11	.09	.05	.06	.07	.06	.06	.06	.06	.06	.07	.07	0	0	0
C7	0	.09	.10	.10	.04	.06	.05	.05	.05	.04	.04	.04	.06	.04	0	0	0
C8	0	.10	.10	.12	.04	.04	.04	.04	.03	.04	.04	.04	.04	.04	0	0	0
C9	0	.09	.11	.11	.03	.02	.03	.03	.02	.02	.03	.03	.03	.02	0	0	0
C10	0	.09	.10	.12	.01	.01	.01	.02	.01	.01	.01	.01	.01	.01	0	0	0
A1	0	0	0	0	.38	.37	.39	.36	.40	.38	.40	.41	.42	.35	0	0	0
A2	0	0	0	0	.32	.33	.30	.35	.30	.32	.31	.28	.32	.34	0	0	0
A3	0	0	0	0	.29	.30	.32	.30	.30	.29	.29	.32	.26	.31	0	0	0

Finally, the final result is the same normalized weighted super-matrix or limited super-matrix and for the calculation of global prioritization weights. The final results calculated the weights of each level of the hierarchy, namely, the research purpose, dimensions, criteria and alternatives (companies), respectively including: $W_{Goal}=(G)=(0.32)$, $W_{Dimension}=(D_1,D_2,D_3)=(0.24,0.43,0.34)$, $W_{criteria}=(C_1,C_2,C_3,C_4,C_5,C_6,C_7,C_8,C_9,$

$C_{10})=(0.15,0.13,0.09,0.05,0.08,0.11,0.12,0.08,0.1,0.1),$

$W_{\text{Alternative}}=(A_1,A_2,A_3)=(0.4,0.3,0.3).$ Then, the most important criteria were C1 and C2 respectively, with C1 being the highest-rated job incentive with a weight of 0.3578, followed by C2, or training and learning within the individual skill level weighing 0.1240 in the next rank. Also, the most important alternative, which can be determine as a target and template, is assigned to A1 or MAPNA Holding, which has the highest priority position with a weight of 0.4498 in top priority, followed by A2 and A3 respectively with weights of 0.2579 And 0.2132 in the second and third places. It can be seen, according to the causal diagram in Figure 1, that the highest amount (D + R) is related to C2 and C1 criteria, that are respectively learning and training capability and job motivation as the subcategories of individual abilities. The next criteria at a lower level are C7 and C6, both of which are related to organizational capabilities. Therefore, it can be clearly understood that firstly, these are the individual abilities that provide the starting point for an action set for creating innovation and entrepreneurship, and consequently, the organization provide the appropriate space and facilities to make these two important items realized. Although some criteria like C9 and C10 have high values of (D + R), but their (D-R) values are close to zero or negative. Such conditions mean that these criteria have a great impact on the innovation and entrepreneurship of companies; however, they are also influenced by other criteria. Hence, they are specific receivers and should be placed at a lower level in management prioritization.

5. Conclusions

In this paper the research gap between two fields of innovation and entrepreneurship is identified by literature evaluation. Moreover, a new model is proposed for evaluation and analysis of innovation and

entrepreneurship indices of international companies. The evaluation is simultaneously focused on three major dimensions of individual, cultural and organizational characteristics. The proposed model could identify the relationship between dimensions, criteria and options in the field of innovation and entrepreneurship indices by using Meta-synthesis method. Then, the prioritization of criteria and indices are obtained by using Meta-analysis and DEMATEL-ANP combined method.

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