O USO DE INDICADORES DE DESEMPENHO NA GESTÃO DO CONHECIMENTO EM PROJETOS DE UM CURSO DE GRADUAÇÃO

THE USE OF INDICATORS IN MANAGING THE KNOWLEDGE GENERATED IN PROJECTS FROM A GRADUATION COURSE

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Abstract

Organizations are executing continuous improvement projects in their internal environments with increasing frequency. The knowledge of development stages of projects is essential to obtain the most effective results. Many institutions are realizing the importance of investing and developing projects that enhance internal knowledge and therefore gain a market differential. However, it is necessary to gestate this knowledge so that it becomes productive and add value to products and

institutional services. In this context, this paper aims, through a qualitative study and an applied case, to systematize a set of performance indicators that assist an Undergraduate Course from a University Center in managing the knowledge generated by the projects carried out. The contribution is the generation of systematic knowledge on the topic of performance measurement and the generation of scientific knowledge as well as the assistance in identifying trends and future usage.

Keywords: Performance Indicators, Performance Measurement System, Project Management, Knowledge Management.

Resumo

As organizações estão executando projetos de melhoria contínua em seus ambientes internos cada vez com mais frequência. O conhecimento das etapas de desenvolvimento de projetos é imprescindível para a obtenção de resultados mais eficazes. Muitas instituições estão percebendo a importância de investir e desenvolver os projetos que valorizem o conhecimento interno e com isso obter um diferencial de mercado. No entanto, é necessário gestar esse conhecimento para que se torne produtivo e agregue valor aos produtos e serviços institucionais. Neste contexto que o presente trabalho busca, através de um estudo de caso qualitativo e aplicado, sistematizar um conjunto de indicadores de desempenho que auxiliem um Curso de graduação de um Centro Universitário a gerenciar o conhecimento gerado pelos projetos efetuados. A contribuição empregada é a geração de um conhecimento sistematizado sobre o tema de medição de desempenho e geração de conhecimento científico, assim como, auxiliar na identificação das tendências e aplicações futuras.

Palavras-chaves: Indicadores de desempenho, Sistema de Medição de Desempenho, Gestão de Projetos, Gestão do conhecimento.

1 introduction

Managing an organization requires care and control of all inputs and outputs that can interfere in the internal environment. Furthermore, the relationship with the stakeholders must be observed to accompany changes in the external environment, i.e., everything that can cause changes in the organizational environment needs to be considered in management.

The projects are among the practices used by companies to facilitate the management. Projects can be applied to evaluate and to modernize products and services, to qualify processes and transactions and to anticipate internal and market demands (Duffy, 2006). It is up to the team manager to control, to measure and to monitor each step of the processes. The activity management can be facilitated through the use of a Performance Measurement System – SMD, such as performance indicators.

Performance indicators can be used in various stages of a project. As an example, there is Busso and Miyake's case study (2003), which addresses the ability that

indicators have to serve as subsidiaries for the decision making by managers since they submitted their application to all processes in the plant analyzed. They may also function to map the knowledge generated during the development of an activity, as well as the inherent risk procedures as suggested by Rabechini and Carvalho (2013).

Organizations that know and recognize their own potential have a competitive advantage over the competition, especially if you value the knowledge that they are able to generate. Therefore, mapping the level of training of each participating team facilitates the definition of functions and capabilities necessary for each one to develop well his role in the activities. In addition, the undergraduate program that creates opportunities for their students to participate in projects that map the generated knowledge will increase the spread of the procedure along with the organizations.

Then, to enhance the information generated in teams, the aim of this research is to organize a set of performance indicators to assist an undergraduate degree from a University Center in managing the knowledge generated in the project management. The methods, of qualitative nature, with descriptive and exploratory characteristics, were developed through a case study. Data collection occurred through a literature study on the topic, the analysis of documents available on the course and interviews with managers and the ones involved in the projects. The procedures for creating the indicators are based on methods and suggestions of the authors Fernandes (2009), Carvalho (2011) and Amato Neto (2009).

2 Literature Review

A project, to Keeling (2002), is a temporary endeavor, with limited time and in order to create a unique product or service. For each design made, a result is obtained but different from the one produced during the operational course of routines. In short, for a company, a project represents a set of activities involving a group of people united towards a goal to be accomplished once.

The phases of a project are planning, design, implementation and decommissioning. During planning, the problem, objectives, goals are identified and the stakeholders are recognized. The stage of development is the time for team meetings and for the development of the general and operational plan. Implementation is the phase when plans are put into action. And the decommissioning of the project includes the preparation for delivery, which consists of assigning duties and responsibilities of monitoring (Duffy, 2006).

That is, a project depends directly of those ones involved in it as well as the degree of engagement of them. Therefore, a manager who can identify and combine the qualities of his team will be able to manage it more appropriately. Therefore, it is important to follow each phase of the project and its measurement through the Performance Measurement Systems - SMD.

In order to track the performance of activities it is important that measurement systems are applied in full time. According to Valle (2004) this is the biggest challenge when it comes to performance measures, since the measurements must

be made through a balanced and dynamic system capable of gathering relevant information for the decision making. The idea of balance suggests using measures and perspectives to ensure a holistic view of the organization (Kaplan, Norton, 2004) and the concept of dynamics refers to the need for a continuous monitoring of the internal and external environment and constant revision of objectives and priorities (BITITCI, TURNER, BEGEMANN, 2000).

However, to gain an advantage in the use of this system it is important to have previous and coherent criteria along with the organization policies criteria, since this way the measurement and evaluation of selected processes and their critical points will be outlined. According to Ferreira et al (2008), the management system based on indicators establishes a mechanism for the visibility of corporate performance and its quality characteristics, i.e., the controlled indoor environment is more attractive for investors.

Amato Neto (2009) proposes the construction of performance indicators from a broad assessment from key dimensions that serve as the basis for the performance analysis. The study which he conducted intends to construct indicators of a particular productive concentration, a cluster, but the form of the creation of indicators can serve as a basis for the control of other activities as well. At first, the dimensions are evaluated as economic and social, among others, to carry out later a study of local production systems and the creation of a classification according to the degree of organization. From this assessment it is generated an array of evolution levels relating the two strands and positioning organizations according to the quadrant that better suits, from Q1 to Q12.

From the sketch which initially developed the theoretical and structural concepts of organizations comes the development of the indicator system. For the set of indicators, within each aspect, it is taken the assessment of the level of each dimension by applying a structured questionnaire using Likert's scale with five conceptual points. The responses of the indicators are sorted according to the weights assigned to each of the concepts. One way to facilitate the visualization of the position of each point is evaluated through a graph.

Fernandes (2009), states, to begin construction of indicators a detailed analysis, according to the focus of the business strategies and for the definition of the key factors of the process. After the survey, it is important to perform a comparative situation of the organization and of the key competitors. Along with the obtaining responses, the factors in which the organization performed better than the competition are selected for applying rating value of competence. Often the results differ regarding to the factors considered, then it is necessary to establish decision criteria according to the importance of each competency for the organization.

To measure the performance of the areas or processes using Brown's methodology (inputs, process and outputs) and thus can build a causal map which serves as the basis for the alignment of competencies to be developed and benchmarking system. Some statistical techniques may be employed, such as factor analysis, regression analysis, structural equation modeling, which increase the possibility of checking the validity of the efforts carried out by companies in developing teams and impacts on the results.

Using the structure cited by Carvalho (2011) the construction of performance indicators is established by observing the following sequence: deciding what to

measure; identifying the stakeholders; structuring the perspectives and critical success factors; designing the logical structure between indicators; designing the necessary information technology infrastructure; collecting data to feed systems; disseminating results at intervals; promoting benchmark; providing feedback for the system dynamically. After the identification of the factors cited it must be determined the types of projects so that their evaluations must be done properly.

The application of questionnaires in Likert's scale is taken for assigning weights to the qualitative questions, with the sum of these weights and by classifying the indicators again. After organizing the indicators in the order that they comply with the activities, it is made a Gantt's graph chart or even another illustrative alternative that facilitates the monitoring of activities is designed to assign weights in a color scale based on a traffic light. Thus, it is possible to follow clearly the execution time of activities and the level of satisfaction.

2.1 Knowledge Management

In an organization, knowledge has become a more important economic resource than the raw material and money. However, so that knowledge management can be carried out, you need to understand what that means. Davenport and Prusak (2006), knowledge is a mix of experience, values, contextual information and expert insight that provides structure for incorporating new experiences and information, as well as the ability to review the quality of these new elements.

To manage the knowledge generated by a project it is necessary, beforehand, to understand how the intellectual development of the individual is and his role as a knowledge worker. The creation of knowledge in an organization can be seen as a process that starts with the individual, who learns and shares that knowledge with others. Therefore, the professionals' improvement is the only way once the organizations only learn through individuals who learn (Senge, 1990).

Companies can be your own source of knowledge or can get it in other organizations, benchmarking. The creation of knowledge networks that connect multiple organizations can collaborate so that each participant can develop with greater potential than if he worked only individually. According to Reis e Amato Neto (2012), an example of this type of arrangement is the knowledge networks of Small and Medium Enterprises - SMEs of software programs of Campinas, in São Paulo state, Blumenau, in Santa Catarina state and in Belo Horizonte, Minas Gerais state. The results obtained through the research carried out in the three structures are quite positive because the effectiveness of the cooperation network in relation with the process of formal and informal learning could be observed.

There are three particularly important areas that help organizations overcome their inefficiencies and pathologies, the wise use of information technology, the creation and definition of market value of knowledge market and market building. There are some pitfalls of knowledge management that must be observed, such as the indiscriminate investment in technology and software does not guarantee the spread and usability of users. When there is the lack of control and observation of managers, the inefficiencies and errors in implementation of the project may fall in technology, since it is easier to implement and to measure. The creation of manuals of online employees may, instead of serving to support new initiatives, focus on the

parameterization of processes that stiffen the creation of new knowledge (DAVENPORT, PRUSAK, 2006). It requires the development of an institutional policy potential to find a balance between the parties.

3 Methodology

As it regards to the methodological procedures, the present research is characterized as a study of qualitative nature, since it emphasizes the perspective of the object / subject being studied. For Miguel (2010), individual interpretations are pieces of a mosaic that an organizational researcher needs to capture to understand the complexity searched. As to the objectives, the research is characterized as a descriptive and exploratory one.

With respect to technical procedures, we opted for an applied research, the use of the case study method, in particular, in a graduation course at a University Center of Santa Maria, in Rio Grande do Sul state. As the data collection plan, a bibliographical research as firstly used and later, the analysis of documents from the undergraduate course was carried out as well as semi-structured interviews with those responsible for Coordination Course, Research Coordination of Extension, Training Period Coordination, Final Graduate Work Coordination and Laboratory Practice Course Coordination.

Made the outline of the relevant indicators, the plan for data analysis was performed by applying the same questionnaire in two collections with the time difference in exposure of two to four weeks. When the responses were collected, the data correlation coefficient was computed. Thus, it was possible to verify the reliability of the indicators which were set up. This procedure is called test-retest.

The correlation coefficient, originally proposed by Pearson, is also called Pearson's correlation coefficient, simple correlation, and bi-varied correlation. It summarizes the strength and direction of association between two metric variables (Malhotra, 2011). From n observations, X and Y, which correspond to the first and the second scans of the questionnaire respectively, the correlation can be calculated by:

$$r = \frac{\sum (x_i - \bar{x})(y_i - \bar{y})}{\sqrt{\left(\sum x_i - \bar{x}\right)^2 \left(\sum y_i - \bar{y}\right)^2}}$$

In this equation   and   represent the sample means, and the denominator is the standard deviation. Covariance measures the extent to which X and Y are related. This can be positive or negative and vary between -1.0 and +1.0 and its interpretation will depend on the numerical value and the sign for r = -1, perfect negative correlation; -1 < r <0, negative correlation; r = 0, zero correlation; 0 < r <1, positive correlation; r = 1, perfect positive correlation; 0.2 < r <0.4, weak correlation; 0.4 < r <0.7, moderate correlation; 0.7 < r <0.9, strong correlation; the same meaning is used for positive or negative cases. It is calculated the correlation coefficient to determine the degree of similarity between the two measurements and, the result of 0.6 or less, generally indicates a poor reliability.

4 Results and Discussions

The undergraduate course at the University Center is managed by a coordinator and a vice-coordinator appointed by the rector and who work according to the pedagogical course plan - PPC. In PPC all the steps of creating and structuring of the Course are described, the rules that govern it as well as the responsible people for it. Based on this design, the course defines its strategic intents, which are configured elements in guiding their activities. The academic-administrative management is common to the coordinator and his deputy, the Core Teacher Structuring - NDE, the Course Collegiate, the coordination of internships and the coordination of research and extension.

To suggest performance indicators that demonstrate how, and if, the projects of the course are generating and disseminating knowledge, interviews were taken with the coordinators of the course, and the Extension of a Junior Company, which is a student organization linked to the course. It was established in 2009 with the aim of applying the administrative practices in real cases by the students. Its mission is to provide personalized services, developing employees and customers in order to contribute to the growth of the Course.

Among the interviews conducted it was possible to verify that in cases of field trips, lectures and events organized directly by the course coordinator, prior plans are not made, except in cases that are already arranged by the PPC, as they follow their own and institutional methodology. In general, the demands come from course of the course and less frequently from its students. Support and development activities teams are formed according to the affinities, availability of time or at random, in accordance with the participants. It is frequent the presence of teams made up of teachers, the presence of students can happen for the development of a specific activity, without the full involvement with the activity.

Regarding to the coordination of extension, according to the PPC of the Course, its assignments are geared to: coordinate the activities of the Forum, event related to academic week of the course; plan, propose and manage extension courses as well as lectures, workshops, etc; foster the development of outreach projects of the course; systematize the results of the related disciplines of the course projects; establish relationships with professional associations and external organizations.

According to the coordination, all activities related to planning and event management developed by the Course, being them internal or external, strictly follow a model structured by the Pro-Rectory for Graduate Research and Extension project. Thus, besides the Forum, which is an event that takes place annually in the second half of each year and relates to the academic week of the course, other events can be developed (internal courses, lectures, workshops, etc.), which are generally planned by the Course Management Plan annually, or on demand.

Concerning to Extension Courses, these can be idealized by any professional of the course and later systematized into a formal project that should be subjected to Pro Rector for its review and approval, and only after being approved they can be opened

to the public to whom they are intended. The projects developed by the Company Junior follow a previously structured standard planning. Each of the developed stages is specified in the reporting model used for the description of activities.

The study carried out mainly emphasizes the development of technical and scientific expertise of those ones involved with the course since, through the evaluation of the activities carried, seeks to map the processes and outcomes. Thus, it can be seen that the projects developed by the Course do not follow a standard structure or are documented. The processes take place in an intuitive and convenient way for the development time as there is no assessment of the concluded activities or a further evaluation by the end of the project. In both spheres no controlling or performance measurement instruments with the performance indicators are used. This situation proves the importance and the validity of the suggestion presented by the work study because, with a suitable mapping, it is possible to obtain qualifications in planning and in the implementation of other projects.

The indicators proposed in the Table 1 follow the following prospects for success: defending the full intellectual development of those involved in the project; encouraging the development culture of organizational knowledge; expanding the capacity of self-management, aligning personal and organizational interests.

Table 1: Indicators proposed

Category	Indicator	1	2	3	4	5
Intelectual development						
Professional experiences	Number of projects in which he/she took part					
Mental models	Level of learned skills Capacity of implementing innovations					
Cognitive knowledge	Participation in training Study of real problems					
Advanced skills	Application of theoretical knowledge in the practice Capacity of adaptation and team swap Level of development in challenges / competitions					
Understanding the systems	Anticipating interactions with unpredicted consequences					
Self-motivated Creativity	Level of ambition, motivation and adaptability					
Developing personal domain	Level of development of the interaction between reason and intuition Capacity of vision on the connectivity with man/world Capacity of flexibility Level of commitment with the whole Level of self-knowledge/self-management					
The alignment of personal and organizational interests						
Feedback	Level of alignment of personal and organizational interests Capacity to have emotional control					
Valorização/ recompensas	Level of personal satisfaction					
Capacityof self-management						
Create opportunities to actively participate in decisions	Levelof pro-activity Level of developing autonomy Level of interpersonal interaction Capacity to assume calculated risks Capacity to transfer knowledge Capacity to act with innovation and leadership					
Culture of the development of organizational knowledge						
Continuous evaluation of the current state	Level of the team performance					
Appreciation of personal growth	Level of the developed capacity Level of satisfaction of the developed activities Level of satisfaction of the received training					
Interaction nets	Level of the interaction with the team Level of the interaction with the internal community Level of interaction with the external community Level of rotation of professionals/activities Level of rotation of professionals					
Achieved results	Level of satisfaction of results Capacity of disseminating the results					

As can be seen in the Table 1, for each indicator there is a respective scale, in accordance with Likert's scale, to enable the value assignment of for the skills which assigns 1 to the lowest level of expectation and 5 for the highest one.

The validation of indicators was done by applying the test-retest. The questionnaires were taken along with the team, made of students and teachers who were responsible for the development of the Forum. The first collection of responses was carried out three weeks before the second one. For each of the 36 indicators established, the correlation coefficients according to the following percentages were calculated:

$r < 0,6 = 2,78\%$ or 1 indicator; $0,7 < r < 0,8 = 8,33\%$ or 3 indicators; $0,8 < r < 0,9 = 19,44\%$ or 7 indicators; $r > 0,9 = 69,44\%$ or 25 questions.

Analyzing the results obtained, only one question should be deleted or revised within the total of 36 questionnaires. The indicator relating to the Personal Domain, called Eyesight Capacity of connectivity with the man/world got $r = 0.5345$, i.e., to use this one it is important that a re-essay is structured to facilitate its understanding. The remaining questions have $r > 0.7277$.

5 Conclusion

The use of performance indicators provides to enterprises a precise level of knowledge about the progress of activities developed by them. Through the use of this resource it is possible to make an accurate measurement of the effort outcomes employed by the projects. Besides measuring, it is possible to develop knowledge as well as to monitor and to manage what comes from the activities which involve a project.

In this sense, the objective of this research was to systematize a set of performance indicators to assist the Undergraduate Course at the University Center in the management of knowledge created during and after project implementations. To achieve this goal, it began by mapping the management activities of the course projects in relation with life cycle and with types of projects developed. At this stage the course coordinators were interviewed as well as the coordinator of the extension course and the Junior Company and we obtained the information that despite the existence of a process of development projects, there is no verification or monitoring activities formally documented on any specific knowledge repository for this purpose.

Similarly, there is no formal monitoring of activities, in order to check the progress of the project stages, we found that performance indicators to verify the results of these projects are not used. The reports the describe and document the executed project are archived in printed document but without having this exact notion of the collaboration for the intellectual development of each team member and gain in knowledge generation for the course.

Thus, it is possible to conclude that it is not taken effective management by the Course of knowledge from the implementation of projects linked to it. This fact further validates the importance of developing this type of research. That means, it is

necessary to alert the academic community about the importance of encouraging the mapping of activities so you can have the precise definition of projects that contribute to the intellectual growth of the Course and its professionals, teachers and academics linked to it.

The course studied, as well as other courses offered by the institution, have great potential for generating knowledge. That is why monitoring this generation is of great importance, because from the degree of maturity of the concepts currently applied to be an evolution and possible rise in the level of knowledge. The practical application of theories and concepts crossing the course will help to effectively achieve a positive result as the promotion of scientific research and suggestions for continuous improvement.

The inter-discipline process is necessary to advance the development of projects. There are no limits for the knowledge and the conceptual and intellectual development. The limits of knowledge of the human being are determined by each person and, like humans, the organizations stop evolving only when they cannot survive any longer. New theoretical bases should arise, new mentalities should be created as well as the evolution of time.

Therefore, the suggestion coming from this work, in addition to testing and practical application of the proposed indicators is to think critically about what is being developed at the project level, the importance that they have for the development and enhancement of organizations, and also to think about the simple improvements that can be meaningful for the business on a daily basis. An improvement which is easy to apply is the staff rotation in the company activities, as well as encouraging the use of new theoretical measures in usual activities of the organizations, followed by new measurements.

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