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KNOWLEDGE MANAGEMENT IN PROJECT DOCUMENTATION: A METHOD FOR OPTIMIZING EFFORTS AND COLLECTIVE LEARNING[1]

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ABSTRACT

This paper aims at proposing a method of Knowledge Management in project documents to acquire and integrate data, information and knowledge. Exploratory, descriptive and propositive research was conducted in documents of different projects run by the Transportation and Logistics Laboratory of the Federal University of Santa Catarina, Brazil. The method encompasses 22 phases and three gates for the analysis of the continuity of the base building process. The results contribute to the reuse of project knowledge by interweaving data, information and knowledge to facilitate future management and collective learning. Finally, this paper suggests the development of intelligent systems for automatic and dynamic knowledge mapping in project documents as well as for its electronic sharing. Such systems would provide fast search to support decision-making and optimization of efforts expended in future projects through the reuse of good practices and lessons learned.

Keywords: Knowledge Management; Project Management; Project Document Management; Knowledge Base; Knowledge Extraction.

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1. INTRODUCTION

Since the 1990s, Drucker (2003) has been stating that the organizational wealth does not refer to the capital/work relation anymore. Actually, as the author posits, such wealth has its core on the productivity and innovation, which would be conquered only by applying knowledge to the work.

In the so-called "knowledge societies", the performance of the organization is intrinsically related to knowledge that enables the organization to cope adequately with the demands of a more competitive context, in which decision-making, as opposed to being based on intuition, has to be based on knowledge (Sabbag, 2007).

In this sense, the existing knowledge in the organizations has to be managed and qualified. This means that it has to be identified, mapped, inventoried, stored and shared, so it can be institutionalized and made available (Dalkir, 2005), that is, transformed into organizational assets. To do so, there are Knowledge Management (KM) processes that give support to decision-making (whether strategic, tactic or operational) and aggregate value to the products (goods and services) in a way to provide wealth and increase the competitiveness of the organizational system as a whole. These processes are based on the use and combination of sources (human and non-human) and types of knowledge (implicit and explicit) (Batista, 2012; Young, 2010; Nonaka et Takeuchi, 1997; Terra, 2005; Freire, 2013).

It is of utter importance for the success of a project to create mechanisms to identify critical knowledge, so they can be managed. This way, the urgency of the implementation of Knowledge Management becomes evident as a systematic process to transform information and knowledge generated during the "present projects" into values for "future projects" (O'Dell et Hubert, 2011; Knight, 1967; Bennet et Bennet, 2004). Through the structuring of a knowledge base, processes can be improved, costs can be reduced and value is aggregated to the project, thus consolidating knowledge that can be passed on to the stakeholders.

According to the scientific literature on Knowledge Management, implementing this discipline in projects means:

- Creating structure to acquire and share knowledge from inside and among projects,
- Streamlining decision-making, making decisions more reliable,
- Having a single repository of data, information, knowledge and histories of processes building,
- Reducing costs and rework by stocking knowledge and experiences for future projects,
- Reducing risks and enhancing the project success.

However, although different authors had pointed out to some principles to guide the implementation of KM in projects, a validated method does not exist yet, mainly because there are differences between organizational KM and KM applied to projects.

Knowledge Management, as Wiig (1993) explains, is the systematic, explicit and intentional construction of knowledge and its application to enhance the efficiency and profits on the knowledge assets of the organization. Schreiber et al. (2002) deepens this definition by equating KM with management Model, that makes possible the improvement on the knowledge infrastructure of the organization aiming at providing the right knowledge to the right people at the right moment and time.

These definitions refer to the organizational KM, a management model that aims at providing adequate knowledge to the right people at the right time, assisting decision-making and improving the performance of the organizational process (Ho, 2009). Considering these objectives, organizational KM could be easily conveyed to KM applied to projects.

The organizational KM focuses on the continuity of the processes, unlike the finite rule that is proper of a project lifecycle, with scope and deadlines previously determined. It seeks the origination of values and brands, originating intangible assets of the organization, while projects seek specific results by managing tangible assets. Besides, organizational KM works with interdisciplinary teams, formed by people with multidisciplinary viewpoints, willing to learn and teach, unlike the multidisciplinary teams composed mandatorily by people with disciplinary viewpoints willing to contribute with their knowledge to solve the problem without necessarily changing their viewpoints.

As for the need of encouraging new studies upon the application of KM in projects, this paper aims at proposing a method of KM in project documentation to favor the acquisition and integration of data, information and knowledge.

2. THEORETICAL FRAMEWORK

When creating the method, it was necessary, firstly, to comprehend how KM can be helpful when applied to projects, bearing in mind that knowledge can be reused in other projects to optimize their results in terms of time and cost. To cut out the waste of projects' knowledge means to be

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able to depart from knowledge that is already known to evolve in terms of competencies. This logic implies that something that was done in previous projects does not need to be done again in a new project, which means that time can be saved to explore brand new knowledge.

Several companies and workers do not pay attention to the fact that, in spite of recreating knowledge in and for each project they develop, they could increase the chances of success by reusing knowledge from projects already conceived, tested and homologated, as well as from experiences undertaken throughout their conception. Such experiences are known as lessons learned (Ferenhof, 2013, p. 55) and good practices.

This way, rework is avoided. As Ferenhof (2013, p. 51) explains, knowledge waste "[…] is on the opposite side of value, that is, every effort, time and attention is expended towards something that does not aggregate value" or that is forgotten after being produced.

Some other projects could be positively impacted not only by the increase of the offer of worth contents, but also due to the dynamicity of the feeding of new contents, thus increasing the performance for the support of assertive decision-making.

Project management has based itself on knowledge already made explicit that comes from already known sources. Schindler (2002) explains that explicit knowledge is that which can be easily declared, described, codified in order to be transformed in organizational knowledge.

Besides the explicit knowledge, there is another important kind of knowledge that can be dealt with in projects, which is the knowledge not made explicit yet in manuals and organizational reports.

Ferenhof et al. (2013, p. 199) also points out that, "in projects, there is the need for making knowledge explicit and shared to improve the relationship between stakeholders in order to contribute for their learning process, thus impacting positively on planning, execution, monitoring and control of the projects".

In addition to the usefulness of KM to the efficiency of the projects, it must be understood that highly efficient projects are those that manage KM inside a project and among a group of projects, being able to rescue and use knowledge in other projects and contribute to the learning process of the team involved (Micklethwait et Wooldridge, 1998).

Therefore, by analyzing the relationship between the project's teams and the behavior of the learning process of this same team, learning process can be defined as a cycle of experimentation, reflective communication and codification. At this moment, it is important to mention the concept of "subgroup strength", defined by Gibson et Vermeulen (2003) as the degree of knowledge overlapping among the team members. Contrary to conventional thinking, the presence of teams inside an organization should be perceived as knowledge islands that need to be accessed so that the collective learning can be processed.

Since Piaget (1998), the importance of the team for the learning process is being emphasized. According to the author, learning is built from the development of cognitive structures that are organized according to the stages of development of the subjects' intelligence that are stimulated by the need to adapt to external and internal changes. The dialectic process is gradual and has an interdependent relationship with informational products or feedbacks from the environment.

The sociohistorical theory proposed by Vygotsky (2007) considers, as well as that of Piaget, that the learning process of individuals is established from their interaction with the environment, which is the base for the development of such process. The concept of mediation that comes from Vygotsky's theory posits that objects only make sense to a subject when they are intermediated by the environment that surrounds this same subject, thus allowing him/her to interpret the symbols they represent. In this sense, the subject, more than being active, is interactive, productive and receptive since he/she constructs knowledge and subjectivity as of intrapersonal and interpersonal relations. This process is constructed by the subject's own quest, inside an organization, for information, concepts and meanings. This non-linear individual process produces the team learning, which, if managed, can build organizational knowledge.

To proceed with the studies about team learning, either theory or praxis should be considered, valuing:

> All the subjects are involved in this process as participants of the environment in which they are inserted in. Also, respecting team learning allows for a strict and dependent interaction with the individual learning process as well as the organizational learning. It is known that the sum of different individual learning is the base for team learning, though it is not sufficient by itself. Thus, the premise that the properties of the parts and that of the team as a whole, are integrated in a dynamic whole, where the parts are interrelated and interdependent, is formed (*Lewin, 1951, p. 324).*

Thus, a project can be defined as a social unit formed by subjects within interdependent functions and by a shared

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view, regulated by predetermined rules and norms accepted by the subjects that form the team. For the acquisition of the knowledge created within this team, it is necessary to understand the context and the elements that made its construction possible, otherwise it will not be well understood and will be of difficult application.

Senge (2006, p. 43) presents the team as a "fundamental learning unit in modern organizations, leading to an improvement on the ability that concerns problem solving and the capacity for action towards environment demands" (Probst et Buchel, 1997).

For Argote et al. (2001, p. 370), team learning can be considered as "activities through which subjects acquire and combine knowledge through the experience with the other". Following the same line, Edmondson (1999, p. 353) defines team learning as a "continuous reflective and active process" in which one goes through questions, feedbacks, experimentation, reflection about the results and discussion about the errors, resulting in an overall feedback of the process to restructure actions.

According to Wilson et al. (2007) and Argyris et Schön (1996), learning is a process of identification of errors followed by correction, whereas for Crossan et al. (1999), team learning is a process of interpretation and integration.

What seems a consensus within scientific literature, is that this learning dimension occurs precisely from the manifestations of the information processing. Team learning is a result of the sharing, storage and retrieval of knowledge from the routine and behavior of each one of the members, for these processes and their interrelations are the main mechanism to process individual and collective learning (Hinsz et al. 1997).

Nonaka et Takeuchi (1997) proposed a seminal model to create organizational knowledge formed by five stages and implied a dynamic management, as a spiral, so that individual knowledge can be processed to be transformed into organizational knowledge. In this process, the knowledge that comes from the subject's mind is spread out to the team he/she belongs, so that it can be acquired, manipulated and shared with every individual of the organization.

The first stage of Nonaka et Takeuchi's (1997) model refers to the sharing of tacit knowledge, and demands an environment that enables social interaction among individuals. In the case of projects, the model demands autonomous teams with a great amount of dialogue between the individuals. In the second stage, the continuous dialogue is also a requirement, but shifting to the collective reflection. The third stage is determined by the authors as the moment to justify concepts; it presupposes the filtering and validation of the acquired knowledge, aiming at comprehending its relation with the strategy of the organization. The fourth stage, called the construction of an archetype, defines the construction of a model or a prototype that enables better understanding by all the individuals involved, even by those who are not involved in the process of knowledge creation. This model should be made available for all, encompassing actions of sharing and dissemination inside the organization and among organizations in the fifth stage of the process of creation of the organizational knowledge.

These affirmations lead us to define that the project's knowledge base should not only register the elements (data, information and knowledge), but also give attention to the processes that occur among individuals, among individuals and groups, among groups, as well as among organizations, which will help to clarify the systemic reason of the team learning process (Whetten, 1989). This means that the knowledge base should unveil the interrelations and interdependencies of individual knowledge and team knowledge within the different level of systems of "learner" that lead to the creation of organizational knowledge (Figure 1).

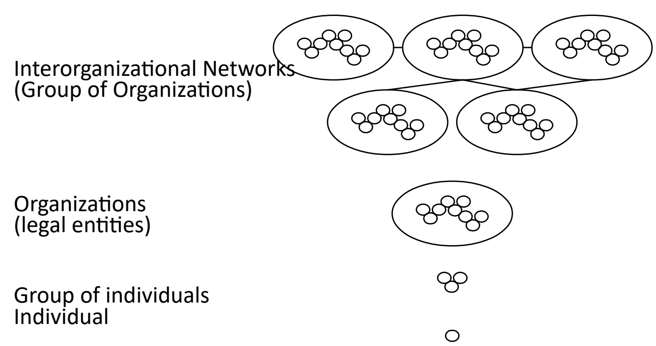

Figure 1. Level of systems of "learner" (Knight, 2002, p. 436)

Nonaka et Takeuchi (1997) emphasize that the creation of new knowledge by the organizations is not only a question of learning with others or acquiring external knowledge. The authors state that knowledge should be constructed by itself through the interaction among the members of the organization. To do so, they suggest determining factors to the learning process that will lead to the creation of the organizational knowledge. They are: the intents of an organization and its goals; the autonomy of the participants to act according to the situational challenges; the generation of the creative tension with the external environment; the redundancy of data and information, which occurs when their existence goes beyond what is needed in activities and tasks; the variety of requisites that allows the constant creation of knowledge to face new contextual challenges.

In more competitive and global contexts, as experienced in the last few decades, Wilson et al. (2007) bring to light the difficulties of retrieving the stored learning. In

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these situations, the capacity of dealing with nonlinearity or of recovering knowledge from the memory related to the original event is demanded, applying this knowledge to different situations, reconstructing meaning. Besides that, the coping with the physical, social and cultural differences of the team members is demanded, since these differences harm the understanding of the new stored knowledge and the way of dealing with its application in a new context.

The relationship among sharing, storing and retrieval for the consolidation of the team learning is beyond the simple sequential position, as pointed out by Wilson et al. (2007):

a) Sharing affects the solidity of the team learning through storage and retrieval.

b) When sharing is expanded, it enables protection from learning decay, since learning is stored in multiple repositories.

c) Retrieval affects storage. When choosing to use some of the storage mechanisms, these very mechanisms are reinforced, while the others are not.

d) The retrieval process can also work as a mechanism of sharing, for, in group, the retrieval requires verbal interaction.

e) The sharing of discussions about the stored knowledge can strengthen the register of the original memory.

f) The distortion of the retrieval process can substitute the original learning.

g) Recovery can evolve to sharing. When a team tries to reinterpret or re-contextualize, to itself, the learning and the store of learning in accessible spaces, there is great opportunity to additional sharing.

It can be concluded that, without storing and handling a proper map to ease the retrieval of the shared learning, the team repertoire may not evolve throughout time. Therefore, it is necessary to have a base of knowledge as a memory to be retrieved.

The organizational memory, according to Conklin (2001), is the virtual or actual environment that stimulates the capture, organization, propagation and reuse of knowledge created by the members and the organization as well. When creating a space of intelligent memory, organization improves the way with which it manages its knowledge (not letting it archived in documents), in order to ease the access, sharing and reuse of knowledge by several members of the organization. Accordingly, essential information and knowledge are represented explicitly and persistently, increasing and actualizing the competitive intelligence (Abecker, 1998).

In this sense, it is important to propose a method of Knowledge Management applied to project documentation to acquire and integrate data, information and knowledge (DIP)[1], and, consequently, to construct a knowledge repository that will be the basis for an intelligent system of project management.

With the theoretical framework here presented, the specific objectives of the proposed method are:

a) Giving support to the acquisition and sharing of knowledge of the projects' teams.

b) Streamlining and making the process of decision-making more reliable during the project's lifecycle and after its end.

c) Having a single repository of knowledge and strategic information relevant to the alignment of a project and among projects.

d) Reducing costs and rework by storing the results of the collection of data and information.

e) Storing the history of the projects for further consultation.

f) Making graphically explicit the path used to create knowledge, easing the reanalysis and reuse by other analysts.

g) Stimulating knowledge by sharing it between the members.

Such path begins with the construction of a single base of data, information and knowledge (DIP) for the sharing of knowledge. When constructing the base, the first four steps of an intelligent system of KM project are complied with. They are: identify, map, inventory and store (Figure 2).

Thus, in order to construct the base, one must identify the project's critical knowledge and value DIP; map the processes of construction, use, and document deliveries; inventory the interrelationships and interdependencies of the elements; and store the DIP in the base.

1 The authors created the initials DIP to represent the words data, information and products, since product is the meaningful knowledge determined by the final delivery of each project.

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3. METHODOLOGICAL PROCEDURES

In what regards the approach, this is a qualitative research that enables deep analysis of the comprehension of the context of elaboration and execution of projects.

As to the goals, this research is defined as exploratory, descriptive and propositional (Alves-Mazzotti, 2001; Bobbio, 1997; Patton, 1988; Serra, 2006). Concerning the type of survey, this research is classified as documentary, because there were collected documents created for two projects of the Transport and Logistics Laboratory of the Federal University of Santa Catarina, Brazil. To preserve the confidentiality of the projects, in this paper these projects will be called as Project A and Project B.

To better understand the analyzed material, after the exclusion of the replicated documents (which concern the partial reports presented again in the final reports of the projects), the total amount of 13 documents was collected as a final sample. Of these, 96 are diverse and belong to Project A, and 7 are reports that belong to Project B. From this total amount of 103 documents, 15 are reports, eight are executive summaries, 21 are appendixes developed specifically during/to the project (called "IA" from now on), 31 are appendixes from external sources (called "EA" from now on), two are appointment registers, one is an official letter, 16 are complementary material, and nine were classified as "others" by the interviewees.[2]

The content analysis was used for the collection of the tacit knowledge of the projects' teams. The meaning presented by the subject in his/her speech was the one taken into consideration. Such analysis was also used to map the critical knowledge and value DIP in the documents. Moreover, the existent interrelations and interdependencies were inventoried. This kind of analysis served the purpose of describing the characteristics of the information and the knowledge made explicit, stablishing their nature and correlations among the diverse elements.

The verification of the method reliability was done in documents of projects of other project teams, which were chosen due to accessibility. Regarding the secrecy asked for the participant organization, little description of the documentation can be made in this paper.

However, since this is a qualitative research, the methodological procedures made possible both the identification of the critical knowledge of the project documentation and the acquisition and integration of the DIP to be used in future projects. Hence, the method further exposed can be considered as validated.

4. ANALYSIS AND RESULTS

To conduct the elaboration of the LabTrans Knowledge Management Method Applied in Project Documentation,

2 T.N.: In Brazil, the Brazilian National Standards Organization prescribes different words to refer to the separate parts present at the end of a document, i.e. in a report or a thesis. *Apêndice* is the Portuguese word used to refer to the extra part provided by the author(s) of the document, whereas *Anexo* is used to refer to the extra part of other authorship (external source) that the author(s) considered as relevant information for the whole work. The translator chose the word appendix to refer to both types of parts and, specifically, the initials "IA" to refer to *Apêndice* and "EA" to *Anexo*.

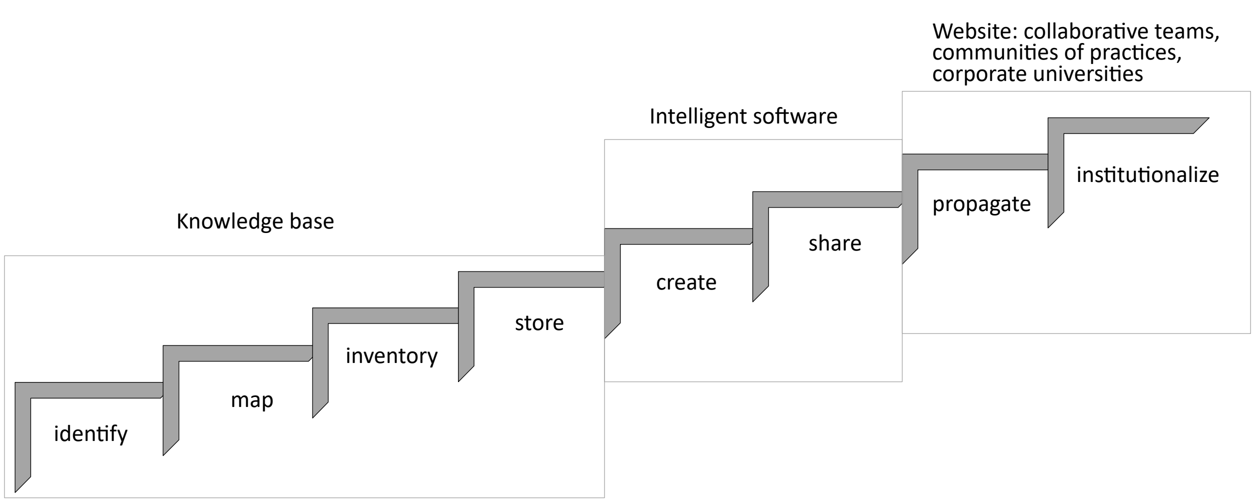

Figure 2. Linear view of the Intelligent System of the project's KM

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categories of analysis and the modelling of the mapping process of the document's DIP were defined, thus revealing the strategies and premises that will allow classifying the components of the Project's Knowledge Base.

4.1 Data, Information and Knowledge (DIP)

The **data** category encompasses the direct citations present in the documentation, as well as secondary data used in bibliographical searches. It also includes raw data and photographs that were not modified by the project team, such as those from Google Earth.

The **information** category refers to the data processed by the project. It includes the presentation of the results obtained in empiric, quantitative and qualitative research when these results had not been categorized yet; as well as the representation of the information flow and any processes mapping.

In this category, photographs that portrait reality were also classified with additional marking or with the proposed use for the place photographed. Either primary or secondary photographs are considered as **information**, that is, those that have some kind of marking or signaling of specific elements existent in reality, besides the ones that portrait reality and incorporate an analysis – for example, those with an indication for a specific use in the future.

The **knowledge** category stands for both the information processed or analyzed, as well as for the presentation of categorized results obtained in empiric quantitative and qualitative research. It also stands for the knowledge obtained from human mind, especially through in-depth interviews, and any other scenery elaborated during the project life cycle. Photographs that portrait reality, of which an architectonic project was incorporated, were also included in this category.

The **knowledge representation category** has to do with the knowledge analyzed and processed in terms of figures, graphics or tables, including graphics created by the human mind, providing analysis of the average values, action plans, conclusions and especially the final products of the project.

The **potential knowledge category** refers to the ideas of the base users in terms of what could still be created from the existing DIP.

4.2 Mapping process of DIP in documents

The method for KM application in projects sets the mapping of the process of knowledge creation in the projects as well as the documents and historical data in order to enable comprehension and establish the hierarchy of the elements. This method encompasses 22 stages and 3 gates for the continuity analysis, according to what will be described below.

There are four steps in which the gates are segmented. Within these four steps, the KM team decides whether they will continue with the process or move backwards to redo some of its parts. The first stage of the first step of the method (Figure 3) comes from the definition of the scope of the work, that is: (1) definition of the project to be mapped.

The second stage (2) concerns the creation of the of the project's structure base as a knowledge map. This map portrays the project's scope with its objectives, products and activities. Besides that, as a concept map, it describes the interdependencies and interconnections of each element. Based on it, it is also possible to (3) identify the documents, defining a priority grade.

The next stage stands for the initial mapping of the DIP (4). In this stage, the exploratory reading of the DIP that was made explicit must be done. To complete this stage, the initial map can be done as a draft to portray how the document was understood (5). When the map is ready, the KM team must call a meeting with the team in charge of the project under analysis (6), and then meet with them (7). In this meeting, the project team is interviewed by the KM team aiming at achieving two objectives: (7a) Verify whether the knowledge map seems solid enough and (7b) Extract DIP (tacit knowledge).

By the end of these stages, there is the first gate, in which the reliability of the initial base is analyzed to know whether the knowledge acquired in the meeting is enough to undertake the process or not. If the initial base is unreliable, the fifth stage should be performed again. If the knowledge acquired in the meeting is not enough, it is necessary to return to the sixth stage as many times as necessary until it is assumed that there is no more significant tacit knowledge to make explicit.

By finishing gates 7a and 7b, it is time for the second step of the method (Figure 4). In the following stage (8), the base can be widened by inserting the DIP that was made explicit in the interviews. At this moment, all this knowledge must be categorized according to its interrelations and interdependencies (8).

In the following stage (9), the DIP mapping in the documents must be deepened. Then, three different reading levels of the project documentation must be performed; they are: selective, critical and interpretative, so that the DIP can be selected, and it is possible to reflect on their meanings and interpret the constructive processes to, finally, design the base.

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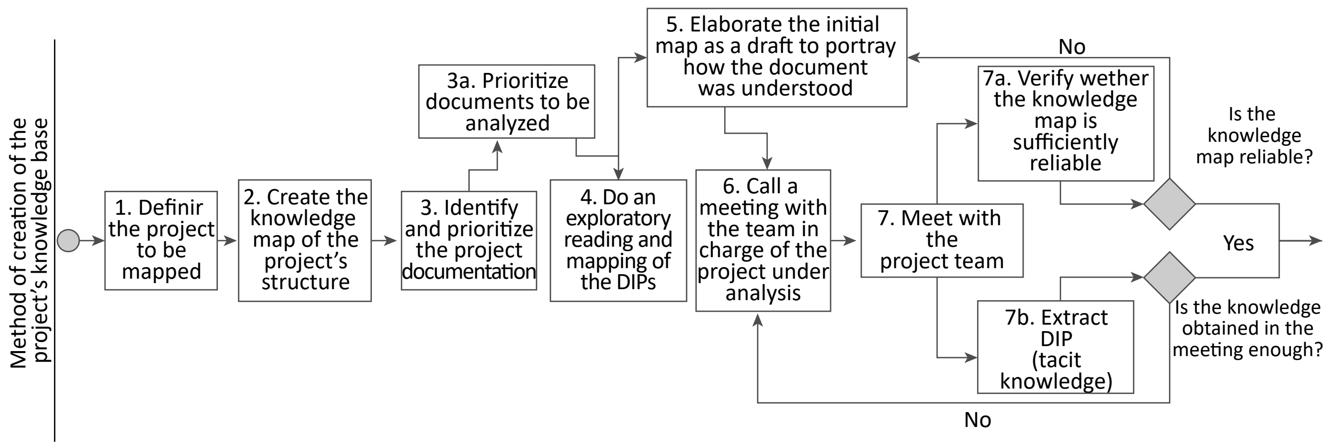

Figure 3. First step of the method

Then, respectively, the hierarchy of the DIP must be established (10) and the binding terms must be defined, initiating the representation of the base through a concept map tool (11). This tool demands the establishment of the hierarchy of the elements that will be drawn and the inclusion of interrelation lines between them. After that, the base is created in the software CMapTools or other chosen by the organization. In this research, CMapTools was chosen because it is a free tool.

After the draw's elaboration, the project team must homologate the base (13), originating the second gate of the process: Was the initial base validated or not? If the base has not been validated yet, some changes must be done in it, consequently returning to the eighth stage. If the base is satisfactory, the process can continue to the next step of the method (Figure 5).

As soon as the base is ready, in the next stage (14), the inventory report must be elaborated, as well as the cards that describe the inventory and that present both the sequence and hierarchy of the relations among the elements that were identified in the project. In the following stages, each element must be qualified (16), and the base must be classified according to its level of secrecy – both tasks are part of the deep analysis of the map that makes the base more reliable.

As of this moment, two maps must be generated: (18) a map of the DIP' group map that allows a better visualization of the elements directly related to the base and (19) a map of the constitutive elements of the different groups.

In the 20th stage, the maps must be elaborated and validated. The project team is consulted in a meeting to confirm whether the maps are coherent. Now, at the third gate, if the project team did not validated the results of the maps and some restructuring is necessary, the process has to go backwards to the 18th or 19th stage, depending on which map had not been validated.

As soon as the maps are approved, it is followed by the two final stages: (21) implementation of the base, and (22) integration of the DIP inter-project (Figure 6).

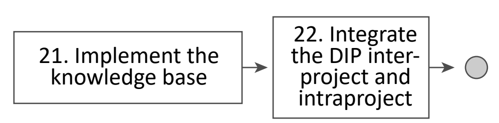

Figure 6. Fourth step of the method

Besides going through the process described a careful work of collection and storage of the files must be carried out, connecting these files to the mapped elements, so that

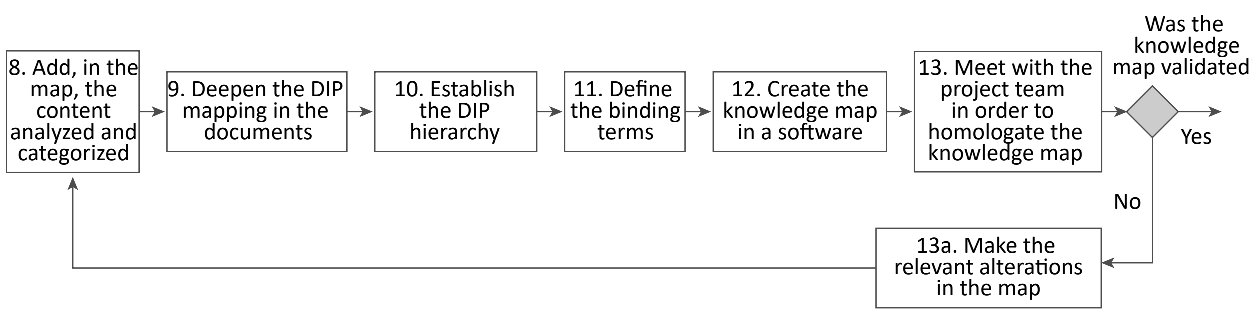

Figure 4. Second step of the method

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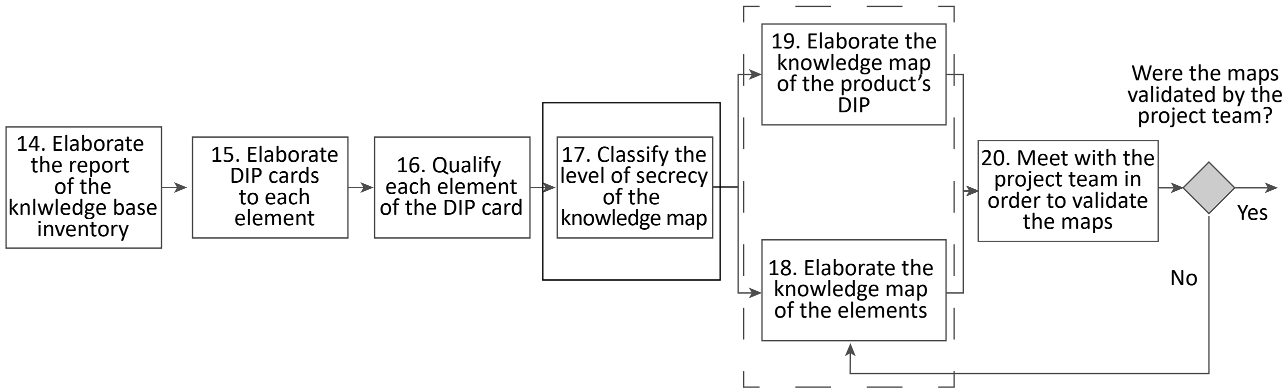

Figure 5. Third stage of the method

the knowledge memory can be created. While following the stages described, another team must prepare a digital repository to place the identified DIP. Such repository will be the base memory, since it will be accessed whenever necessary to retrieve the DIP. The creation of folders is suggested so that the files can be stored in folders related to each project under study.

In some of the method's stages, the DIP is created to be stored in this repository. Thus, stage 4 is related to the storage of the DIP initially diagnosed, which is amplified with the DIP listed in stages 8 and 9.

Also, the inventory created in stage 14, as well as the cards elaborated in stage 15, must be sent to the knowledge memory. Then, the following are stored: the knowledge map validated in stage 13, the DIP group map, and the map of the constitutive elements (19).

After going through the 22 stages, it will be present in the memory of the organization, as Conklin (2001) pointed out. Be it a virtual or actual environment, this base will stimulate the project managers to collect, organize and store the knowledge created during the projects, because value will be aggregated to the results when such knowledge is used by other projects or recognized by the organization.

To the elaboration of the LabTrans Knowledge Management method for project documentation, the categories defined in the scope of projects A and B were applied. It was possible to extract 202 elements of the knowledge classified in 59 data (D); 59 pieces of information (I); 56 pieces of knowledge (K); 26 representative elements of knowledge (R); and 2 potential pieces of knowledge (Rp). All the elements extracted originated the DIP maps validated by the project teams. All managers and project participants consented, in the interviews, that the LabTrans Knowledge Management method for project documentation would bring celerity to the organization's processes.

5. CONCLUSIONS

It is known that projects use and create knowledge throughout their processes and development, thus being a specific group of products and tasks to respond to a specific objective. Bearing this in mind, LabTrans elaborated a method of Knowledge Management for project documentation in order to acquire and integrate data, information and knowledge built during the development of the projects so that they can be retrieved by other projects.

The LabTrans Knowledge Management method for project documentation, in a broader view, will promote the reuse and alignment of the knowledge present in the technical reports and resulting products; will correlate data, information and knowledge in a way to ease the intelligent future management; and, mainly, will open a horizon to learning. In other words, the LabTrans method can be considered a method of optimization of efforts and collective learning in projects.

However, it is relevant to point out the method limitations. Each project is very different from the others, regarding scope, time and work groups. Therefore, these specificities must be taken into consideration for the constant feedback of the taxonomic map. The knowledge base must be managed as an alive element, so that its dynamicity can be respected, and the constant feedback of data, information and knowledge can be seen as mandatory.

It is suggested to continue this research with a view to elaborating intelligent systems that enable the automatic and dynamic mapping of the DIP in different documents of different projects as well. It is also suggested the electronic sharing of such knowledge in order to provide faster responses that will give support to operational, tactic or strategic decision-making, thus optimizing the efforts by reusing good practices and lessons learned in future projects.

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