XVII INTERNATIONAL CONFERENCE ON INDUSTRIAL
ENGINEERING AND OPERATIONS MANAGEMENT
Technological Innovation and Intellectual Property: Production Engineering Challenges in Brazil Consolidation in the World Economic Scenario.
Belo Horizonte, Brazil, 04 to 07 October – 2011

INNOVATION IN PROJECT DEVELOPMENT BASED ON KNOWLEDGE MANAGEMENT

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The present paper aims to contribute for the intellectual capital build-up on the field of public-private partnerships (PPP). Therefore, a support system for the decision of the building up and the management of PPP projects on transportatiion infrastructure has been developed based on the methodological support of the Knowledge Management (KM) Theory. The aforementioned system considers a sequence of proceedings directed to the prioritization ranking of knowledge objects, so to assist managers to choose priorities regarding information and theoretical knowledge. This stage consisted of the following steps: (a) the assembly of critical success factors; (b) the determination of information areas; (c) the prioritization of the needs of information. Furthermore, the designation of knowledge objects ensued as follows: (a) the selection of the concept of knowledge; (b) the identification and acquisition of knowledge; (c) the prioritization of knowledge objects, (d) the mental representation of the objects of knowledge. The results obtained have been satisfying, validating the proceeding proposed for assembling and the prioritization of critical knowledge for projects on PPP, as well as for the constitution of other elements of the intellectual capital for the concession policies and partnerships, utmost on the road investment field.

Palavras-chaves: Transportation-Infrastructure-Public-Private Partnerships (PPP)-Knowledge Management-Mental Maps

1. Introduction

The feasibility of investments on road transportation infrastructure is now one of the great challenges for the Federal Government, due to the budgetary restraints in opposition to the growing demand for services traditionally supported by the Government. For this aim, PPPs have been considered as a prioritary tool for infrastructure investment by this same Government. Nevertheless, the building-up and the management of public-private partnership projects represent complex and risky proceedings, which require highly experienced multi-disciplinary teams and a powerful information basis.

This contribution focuses on the definition of knowledge priorities. On the basis of a methodological strategy explained further, which included interviews with Brazilian specialists in private road investment, the priorities have been systemized and priorized.

2. Knowledge Management and Public-Private Partnerships

The building-up and the management of a PPP project require highly complex analytical approaches, which include subjective elements. Thus they demand the technical mastery of various technological, legal, financial and political aspects and procedures. Knowledge Management may represent a strategic tool, increasing the institutional capacity of both the Public Sector and the Entrepreneurs in their assignments of formulation, evaluation and execution of such projects. The KM would work as a facilitator instrument of improvement, contributing for the quality of services and the enhancement of the agility to decide.

Here, following the proposals of Bukowitz and Williams (2002), knowledge is considered as the elaborated, refined information, which is also able to self-evaluate its liability, relevance and importance. Knowledge is to be considered as the most important information as it includes a precise context, a concrete meaning, the respective interpretation and reflexion, is added by personal wisdom and considers widest implications (Davenport and Prusak, 1998). Moresi (1998) proposes a chain composed by following elements: processed data, elaborated information, synthesis by knowledge, and, finally, the intelligence. The knowledge step converts by the synthesis information into knowledge. After this synthesis, the information is gathered in blocks in such a way that they can later be used by specialists who filter it and standardize it in order to apply it to a specific situation.

On its turn, Knowledge Management (KM) is defined as an integrated set of intervention tools (Probst *et al* 2002) which consists of a systematic process of identifying, generating, distribution, application and creating knowledge.

3. Methodological Support to Identify Knowledge Priorities for Public Private Partnerships Programmes and Projects

The current proposal to build up a methodological support applied to the public-private management happens within the following proceedings: we start by modeling the needs of information required to feed various activities developed (by the areas of information) in the build-up and the management of PPP projects, which will be developed starting from the Critical Factors of Success, that will be identified and evaluated. The Method of Critical Factors of Success is the most used to determine the needs of information in businesses. In order to identify and to set priorities for knowledge needs in PPP projects and programmes, following steps are foreseen: a) the application of Critical Success Factors tool; b) the identification and c) ranking by importance of information areas and d) synthesis of critical knowledge subjects. These different stages are detailed here.

Phase 1: Determination of CSF
This phase is focused on determining the CSF, and is itself structured in two stages: (a) identification of CSF and (b) evaluation of CSF.

(a) Identification: The identification of CSF is based on the combination of various methods (Liedecker and Bruno,1984): (a) environmental analysis (external variable: political, economical, legislation, technology and among aothers.); (b) analysis of the industry structure (users needs, the evolution of the demand, users' satisfaction level, their preferences and needs; technological innovations); (c) meeting with specialists and decision makers; and (d) the study of literature.

(b) CSF Evaluation: After their identification, the CSF are evaluated in order to establish a ranking by relevance. Here the scale model of categorical judgments designed by Thurstone in 1927 has been adopted. This model starts form a mental behavior to explain the preference of a judge (individual) concerning a set of stimuli $\{O_1, O_2,\ldots, O_n\}$. Thus, the evaluation of the CFS is systematized in the following steps: Step 1: determination of the frequencies by pairs of stimuli. Step 2: determination of the frequencies of ordinal categories. Step 3: calculation of the matrix $[\pi ij]$ of the relative frequencies accumulated. It is highlighted though that the results to be achieved in Step 3 reflect the probabilities of the intensity of the specialists' preferences regarding the stimuli, the Critical Factors of Success in this work. As result, an hierarchical structure of CSF is obtained.

Phase 2: Identification of the Areas of Information
Having the CSF already been defined, information areas are delimited with respect to the different CSF.

Phase 3: Prioritization of the information needs starting from the crossing of CSF and the Areas of Information

Again, these information areas are ranked by application of the same Categorical Judgment Method of Thurstone (1927) and put into relation with the CSF. At this moment,

following tools have been adopted: (a) Multi-objective utility – multi-attribute, in this case Compromise Programming ™, which represent mathematically the decision makers' preference structure in situations of uncertainty; (b) selective, taken on account for the situation, Promethee II ™ and (c) Electre III ™. The critical knowledge for PPP is determined in the sequence.

Phase 4: Determination of the Critical Knowledge in PPP

This phase has been subdivided as follows: stage 1 - identification and acquisition of knowledge; stage 2 - evaluation of knowledge; and stage 3 – representation of knowledge. This proceeding is shown in details as to its structure.

Stage 1: Identification and Acquisition of Knowledge

At a first moment, information topics which have been already identified will be elaborated, analyzed and evaluated in order to be understood by the decision makers during the formulation and the management of a PPP project. In the following, they will be reviewed and organized and validated by PPP specialists. Afterwards, relevant theories and concepts are determined. With respect to the acquisition procedures, the different procedures of

The process of acquisition represents the acquisition of the necessary knowledge, abilities and experiences to create and maintain the essential experiences and areas of information selected and mapped out (Thiel, 2002). Acquiring the knowledge (from specialists) implies, according to Buchanan (Thiel, 2002), the obtaining of information from specialists and/or from documental sources, classify it in a declarative and procedural fashion, codify it in a format used by the system and validate the consistence of the codified knowledge with the existent one in the system. Therefore, at first, the way the conversion from information into knowledge is dealt, which is the information to be understood by and useful for the decision making in project on PPP. Fist the information is gathered. Then the combination and internalization is established by the explicit knowledge (information) so that it can be better understood and synthesized in order to be easily and fast presented whenever possible (the information must be useful for the decision making, for that reason, it must be understood). In this work, we aim to elaborate the conversion of information into knowledge. The conversion (transformation) takes place as follows: first, the comparison of how the information related to a given situation can be compared to other known situations is established; secondly, the implications brought about by the information for the decision making are analyzed and evaluated; third, the relation between a new knowledge and the accumulated one is established; fourth, what the decision makers expect from the information is checked. The conversion of information into knowledge is assisted by the information maps (elaborated in the previous phase by areas, through analysis and evaluation of the information). We highlight that the information taken into account are both the ones externally and internally originated. The information from external origins has as a main goal to detect, beforehand, the long-term opportunities for the project (Célis, 2000). The internal information is important to establish the strategies, but they have to be of a broader scope than the one used for operational

management, because besides allowing the evaluation of the performance they also identify the strengths and weaknesses.

Following the proceedings for the acquisition of theoretical background and concepts are dealt. Such proceedings begin with the areas of information, one by one, where the concept and the theory on which is based the performance of the actions (articulations) developed in those areas that allow to guarantee the feasibility of the projects on PPP are identified. In other words, which knowledge and theory are required to be known in order to ensure success of projects on PPP in that area. Then, the analysis of surveys in public and private institutions about the job market for these institutions, bearing in mind the demands of similar areas studied in this work, takes place. As for the offer, we intend to search for the level of knowledge required by the companies and other organizations in those areas, as well as what concerns technical improvement (means) for the professionals. After been identified and acquired, the knowledge is evaluated, with the aid of the Method of Categorical Judgments of Thustone (1927).

Stage 3: Mental Representation of Knowledge
The goal in building up a mental map is to make the decision makers of projects on PPP understand the decision context better.

The data to be mapped out is extracted by various means, in this case, we have worked using semi-structured interview, considered as a high-valuable instrument to identify the hierarchical structure and the dimensions of the judgment underlain to the processes of classification. In this classification, it is described how the specialists organize or structure this knowledge and therefore use the process of classification by areas of information. In sum, the development of this stage is structured as follows: (a) after determining the priorities of knowledge assisted by the method of Categorical Judgments, (b) the development of mental maps by categories of area of information takes place. As a support instrument, the software *Statistica* is used, which makes easy the process of organizing in the space the intensity of the decision makers' preferences in relation to each object of knowledge, identified on the map as the most homogeneous ones.

4. Application of the methodological framework

The purpose of this section is to present the application of the methodological framework, aiming to provide managers of projects on PPP with investments on infrastructure, information, enabling them: (a) to monitor the political, economical and social environment, the regulations, judicial aspects and risks that impact directly or not the organizations; (b) the best decision as for the contractual negotiation, specially the rights and duties between partners; (c) the best choice of partners; (d) the best build-up and management of the project; (e) the best definition of the competition policy; (f) the definition of tax criteria and the budgetary structure; (g) the best definition as for investments in projects on road transportation infrastructure; (h) the best

financial engineering management; (i) the definition of the goals to be met; (j) the management of shared risks associated to these concession projects.

In order to do so, the data gathered from the specialists were used. As follows, the methodological proceeding proposed applied to the study of road concession in Brazil is described, having the phases: *(1) the determination of CSF; (2) the determination of the areas of information; (3) the prioritization of the needs of information and (4) the determination of the critical knowledge.*

Phase 1: The determination CSF

Determining the CSF is the goal according to Aragão and Oliveira (2003), the CSF in projects on PPP are (Table 1): first, the Political Factor; second, the Economical and Financial Factor; third, the Judicial Factor; fourth, the Technical Factor; and fifth, the Market Factor.

TABLE 1: CSF of projects – Method of Categorical Judgment of Thustone (1927)

Stimulatons (CSF)	C1	C2	C3	C4	$\mu i = -\sum_{j=1}^{4} Zij /4$	CLASSIFICATION
Political	-1,22	-1,22	-0,76	-0,13	-3,34	1º
Judicial	-0,76	-0,13	0,13	0,76	0	3º
Technical	-0,13	0,43	0,76	3,86	4,92	5º
Economical and Financial	-1,22	-0,76	-0,43	1,22	-1,19	2º
Market	-0,76	0,13	0,76	1,22	1,36	4º

Phase 2: The determination of the areas of information

After determining the CSF, the determination of the areas of information ensues. The result has allowed defining four groups that represent the areas of information: *first*, the Governmental Area on Public Policies; *second*, the Economical and Financial Area; *third*, the Technical Information Area; *fourth*, the Market Area. The goals of the areas of information define specifically what must be achieved by these areas to meet one or more objectives from the projects (business), contributing for the enhancement of the project performance as to quality, productivity and profitability.

Phase 3: Prioritization of the needs of information related to CSF

Aiming to know about what area of the project the decision makers must develop a "strong management", the prioritization of the needs of information takes place. The results shown by the Methods *Compromising Programming, Electre and Promethee II* have pointed out the Governamental Management Area on Public Policies as the most relevant one to guarantee the CSF. The gathering, analysis and processing of information must be to strongly reinforce the set of activities that form his area, specially in what concerns the information about actions on: *(a) Institutional Policies and Environment of PPP concessions; (b) Negotiation on the build-up of projects and the selection of concessionaires; and (c) General Judicial Environment.*

Phase 4: The determination of the objects of knowledge
This phase is systematized in three stages, which are:

Stage 1: The definition of the concept of knowledge
This stage determines the concept of knowledge to be taken into account on the development of this work. So, for the operational goals of this work, we have adopted them as the "contextual information" and the "theoretical framework and concepts".

Stage 2: The identification and acquisition of knowledge and priorization
In order to demonstrate the application of the methodological proposal, the results of the objects of knowledge on the "Governmental Area of Public Policies" were dealt.

The results are presented in a growing order of importance: (1) institutional organization for policies on PPP; (2) adaptation of the legislation and strategical adequacy of the public sector; (3) strategic planning on defense against competition; (4) policy and legislation on defense against competition; (5) monitoring and control; (6) criteria, organization, proceeding and monitoring of projects; (7) environmental policy and legislation; (8) actors; (9) regulation on security and quality; (10) contractual agreements and taxation; (11) civil and commercial contracts; (12) productivity policy. These results refer only to the Governmental Area on Public Policies, so as to show the feasibility of our proposal.

Stage 4: Mental Representation of the objects of knowledge in cognitive maps.
After prioritizing the objects of knowledge, the build-up of cognitive maps take place (Governmental Area on Public Policy), assisted by the software *Statistica*. In order to create maps, the denominations of the objects of knowledge have been abbreviated. The results of the decision makers' intensity about the objects of knowledge can be visualized in Figure 1

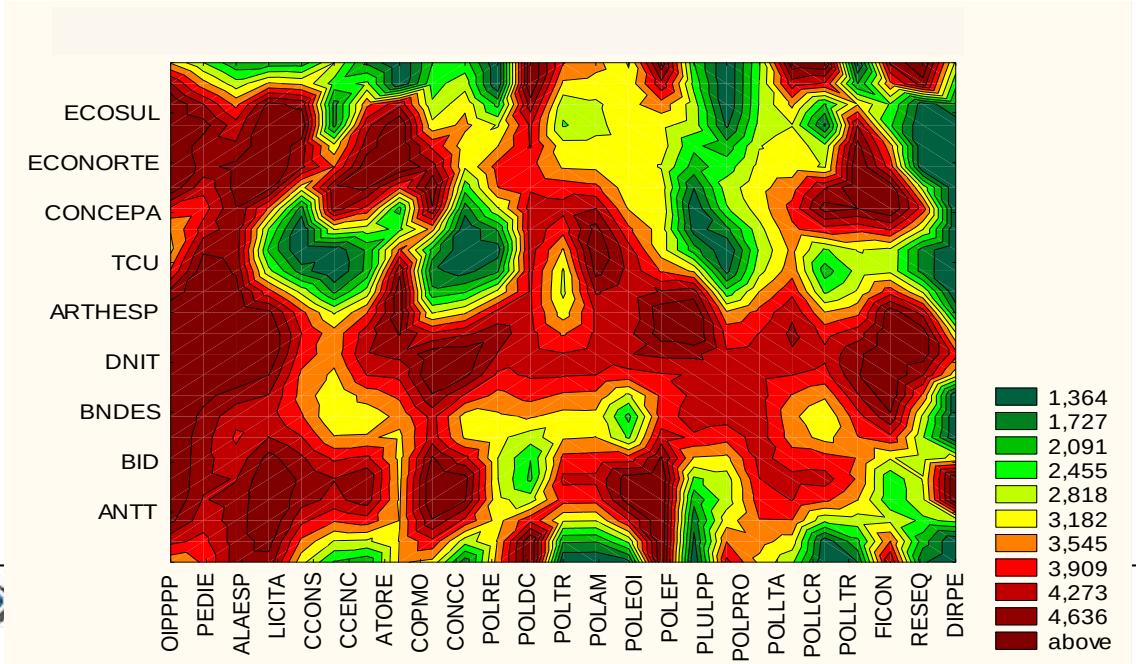

FIGURE 1. Mental Representation of the objects of knowledge in cognitive maps.

5. Final words

This paper is aimed at an important area for Brazil where there is a new commitment to PPP as a way of funding public transport infrastructure. To be successful, PPP must be introduced with an appropriate organizational structure and within an appropriate legal environment. The current challenge is to develop KM systems to collect and distribute/disseminate information/knowledge to enable/facilitate policy development for the early implementation of PPP.

A general introduction to knowledge management and knowledge maps (graphical representations of knowledge objects, bearers, structures, and processes), leads to a list of typical steps to knowledge map development, and a list of typical knowledge map applications. Finally, ideas for the implementation of knowledge management to PPP in public transport are discussed..

The methodological proposal developed here differs from other methods of decision support because it extracts the tacit knowledge and converts it into the managers' explicit knowledge about projects on PPP and concessions. The approach of this work is to make the decision scope more intelligent, making available the knowledge about the development and the management of projects.

By basing on the Knowledge Management and its techniques, we have developed the proposal of a methodology that is focused on contributing to patterns of resource allocation to build-up intellectual capital on PPP.

As for the infrastructure to make viable the partnership projects, Brazil is still in a disadvantageous position when compared to other international experiences: it lacks material, technological and human resources, what makes impossible the feasibility of projects of such greatness. Knowledge is insufficient and the intellectual capital is unprepared. In this scenario, our methodological contribution is highlighted, because it provides with support for the critical priorities for the implementation of this project and is directed to building up of the intellectual capital as a key element for the development of PPP. We are looking forward here to a more practical and efficient orientation supporting its long-term goals and assuring the national competitiveness concerning the category of priorities.

This methodological support does not intend to be complete, but it is our intent to make it a generator of stragical elements for the development of partnership projects. It is here where the information Management is important, being a key instrument to develop projects in such a complex issue as it is the case of PPP.

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