TECNOLOGÍA: RESULTADOS DE INVESTIGACIÓN

Applying soft systems methodology in a problem related to the Delphi method and its alignment with the innovation strategy in the framework of innovation management models

Aplicación de la metodología de sistemas suaves en un problema relacionado con el método Delphi y su alineamiento con la estrategia de innovación en el marco de modelos de gestión de innovación

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RESUMEN

El artículo presenta una aplicación de la metodología de sistemas suaves en un problema relacionado con el Método Delphi y su alineamiento con una estrategia de innovación en el marco de un modelo de gestión de innovación, con el fin de generar un problema mejorado.

Entre los principales resultados se destaca la ventaja del uso de la metodología de sistemas suaves para ayudar en el mejoramiento de problemas de actividad humana no estructurados relacionados, en este caso específico con un problema relacionado con el método Delphi y su alineamiento con la estrategia de innovación empresarial en el marco de modelos de gestión de innovación, así como la posibilidad de complementar la metodología de sistemas suaves con cuestionarios de priorización para obtener opiniones de expertos para el mejoramiento del entendimiento del problema.

Palabras clave: Método Delphi; Metodología de sistemas suaves, alineamiento

ABSTRACT

The article presents an application of the soft systems methodology- SSM on a problem related to the Delphi Method and its alignment with an innovation strategy in the

framework of a management model innovation, in order to generate an improved problem.

Amongst the major findings throughout the case, highlights the advantages of using soft systems methodology to assist in the improvement of non-structured human activity problems, in this specific case, a problem associated with Delphi method and its alignment with the business innovation strategy in the context of innovation management models, additionally, the possibility of complementing the soft systems methodology prioritization questionnaires for expert opinions for improving the understanding of the problem.

Keywords: Delphi method; Soft systems methodology, alignment

INTRODUCTION

This article deals with the application of soft systems the methodology SSM in order to analyze a problem of a Doctoral dissertation entitled "The Delphi method as an enabler of innovation strategies in the context of a managerial framework model for innovation in organizations in the productive sector" of the PhD in management from the Universidad de Medellin – Colombia. The main objective is to obtain an improved problem regarding the alignment that can exist between foresight studies through the Delphi method with the components "innovation strategy and management innovation model. The article is divided into several sections. First, concepts of the Delphi method, innovation strategy, management innovation models and SSM, then the methodology is explained, the results, the discussion and finally the conclusions.

Theoretical Framework

The definitions chosen in this research on the three components that are part of the study are presented:

Delphi Method: systematic and interactive method in which a panel of independent experts are involved through a series of opinions on anonymous communication and

feedback. It is flexible and serves to enrich consensus in the method. Trials are summarized and sent back in order to refine the problem on a wide range of fields (Helmer and Rescher, 1959). According to Rowe and Wright (1999). The latest applications are made based on what is called "modified Delphi method" in which consensus is not necessarily looked after and has fewer rounds, amongst others.

Innovation strategy: the emphasis chosen is from Schilling (2013) that establishes a methodology to formulate an innovation strategy within organizations in phases: R+D project map, collaborative forms, intellectual property and digital rights mechanisms, the author also mentions the phases of the innovation strategy implementation: organizational structure, new product/service management methodology, development team structure, and strategy deployment

Models of organizational structure (Cidet, 2012), (Rothwell, 1992) involving models of innovation processes, their trajectories and feedback. (Kline and Rosenberg, 1986).

Soft Systems Methodology SSM:

According to Checkland (1985), the SSM is itself a learning system, which uses a model system of human activity. It is accepted that these models are not models that form part of the real world, but ways of perceiving the real world.

The SSM was used by Lehaney and Paul (1996) as a tool to aid in the identification of activities for simulation models. It uses the dialectic of an idealized scenario through mechanisms to develop "root definitions" (Eden, 1995), whose purpose is to take decisive action in human situations, considered as problematic.

Other approaches and applications have been conducted, for example, about existence of multiple actors, multiple perspectives, conflicts of interest and uncertainties (Rosenhead and Mingers, 2001), (Mingers and Rosenhead, 2004), development and definition of the issues that form the problem (Mingers and White, 2010), SSM as help to the process of building models (Lehaney and Paul (1996), operations research and

management science (Churchman (1979) and Ackoff (1979), practice in operations research (Mingers and White, 2010), workflow and information flow in the care of chronic diseases (Unertl, et al., 2009), the evolution of the management of critical science Mingers (1992),

Methodology

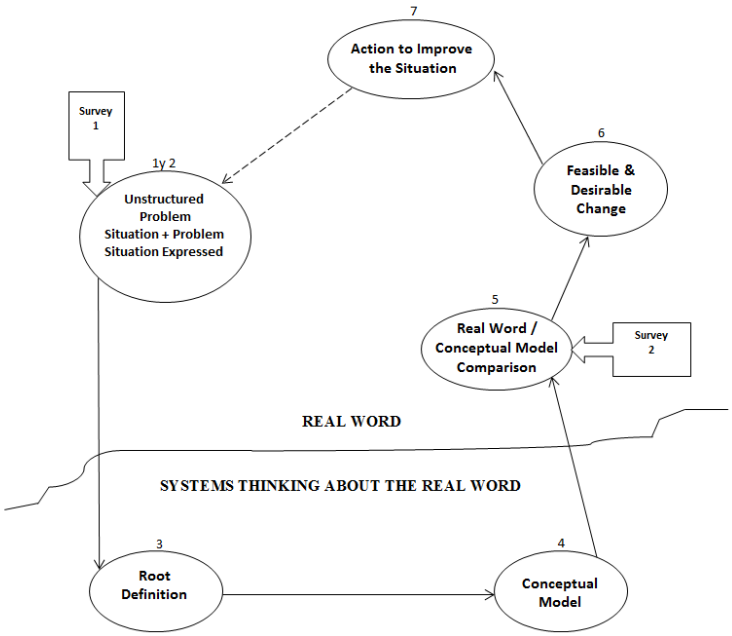
In this research, content analysis and technical information related to the Delphi method about these articles was found in Scopus databases, patents are also analyzed on the basis of data free patents online, including patent databases in Europe, Japan, US, Germany and the world intellectual property organization WIPO, ProQuest dissertations, University of Manchester, George Washington University, University of Phoenix, University of Oslo Brunel and the Massachusetts Institute of Technology.

Eventually, work was done on problem related to non-structured human activity and Soft Systems Methodology. A doctoral dissertation related to the Modified Delphi Method, was applied to the problem as a catalyst for innovation strategy in the framework of a management model innovation in organizations. In order to demonstrate the benefits of applying SSM in the Delphi Method related to non-structured problems.

Steps 1 and 2: Expression: the non-structured problem was investigated and the problem situation was expressed.
Questionnaire [I] was designed and applied. (Zartha, 2015).
Step 3: Setting the root definitions.
Step 4: Preparation of the conceptual map - under the focus of entries - transformation process - outputs.
Step 5: Introduction of the model in the real world.
Questionnaire [II] was designed and applied. Zartha (2015).
Step 6: Definition of possible changes.
Step 7: Actions to improve the situation problem.

In Figure 3, the process of the seven stages used in the soft systems methodology is mentioned with a modification related to the inclusion of the 2 questionnaires, in order to involve them in the real world and the fusion of steps 1 and 2.

Figure 3. The 7 Processes, stages of the Soft Systems Methodology



Source: Adapted from Lehaney and Paul (1996)

RESULTS

In order to demonstrate that the unstructured problems are not a problem, but a reality or feature of many systems, there are methodologies to understand, analyze and improve these unstructured problems, SSM was applied to a problem related to alignment of the Delphi Method.

Below a summary of the steps applied is presented, however, all the details of the application of SSM in this case can be reviewed in the article “The modified Delphi method. An approach from the Soft Systems Methodology” (Zartha et al, 2015).

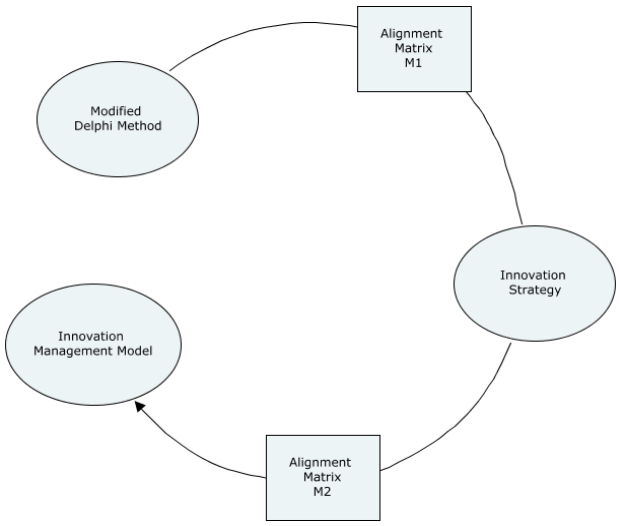
For steps 1 and 2, expression:

The best possible image was put together to describe the actual situation, but not about the problem, the situation about the problem was expressed in the following way:

There is little or no mention of the Delphi method in studies on innovation strategy, and these two components in the management innovation models about organizations of the productive sector, so it is not known how to align the Delphi method with the innovation strategy as part of a management innovation model in these organizations.

From the point of view of figure 4, the model that best represented the situation of this stage is shown below:

Figure 4. First picture of the current situation or first version of the model of the relationship between the three components



Source: Self-elaborated

Steps 1 and 2: They were supplemented by a first questionnaire or survey [I], which was used to investigate the real world on the prioritization of the issues to be discussed in the dissertation.

The surveys or questionnaires [I] and [II], were submitted to the representatives of the seventy-one Technological Development Centers acknowledged by Colciencias –

Colombia. The first survey was sent along with the participation letter to the email address that appeared on each website. Furthermore, to give balance to the participation of the other experts, the assistance of the specialists from Chile (Aenor – Chile and the open innovation platform Oceano), postgraduate teachers and enterprise representatives was required. A total of sixty-nine invitations were submitted to development and innovation experts, including two international specialists. Fourteen out of the contacted experts accepted to participate in the surveys.

Step 3. Definitions Root:
First definition: *Modified Delphi*

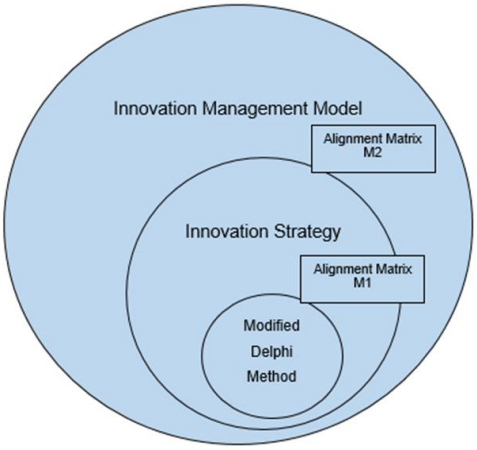
The elements taken considered were: Customer, agent, transformation process, weltanschauung Outlook that gives rise to the following definition, owner, environmental constraints, a similar process was applied to the root definitions from innovation strategy, alignment, and innovation management model. (Zartha et al, 2015).

Step 4. Conceptual Model
Inside this step, the use of a verb list is posed; which describes the activities that are necessary in the specified systems in the definition of root. Also, it is important to try to structure these verbs in a logical sequence (Checkland, 2001).

Step 5. The models are introduced to the real world and are confronted with perceptions of what exists there.
Since this was a comparison aimed at generating a discussion with people interested in the problem situation, a second survey, or questionnaire [II], was created. This survey was created in a similar manner to how the experts in management of the R & D departments, plus the innovation department, generate inputs on the conceptual model.

5.1 Figure 10, with the model of relationship in between the modified Delphi Method, the innovation strategy and management innovation model in the productive sector organizations.

Figure 10. Model of relationship between the three components



Source: Self-elaborated

5.2 Methods of alignment presented in Figure 11:

• Among the modified Delphi Method and Innovation Strategy

• Among the modified Delphi Method, the innovation strategy and management innovation model

Figure 11. Proposed shapes of alignment components of a modified Delphi, innovation strategy and management innovation model.

	V1	V2	V3	V4	V5	Vn
V1						
V2						
V3						
V4						
V5						
Vn						

	O1	O2	O3	O4	O5	On
A1						
A2						
A3						
A4						
A5						
An						

Delphi method gaps	Innovation strategy gaps				
				S	I
			L	S	
		L	I		
			L		
	I	A	S		

Delphi method gaps	Innovation strategy gaps				
		X		√	√
			√	√	
		√	√		
			√	X	
	√	√	√		

Source: Self-elaborated

V1 to Vn: Variables

O1 to On: Objectives

I. Implement, L: Lead, S: Support, A: Approve

Steps 6 and 7: Possible Changes and Actions:
According to the respondents in the second survey, changes that were considered to be desirable and feasible are denoted below:

• Using cross-impact matrices to support alignment.
• Alignment of objectives, mission of innovation and organizational mission objectives.
• Inclusion of "new business" in the Delphi Method
• Analysis and implementation stages for the formulation and implementation of an innovation strategy.

DISCUSSION

Below, an analysis is presented with a focus on the benefits obtained by complementing SSM with two questionnaires or surveys where experts helped contextualize the problem of alignment of the Delphi method with components of the innovation strategy.

Questionnaire "I" as the complement of SSM:

The first and second steps of SSM generated a first model that was later improved by the construction of the questionnaire "I". The responses of 14 experts from organizations and centers for technological development in Colombia and Chile helped to improve this first version of the model and prioritize the types of problems that continue to be worked on in a doctoral dissertation. This view relates to the consultation of experts or actors and it is directly related with the characteristics of various applications of Soft Systems methodology. (Rosenhead and Mingers, 2001; Mingers and Rosenhead, 2004).

Until the application of the questionnaire [I], the problems that had higher priority in the Delphi method consisted of aspects of differentiation in original and modified methods and statistical features; while problems such as lack of horizon suitable for an exercise with the Delphi Method and weaknesses in the interpretation and exploitation of the results based on the life cycle of the products of the organization had an intermediate value time. In terms of what was answered in the surveys, it is not necessary to prioritize

or make emphasis on the time horizon in a foresight study. If it is important to make clear about what an original Delphi is and its characteristics, just like it was applied in its beginnings in RAND – (research and development) corporation; regarding what a modified Delphi was with its anonymity characteristics, feedback, number of rounds and statistical applications, amongst others.

Problems related to the innovation strategy, with the highest priority, included: the lack of knowledge about what is happening with the formulation and implementation of innovation strategies, the importance of innovation activity as an ability that can be developed systematically in the context of an innovation strategy, and problems with weaknesses in the interpretation and exploitation of innovation in terms of the life cycle of the products of the organization. Even though the alignment considered as prioritized does not appear, it is convenient to wait for a larger number of experts. Furthermore, spite that they are professionals with a high degree of expertise in some of the components; it is possible that it is not necessary for them to focus in alignment shapes; given that it is probably a well-known subject for them.

To complete the analysis of the first questionnaire, as priority issues of innovation management models related to the understanding and integration between management models of innovation, innovation management systems and their standardization. This can be of great importance as it provided the rules for the management of R + D + I type NCT 5801, 166002 and British Standard BS 7000-1: 2008 may have a high prominence in the near future for organizations as diagnostic tools in future mapping profile or innovation management models. In this same component, it is important to note that experts consider that the problem of "ignorance of the relationship between a management model of innovation and competitive advantage in organizations" is not a priority to focus and direct research at this time.

One of the main benefits of the application of SSM was the establishment of root definitions (Eden, 1995). Thanks to this step, definitions could be established for the three project components and disaggregate in areas where it had not previously been

thought of; including an early version of "transformation" that was key to the conceptual model and the development of questionnaire "II".

Questionnaire "II" as the complement of SSM:

The introduction of the model, or conceptual models in the real world, was complemented by the inclusion of views of stakeholders through the questionnaire "II". One of the most important results is the validation of the conceptual framework given that it was prioritized. Also, it had a mode of 4 and a high consensus percentage. It is important to mention that the grades 4 and 5 are in the 75% consensus.

As for the option of performing the alignment of the three components, the higher percentage of consensus were to align the mission and objectives of innovation with the mission and goals of the organization. However, alignment through cross-impact matrices obtained 75 percent of the marks obtained by taking the high values of 4 and 5.

From the point of view of the alignment between the innovation strategy and the innovation management model, the choice of alignment through cross-impact matrices obtained a mode of 5 with a high percentage consensus.

In this sense, the shape of alignment included: approve, lead, support, and implement or matrix: I, L, S, A (Flores 2008); which, as one of the alternatives strong obtained a mode of 5 with a high percentage of consensus.

Continuing the analysis of the questionnaire II, regarding inputs, transformations, and outputs in the modified Delphi Method, the variable “new business” obtained a modal value of 5 with a percentage of 75% consensus, regarding transformation process feedback, it received a varying mode of 5 and higher percentage. Meanwhile outputs, which were variables with greater modal value and percentage of consensus, consisted of: technologies, new priority business innovation mission, different perspectives and policies, These results are important because they can become the basis for generating

diagnostic or organizational level profiles regarding the process of the Delphi method or the results of the method with the core elements that compose it.

Reviewing the results of "innovation strategy", in terms of inputs, the variable "strategic direction" had a high modal value and obtained the highest percentage of consensus in the process of transforming the variable "analysis and implementation stages for the formulation and implementation of an innovation strategy' achieved a mode of 5 and a high percentage of consensus. In relation to the outputs, variables with a higher mode and percentage of consensus were: distribution and marketing activities of innovation, process development of new or improved services / products and partnerships. Similar to the results obtained in the Delphi method, these can become an input for the generation of diagnostic or organizational level profiles on innovation strategies in its core elements.

When it comes to innovation management model components, the inputs mode and percentage of consensus were culture of innovation, knowledge bases and stakeholders. Regarding the transformation process, variables with greater percentage of consensus and higher modal values were: implementing the necessary actions to achieve planned results, continuous improvement of the R & D + I, and establishment of mechanisms for the protection and exploitation of results. In terms of outputs, variables that met the highest standards in mode and consensus included: successful and impacting innovation objectives, constitution and operations of the unit R & D + I, and propitiation of spaces of formal and informal communication within the R & D + I policy implementation recognition and motivation to participants in the process innovation. As mentioned in the two previous components, results in the management innovation model can become the basis for generating diagnostic or profiles in management innovation models in organizations and could allow the creation of a tool or method to learn good practices and options for the improvement or gaps in businesses.

CONCLUSIONS

The use of Soft Systems Methodology allowed for the improvement of a problem of unstructured human activity related to the Delphi Method as a driver for business strategy innovation under management models of innovation, as it allowed for a better understanding of the problem and continues in later stages of the doctoral dissertation.

The use of two structured questionnaires or surveys, as additional elements in the application of SSM, allowed for the consideration of opinions from the people in the real world that were involved and interested in all three components: Modified Delphi Method, innovation strategy and management innovation model. This way, specific improvement actions on the issue of doctoral dissertation could be established.
For component of management innovation model, the priority issues included:

Absence of concepts, techniques and tools for the integration of a model and management system innovation in organizations, a poor understanding of how to interpret a management innovation model, a misunderstanding of the difference between a model of innovation and a management innovation model, and a misinterpretation of whether there is standardization in terms of management innovation models.

The conceptual model proposed had a high mode and high percentage of consensus, leading to the consolidation of the conceptual model of alignment with the indicator “appropriate”.

In the component of the modified Delphi method, innovation strategies and the management innovation model, the results can become an input for generating diagnoses, mapping or profiles on the three components and could allow the creation of a tool to disseminate good practice gaps in businesses.

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