Systematization of absorptive capacity microprocesses for knowledge identification in project management

Alan Tadeu de Moraes, Luciano Ferreira da Silva and Paulo Sergio Gonçalves de Oliveira

Abstract

Purpose – *This study aims to systematize the acquisition phase of absorptive capacity microprocesses that contribute to project management (PM) knowledge identification.*

Design/methodology/approach – *An exploratory and descriptive qualitative research was adopted. The first stage consisted of building the conceptual framework based on four systematic-literature-reviews. The data collection process in the second phase involved in-depth interviews, which are adequate to understand the interviewee's reality. The sample composition consisted of 15 respondents who are PM professionals with an average of 15 years of experience. Each interviewee was chosen based on their expertise and ability to transmit the entire management process of several projects. The data were analyzed using the Atlas. Tecnology information software following the grounded theory technique with three coding cycles: open, axial and selective.*

Findings – *Based on the results, the authors organized the microprocesses into three groups: events, social interaction and the use of tools and techniques.*

Research limitations/implications – *The primary limitation of the study was the number of respondents. Future studies will be able to identify other microprocesses and evaluate their role in the knowledge identification process.*

Practical implications – *This study presents a systematization of microprocesses in knowledge identification, as it occurs in the context of PM. Based on the results of this study, organizations will be able to choose the microprocesses that best fit their operations and activities according to the complexity, innovation and/or criticality of their projects.*

Originality/value – *The systematic literature review revealed a gap in the knowledge identification phase of knowledge management as it pertains to PM. Thus, this study presents a systematization of how knowledge identification occurs in the context of PM.*

Keywords *Project management, Knowledge management, Knowledge acquisition, Absorptive capacity, Knowledge identification, Microprocess*

Paper type *Research paper*

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1. Introduction

In project management (PM), it is common to track the success or failure of a project at the execution stage. Guides such as the Project Management Body of Knowledge (PMI, 2017), Individual Competence Baseline – International Project Management Association (IPMA, 2015) and Human Change Management Body of Knowledge (HUCMI, 2013) describe this process. While such guides intend to assist organizations in the process of managing lessons learned, the PMI – Pulse of Profession 2018 report shows that only 58% of organizations understand the entire PM process, and only 47% of organizations have formal methods of knowledge transfer (PMI, 2018). This apparent lack of understanding likely accounts for the high failure rate in the PM area, which reach percentages of up to 70% (Othman *et al.*, 2017).

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In this sense, improvements in knowledge transfer could reduce project failures, thus making knowledge management (KM) particularly relevant to successful project outcomes. Indeed, failures in KM interfere with the efficient use of lessons learned (Rodrigues, 2019). These learning deficits, even with the application of lessons learned management as described in the studies of Yang *et al.* (2020) and Eken *et al.* (2020), and the lack of knowledge identification models indicate that project failure is primarily caused by problems at the beginning of the learning process.

In the PM area, the first step in the learning process is knowledge identification. However, our search for previous analyses of KM models in the literature revealed that knowledge identification is not well utilized or completely absent in most models (Santos and Silva, 2017; Calvo-Mora *et al.*, 2015; Probst *et al.*, 2002).

Previous studies showed that knowledge transfer occurs by converting tacit knowledge to explicit knowledge and vice versa (Nonaka and Toyama, 2003; Magliacani and Madeo, 2018). Nonaka and Takeuchi's (2009) socialization, externalization, combination and internalization (SECI) model highlights the benefits of leveraging tacit and explicit knowledge transformation for the creation of knowledge. Moreover, transforming these types of knowledge can assist in the formation of organizational memory and be used for learning analysis (Nonaka, 1994). In this sense, improved KM enables organizations to transfer knowledge by applying lessons learned from previous projects (Duffield and Whitty, 2016; Ali *et al.*, 2018; Oliva and Kotabe, 2019). Furthermore, assuming that the human mind is the origin of knowledge (tacit knowledge), lessons learned then originate from processes where there is a stimulus for a creative process.

As alluded to above, most KM models do not exhaustively or thoroughly explore the knowledge identification phase. For example, in the studies of Santos and Silva (2017), Calvo-Mora *et al.* (2015) and Probst *et al.* (2002), the identification phase is already established, concrete and available to all of the participants in the PM process. Additionally, the model proposed by Gasik (2011) that aimed to present a complete and consistent model mentioned the identification phase but only for identifying the necessary knowledge for a specific type of project. In this latter case, the author assumed that the knowledge had already been mapped and identified.

In this context, there is a challenge for companies to recognize, capture and assimilate knowledge from the success or failure of previous projects, a process known as absorptive capacity (AC). In other words, AC is an organization's ability to absorb knowledge from lessons learned, or other sources, and apply it to the management of future projects (Duffield and Whitty, 2016; Ali *et al.*, 2018).

However, the ability to incorporate AC into an organization's practices requires identifying knowledge, recording the lessons learned and building repositories, processes notoriously avoided in many organizations. Furthermore, Davenport and Prusak (1999) point out that it is not enough to just have a robust knowledge repository, one must know how to effectively utilize it for it to be considered a precious asset of the organization.

As evidenced by Minbaeva (2013), non-systematic knowledge identification processes reduce the utility and accuracy of an organization's existing processes. Moreover, Haas and Ham (2015) point out that an inefficient identification phase, or its complete absence, can result in the loss of connections and/or the inhibition of innovative processes. Indeed, the identification phase is a means for companies to assess their needs, understand what to do with the acquired knowledge and effectively use all of the knowledge (Minbaeva, 2013). An effective identification phase may also facilitate the transfer of appropriate knowledge to the employees, thus enabling the integration of relevant external knowledge to create recombination (Bogers *et al.*, 2018). Notably, Gasik (2011) mentions knowledge identification but does not explore it as a precedent for managing the absorption of knowledge. In this sense, we assume that the identification of knowledge depends on

lessons learned and other sources of knowledge from previous projects. Thus, based on this gap in KM models, the objective of the present study was to systematize the acquisition phase of AC microprocesses that contribute to PM knowledge identification

Herein, 15 PM professionals (respondents) with an average of 15 years of experience participated in the study. The data collection process involved in-depth interviews, which provided an adequate understanding of the interviewee's reality. The interviews were recorded, transcribed and analyzed for qualitative data analysis. We used the Atlas.Ti (version 7.5.4) software for data analysis, according to Charmaz (2006) and utilized a process known as the grounded theory to analyze the coding cycles and construct categories (codes). The process can be guided by data (data-driven), being built from the diverse sources of evidence collected (Saldaña, 2012) or from previously determined categories (theory-driven).

Grounded theory begins with inductive strategies to collect and analyze qualitative data and develops medium-range theories (Charmaz, 2006). In this sense, grounded theory is an analytical technique that develops theoretical discussions that explain the primary concern of the studied population. It can also provide solutions for how that concern will be resolved or processed. Through the process of constant comparison, grounded theory can also search for and conceptualize underlying social patterns and structures of that population (Silva *et al.*, 2006).

Because of the non-systematization or lack of knowledge identification practices, organizations lose their innovative position. The AC model proposed by Zahra and George (2002) shows that the activation of knowledge identification processes herein referred to as microprocesses, have an impact on obtaining other sources of knowledge and stimulate the development of new knowledge. Therefore, we propose that the microprocesses of the AC acquisition phase contribute to the identification of knowledge and that properly using these processes could potentially improve the success rates in PM.

2. Theoretical framework

As mentioned previously, the organizational knowledge creation model known as SECI (Figure 1), converts tactic and explicit knowledge into organizational knowledge (Nonaka and Takeuchi, 2009).

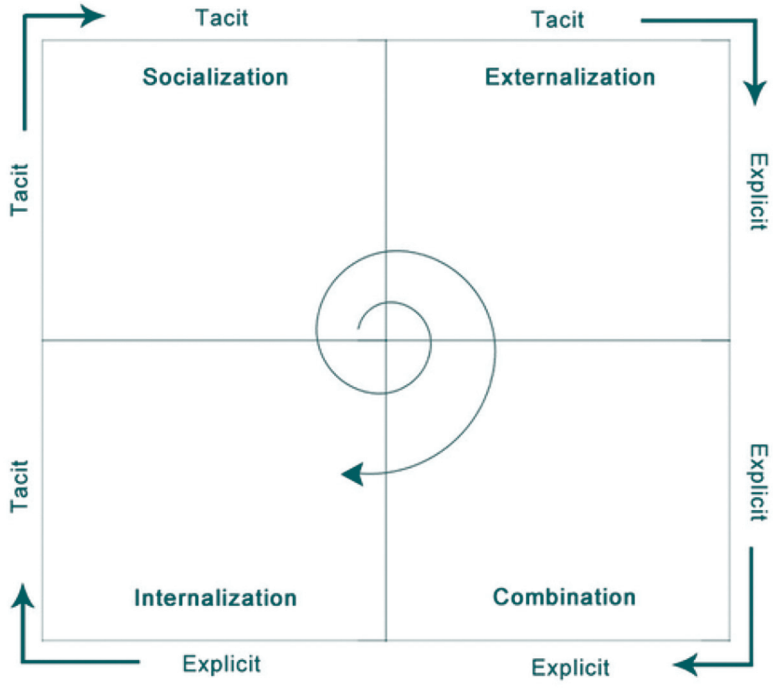
As shown in Table 1, this model has been utilized as the basis for other KM models.

Interestingly, while analyzing the literature, we were able to identify the phases of the KM process (Table 2). In the models of Gasik (2011), Santos and Silva (2017), Orzano *et al.* (2008) and Addas and Pinsonneault (2014), they use different terminologies for the knowledge identification phase, which, herein, we grouped together and simply refer to as knowledge identification.

Considering the knowledge identification phase, it is necessary to highlight that the models consulted did not exhaustively deal with the identification process. For example, Gasik (2011) understands that knowledge identification is the first step in PM and defines it with the specification of what is needed. For Orzano *et al.* (2008), the development and implementation of this phase mean finding or discovering objects that have not been coded but do exist. We interpret that latter view as evidence of the identification phase.

Knowledge identification occurs through actions, which in the context of AC are understood as microprocesses that lead to the identification of a new type of knowledge. Examples of such processes include activity descriptions (Gasik, 2011), workshops, focus groups (Duffield and Whitty, 2016), interviews, lessons learned processes, repositories (McClory *et al.*, 2017), document analyses (Santos and Silva, 2017), brainstorming activities, informal conversations, meeting minutes, socializing among employees (Faccin and Balestrin, 2018), among others. Therefore, almost any observation is a potential source of knowledge.

Figure 1 SECI model



Source: Adapted from Nonaka and Takeuchi (2009)

Table 1 Other models that used the SECI model

Model	*Another approach*	*Author(s)*
Strategic KM model	Balance score card	Jafari *et al.* (2010)
E-CKM	Customer relationship management	Su *et al.* (2006)
Blended KM model	E-learning	Yeh *et al.* (2012)
Three-dimensional model	BA	Faccin and Balestrin (2018)
KMmodel	Boisot's Information Space model	Boutard and Guastavino (2012)
Enterprise KM model	–	Oztemel and Arslankaya (2011)

Note: E-CKM = Electronic customer knowledge management
Source: From research data, 2020

We stress that within the knowledge identification phase, actions such as recognition, mapping, and classification typically occur. More specifically, recognition consists of knowing how to identify potential sources of knowledge (Ale *et al.*, 2014), mapping is a process that tracks the pathways of identifying knowledge present in the various areas and activities of the organization (Oztemel and Arslankaya, 2011), and classification facilitates the utilization each type of knowledge (Gasik, 2011).

It was stated by Simon (1991) that learning occurs when members of an organization have knowledge that the organization lacks. In this respect, Machlup (1980) mentioned that there are at least 13 elements present in the act or state of knowing including accustomed, familiar, conscious, remember, recollect, acknowledge, distinguish, understand, interpret, and be able to explain, demonstrate, speak and implement, which according to the author are mutually exclusive.

Table 2 Description of the knowledge management process phases

Phases	*Description*	*Author(s)*
Origin/introduction/finding/ knowledge identification	Process focused on establishing precise standards, models or specifications of what it takes to build new knowledge. It can be focused on third party knowledge or not	Gasik (2011), Santos and Silva (2017), Orzano *et al.* (2008), Addas and Pinsonneault (2014)
Acquisition/capture/ extraction of knowledge	It consists of the external process of obtaining knowledge	Gasik (2011), McClory *et al.* (2017), Pan and Mao (2016), Chen *et al.* (2012)
Knowledge conversion	Understands the process of turning employee and business partner knowledge into enterprise operations	Lee and Lan (2011)
Coding/grouping of knowledge	It consists of learning, separating, directing, diffusing, transferring and using specific knowledge	Boutard and Guastavino (2012), Gonçalves *et al.* (2009)
Storage/retention/ representation/handling/ recovery knowledge	It is the process of storing the knowledge of every individual who has ties to the organization. After being identified, extracted and organized, it is used to develop the organizational memory of the company	Gomezelj Omerzel *et al.* (2011), Ale *et al.* (2014), Wang and Meng (2018), Lee *et al.* (2010), Carayannis (1999)
Creation/generation/ increase/adaptation/ innovation/knowledge development	It is an internal process of transformation, aiming to satisfy the need for an area, which occurs through the conversion of tacit knowledge to explicit knowledge. This process is also understood as developmental and allows the organization to understand, synthesize, reallocate, diversify and create new processes and alternatives for diverse areas within the organization from an existing source of knowledge	Ale *et al.* (2014), Orzano *et al.* (2008), Gasik (2011), Magliacani and Madeo (2018), Zhao *et al.* (2012), Calvo-Mora *et al.* (2015), Pan and Mao (2016), Chen *et al.* (2012)
Application/use/reuse/ deployment of knowledge	It is the main process of the knowledge life cycle and is the way in which knowledge already acquired is used to make a decision or to perform a task	Wang and Meng (2018), Gasik (2011), Gomezelj Omerzel *et al.* (2011)
Knowledge measurement	It consists of the creation of performance indicators for KM and measures what has been implemented	Gonçalves *et al.* (2009)

Source: From research data, 2020

In the context of projects, employee turnover and the lack of absorption of lessons learned contribute to the loss of knowledge, and this is especially concerning for companies that focus on time, cost and quality as factors of success (Shatti *et al.*, 2017). Since the transfer of knowledge between those involved in the project is essential for PM success, it is the people involved in the company and, consequently, in the project that become the primary agents for producing knowledge. Tow *et al.* (2015) stress that knowledge identification is a crucial process within KM, where organizations proactively seek to identify existing knowledge. Moreover, Zhou *et al.* (2016) understand knowledge identification as the process of identifying what type of knowledge needs to be used in a given process. For Dani *et al.* (2006), some organizations perform the process of knowledge identification citing instruction manuals or how-to guidelines.

Highlighting the presence of non-systematic or the complete absence of knowledge identification processes, Tow *et al.* (2015, p. 2) stated that "organizations do not know what they already know". In other words, organizations are completely unaware of or do not how to utilize their existing knowledge. Thus, researchers need to give more considerable attention to the knowledge identification phase in PM, and it needs to systematized in a way that enables more efficient and effective identification processes (Becker *et al.*, 2015).

While Cohen and Levinthal (1990) did not specifically address the term knowledge identification, they did mention the importance of AC in recognizing the value of new information. For example, the authors state, "the premise of the notion of AC is that the organization needs prior knowledge to assimilate and use new knowledge" (Cohen and

Levinthal, 1990:129). Thus, new knowledge identification contributes to the acquisition of knowledge, which is consistent with the studies of Becker *et al.* (2015) and Ortiz *et al.* (2017).

Knowledge identification involves acquiring external knowledge, which is considered essential for executing activities and necessary for performing tasks that will provide the organization with an advantage over its competitors (Haider and Kayani, 2020). In this sense, AC goes beyond merely identifying this knowledge and has the responsibility of also assimilating and exploiting it (Lane *et al.*, 2006, p. 833). Herein, the focus of this study is on the ability to identify the knowledge generated, which we refer to as the acquisition phase, and its microprocesses (Zahra and George, 2002).

We emphasize that in the researched literature, in addition to the terms microfoundations and microprocesses, the terms foundations and meta-routines are also present. However, to maintain a more fluid discussion, we simply adopted the term microprocesses in this study. Examples of microprocesses include language and symbol sharing, alliances and learning by doing (Cohen and Levinthal, 1990), sources of knowledge and prior knowledge (Todorova and Durisin, 2007), trial and error, improvisation, and directed searching (Lewin *et al.*, 2011). A summary of the different types of microprocesses present in the literature consulted, along with each particular reference, is presented in Table 3. It is important to point out that some authors listed more than one microprocess in their studies. In contrast, others used different terminologies for the same type of microprocess identified, such as meetings and general meetings, considered only as meetings here.

While Teece (2007, p. 1319) describes microprocesses as skills, processes, procedures, organizational structures, decision-making rules and disciplines, Distel (2017) stated that microprocesses might vary according to the area and processes adopted by the organization. Regardless of the description or use of microprocesses, the underlying goal is to completely absorb new knowledge (Mahringer and Renzl, 2018).

Interestingly, while there are AC microprocesses, they are not used in the knowledge identification phase of KM. In this respect, the identification phase is perceived as a gap in KM, especially when applied to PM studies. As previously mentioned, this study intends to focus on the acquisition phase, which uses microprocesses that lead to the identification of new knowledge. Consequently, the identification of this new knowledge contributes to improvements in KM that will enhance the PM processes.

The following section will present and describe the research methods and techniques utilized in this study.

Table 3 Microprocesses in the literature

Microprocesses	*Author(s)*
R&D, problem formulation, networking, brainstorming sessions	Latukha (2018), Felin *et al.* (2015), Li-Ying *et al.* (2016), Alford and Duan (2018)
Events	Costello and McNaughton (2016), Gao *et al.* (2018)
Training	Scatolin (2015)
Benchmarking, interdisciplinary research, networking	Schneckenberg *et al.* (2015)
Replication of activities and processes, meetings, workshops, seminars, learning by doing, monitoring and process scans	Lewin *et al.* (2011)
Transitive memory system (refer to third party memory)	Argote and Ren (2012)

Source: From research data, 2020

3. Materials and methods

To exhaustively investigate the microprocesses related to knowledge identification, in the AC acquisition phase, this descriptive exploratory qualitative research was carried out in two phases. The first stage consisted of building the conceptual framework based on systematic literature reviews (SLR) that involved four searches in Web of Science (WoS; Figure 2). According to Petticrew and Roberts (2006), conducting SLRs before field research can help the researcher visualize the productions produced by the scientific community, as well as the approaches that were or were not used by the researchers in the studies. In this sense, it provides the researchers with the possibility of producing something novel that will contribute to the discussion of their object of study. Thus, the first stage made it possible to understand the studies on KM applied in the field of PM, hence raising the need for a better understanding of the knowledge identification phase.

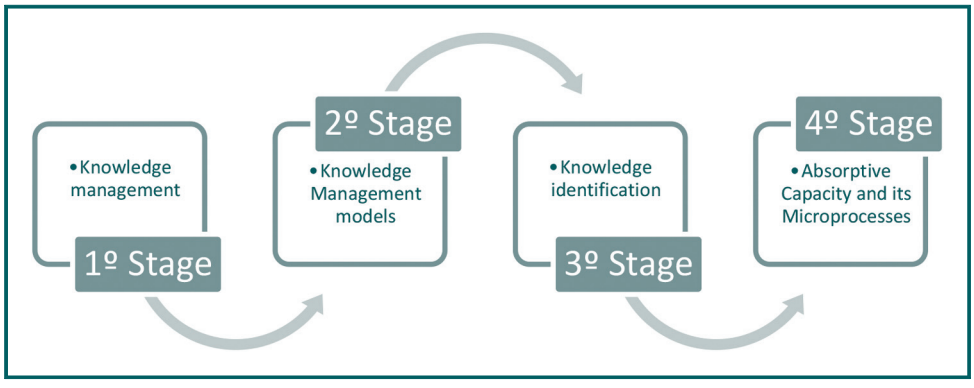
In this study, the SLR revealed previous studies on the application of KM in the field of PM. It also demonstrated that there was a need for a better understanding of the knowledge identification phase. As shown in Figure 2, the theoretical reference search took place in four stages and at different moments.

The results of the four searches were downloaded from the WoS database as BibTex files. We chose this base because it is one of the leading academic bases (Chadegani *et al.*, 2013). These files were extracted using the "R" program package Bibliometrix, generating ".xls" files, which were used to construct the initial Excel database and allowed for the selection and deletion of results.

We performed the first WoS database search on December 25, 2018, using the search strings *knowledge management AND Project OR Knowledge AND Project OR Knowledge model AND Project OR Knowledge management model AND Project OR Knowledge AND model AND Project OR knowledge management AND Project AND Model*. We did not apply any time constraints to the publication date; thus, it was possible to capture articles from any year. This initial search retrieved a total of 49,597 results.

To reduce the number of items returned, filters available in the WoS database were applied. The first filter applied only allowed for articles to be displayed and consequently reduced the number of results to 30,616. We then applied a language filter to only display articles in English and Portuguese, which reduced the number of results to 28,471. The beneficial aspect of incorporating the Portuguese language here is that it was possible to access studies on the themes addressed in the language of the interviewees. This aspect of the research does not harm the results. Finally, we applied a filter to only display articles that included the categories of "business" and "management", and this reduced the total to 2,607 results.

Figure 2 Process of building the theoretical framework



The titles and abstracts of the 2,607 results were then analyzed to identify which articles presented new KM models. We excluded 2,549 articles because they did not propose a model, or the proposed model was intended for other purposes. Examples of excluded articles included models of maturity, the Cerne model, models for decision-making, bilingual research models considering qualitative studies and others. Furthermore, we also discarded articles that only provided some insight to assist in KM. Thus, this first stage yielded 58 articles that we subsequently analyzed in full.

Since the first search did not explicitly consider KM models, we performed a second search. In this search, we used the search string *Knowledge management model* and the "all databases" option. Even though we utilized this string in the initial search, the search returned 264 results not included in the initial search, of which 155 were articles. We again applied the language filter only to return articles written in English or Portuguese, which resulted in a total of 70 articles related to KM models. Since the articles previously considered did not contain information related to the identification phase, we performed a third search.

In this search, we used the search string *Knowledge identification*, which returned 182 results. When applying the filter to only display articles, it reduced the total number of returned articles to just eight publications. However, five of the articles were inaccessible, thus yielding only three usable articles. Notably, the search for information about the knowledge identification phase identified articles related to KM models, as well as AC models, and the studies about AC models also mentioned microprocesses.

Therefore, we performed a fourth search using the search strings *Absorptive capacity* and *Microfoundations*. In total, this search returned 65 articles, and all of these articles were in English. During the title and abstract analyses, we excluded 34 articles since they did not address AC or microprocesses. Thus, we read 31 articles, with a potential contribution to the study, in full.

After pre-selecting the articles in the database, we unified all of them into a single file. This archive of 162 articles will from now on be referred to as the research corpus. For further analysis, the articles were downloaded, renamed according to the ID number, author and year and added to the qualitative data processing software Atlas.Ti. During the analytical phase, the software creates different codes within a hermeneutic unit, which allows the researchers to understand the research corpus better. In this sense, the 162 articles in the theoretical database provide a better understanding and serve as an input for the field research phase by contributing to the construction of the interview protocol and increasing the categories of analysis. The coding considered the specificity of each article and deepened the analysis by gathering as much information as possible. Thus, the survey not only identified the research problem but also built the theoretical framework and outlined the stages of this research.

3.1 Field data collection procedures

For the data collection phase, we established criteria for selecting the respondents of the study. We sought to include individuals who have worked in the PM area for more than five years, and the number of years of experience was not limited to a specific project area or to professionals who only act as project managers. Each respondent was chosen based on their work experience and the ability to transmit the entire process of several projects managed over time. We understood that data collected from in-depth interviews is adequate for understanding the real-life situation of the interviewee. During the interview, the key questions sought to obtain information about the overall experiences, mainly those related to KM and PM, of the interviewees.

Another essential objective of the interviews was to make the interviewees speak as much as possible, and a list of microprocesses served as a guide for the application of specific

questions. If the interviewee did not comment on specific items, the interviewer would naturally raise questions at the end of the interview.

The interviews were conducted individually based on a previously prepared protocol and took place *in loco*, with the consent of the interviewee or via videoconference. Concerning in-depth interviews, Dilley (2000) stated that for the interview to be robust, there must be some key elements such as background information, interview analysis and protocol creation. In this sense, the researcher should be provided with relevant information about the interviewee's cultural context before the interview. As a consequence, the researcher has confidence in the analysis and can expand on his perception of the interview content. Lastly, the protocol outlines the path of the interview.

As shown in Table 4, the script had some opening questions followed by topics addressed in the conversation. For example, personal questions included age, length of experience in the area and certification status. Additionally, work-related questions such as the branch of the company's organization, project complexity level, project innovation level and project criticality level of the projects were asked.

As alluded to previously, the interview objective was to stimulate the interviewee to talk about the research topics, as much as possible. This was achieved by deepening the

Table 4 Elaboration of the interview script

Objective	*Questions/Items*	*Fundamentals*	*Description*
Qualify the interviewee	Tell me a little bit about your project experience?	–	Part of the interview to qualify interviewee
Begin the interview and recognize the potential reality of the interviewee	Tell me about the process of developing a project in the company	–	Part of the interview for starting the project focus interview
Describe how the AC acquisition phase microprocesses contribute to the identification of PM knowledge	Tell me about the process of developing a project in the company. What are the steps? How do you perform the processes? Activities?	Interviewee experience extraction	Part of the interview to explore and delve into the interviewee's examples of AC microprocesses based on their experiences.
See how knowledge identification is carried out by the project managers	How is the process of gaining knowledge in projects that you have already managed or been involved in? What are the sources and resources of knowledge in the organization? What activities would you consider in project knowledge identification, be it a new one or an ongoing one?	Protocol	Part of the interview to: Understand how projects are carried out and their phases Explore the sources and resources of knowledge that exist in the organization Raise routines or activities that contribute to the process of identifying knowledge in projects Compare the routines or activities presented by respondents with AC microprocesses
Specify how knowledge is identified in KM, in PM	How do you understand knowledge identification in PM? Describe activities the company performs to identify knowledge? (e.g. specific research/role development)		Explore the process of knowledge identification based on the interviewee's experience Extract which microprocesses are used in the organization to identify knowledge
Identify the microprocesses in the interviewees' discourse	R&D; formulation of problems; use of networking; brainstorming sessions; events; benchmarking; interdisciplinary research; networking; replication of activities and processes; meetings; workshops; seminars; learn by doing; process monitoring and scanning; transactional memory system (refer to third party memory)	Systematic literature review	Identify the microprocesses in the interviewee's discourse

Source: From research data, 2020

questions by asking "How..?", "Why..?", "What's your opinion?", "Can you talk more about...?", among others. Based on the characteristics of this kind of interview process, these questions justified choosing the qualitative research approach since it allowed us to analyze the interviewee's responses extensively. While the interview approach required the interviewer to be more prepared, it provided him/her with the necessary information to conduct the interview openly, thus creating a favorable environment for obtaining as much information as possible (Turner, 2010).

The interviewers transcribed the interviews within three days after their completion. In total, there were 158 transcription pages made with the help of the Google Docs voice typing. It should be pointed out that the interviewees validated each transcript before starting the analysis process.

To increase the empirical corpus (database) that would be analyzed, the analysis and coding phases took place 30 days after the first interview, when a sufficient number of interviews were applied. We performed the analytical procedures, according to Charmaz (2006), using three coding cycles. The coding technique was based on that of Creswell (2010). It utilized a process of organizing the material and assigning category labels highlighted with a term (code), based on the participant's actual language. Initially, we used open coding, identifying the categories of analysis in the interviews and reaching the aim of the research, which was knowledge identification in projects. Next, an axial codification cycle was applied and involved grouping the codes based on the data or the theory raised and looking for cause and effect relationships, explanations, properties and others. In this step of the research, the categories were aligned based on the discourses, thus consolidating the research results. Lastly, we used selective coding to refine the initial categories and establish meanings in the relationships and explanations combined with theoretical and empirical evidence. Thus, based on the general framework constructed from the incidents (quotations) and relating them hierarchically with other second-order codes (axial), more abstract categories were obtained to explain the situation studied (Charmaz, 2006; Saldaña, 2012).

The data were also analyzed using a constant comparison technique. In this approach, we carried out the coding and analysis activities in a concomitant and circular manner, which allowed us to track the comings and goings of the research corpus and validate the categories of analysis (Charmaz, 2006; Saldaña, 2012). This process follows a flow towards the aim of the research objectives and is not tied to the process linearly. Thus, as the theoretical sampling is increased (i.e. number of incidents found), the main elements, based on more abstract categories, are constructed, and their respective properties are characterized (Silva *et al.*, 2014). It is worth mentioning that the initial categories of analysis originate from the theory-driven perspective. These categories represent the theoretical concepts extracted from the first phase of the research process and constructed from the search and analysis of the theoretical reference.

To find the theoretical saturation in the information collected, and to exhaustively search for new incidents by increasing the database, we performed the "Codes-Primary Documents Table" test in the Atlas.Ti software. This test presents the frequencies of the codes in categories established in the analysis phase and allows us to identify the relationships between categories and interviewees (Friese, 2012).

We should explain that some incidents extracted represent more than one code, this situation is known as a co-occurrence. It is worth mentioning that the use of Atlas.Ti was essential to perform this kind of analysis. We emphasize that Atlas.Ti allows us to relate the codes in their contexts and establish a co-occurrence coefficient, which is determined by the proximity or overlap of codes in the same context, that is, a segment of text selected and classified with the respective codes assigned to this segment.

To summarize the coding process, we initially performed the open coding to identify the categories of analysis, such as the microprocesses, in the interviews. We then used axial

coding to group the categories and consolidated similar microprocesses with different terminologies. Finally, selective coding identified the microprocesses that were present in the AC acquisition phase. In this last phase, we constituted the theoretical abstractions, thus elaborating on the model of this research.

Since the Atlas.Ti program can view previously created codes; some of the codings took place simultaneously. Moreover, the software allowed us to generate a table of codes from the primary documents that show which respondents generated the codes as well as instances when other interviewees also mentioned these codes. Thus, this study considers the emergence of codes in the interviewees' discourses. In total, this analytical approach identified 232 incidences in the discourses of the interviewees and divided them into 24 microprocesses. In the next section, we discuss the results yielded by this process.

4. Results

The initial SLR presented in Section 2 showed that previous studies do not contemplate the knowledge identification phase in the KM models. Towards the goal filling in this gap and improving knowledge identification in PM, the present study sought to identify the microprocesses present in the knowledge acquisition phase of the AC model.

As described earlier, part of our approach involved interviewing PM professionals, and with the consent of each individual, the interviews were recorded, transcribed and coded. Based on the extracted data, we constructed a summary of each interviewee's professional profile.

As shown in Table 5, the profiles of respondents varied and included professionals with 5.5–27 years of PM-related experience. As a group, the 15 respondents had an average of 15 years of experience. Additionally, the age of the respondents ranged from 30 to 57 years, and 33% (five respondents) were female. Four of the respondents did not act as a project manager in a formal position, and five did not have any type of certification.

As a way to start the interview, the interviewer also asked each interviewee to share information about their project experience. Then they were asked to talk about the project development methodologies and techniques performed in the company. In addition to recording and transcribing the interviews, the interviewer incorporated his/her perceptions into the analysis. In this way, it was possible to observe what the respondents were concerned about during the interview. To facilitate this process, we made it clear to the interviewees that no information, including data, names, and values, would be shared.

Since we did not apply a filter to the area of expertise, the sample consisted of professionals from a variety of areas including manufacturing, government, business process outsourcing (BPO), finance, industrial automation, information technology (IT), education, business operations and improvement in IT, health, parking and services and consulting. Concerning the projects, although we did not initially intend to address the levels of project complexity, innovation and criticality, based on the interviewees' statements and responses, it became apparent that we needed to classify them according to these aspects. In this sense, we included a free evaluation in this study according to the perception of each interviewee.

In the literature, project complexity lacks understanding or skill, because of the large number of variables associated with the project and the people involved (Pich *et al.*, 2002). Regarding innovation, the number of ways it can be measured complicates it. Moreover, it can also occur in any business sector and is necessary for promoting changes within the organization (OECD/Eurostat, 2005).

We present a summary of the codes identified in the interviews in Table 6. Notably, these codes, which represent the microprocesses involved in project knowledge identification, were not previously extracted from the literature. As presented by Teece (2007, p. 1319), to

Table 5 Summary of respondent information

Id	*Interviewees*	*Gen*	*Age*	*PM*	*Certificated*	*Years of PM performance (years)*	*Interview length*	*Company branch*	*Methodology type*	*Projects complexity level*	*Project innovation level*	*Project Criticality*
01	E-01	M	30	No	Yes	5.5	00:35:01	Manufacturing Industry and Public Agency	N/A	Medium	Low	Medium
02	E-02	M	42	Yes	No	27	00:37:11	BPO	Hybrid	Medium	Medium	High
03	E-03	F	39	Yes	Yes	9	00:22:57	Financial	Hybrid	Medium	Medium	High
04	E-04	M	37	Yes	Yes	10	00:34:50	Industrial automation	Waterfall	High	High	High
05	E-05	M	30	No	No	7	00:31:06	TI	Hybrid	High	High	High
06	E-06	M	57	Yes	Yes	19	00:40:50	Public service	Hybrid	Medium	Medium	Medium
07	E-07	M	49	Yes	Yes	20	00:24:03	Education	Hybrid	N/A	N/A	N/A
08	E-08	F	47	Yes	Yes	18	00:48:16	Business operation and improvement – TI	Waterfall	High	High	High
09	E-09	M	31	Yes	Yes	8	00:25:40	Health and education	Hybrid	High	High	High
10	E-10	F	48	No	No	25	00:22:52	Financial institution	Hybrid	Medium	High	High
11	E-11	M	45	Yes	No	21	00:29:45	Parking/services	Hybrid	Medium	High	High
12	E-12	M	33	Yes	Yes	10	00:27:06	Financial	Hybrid	High	Medium	High
13	E-13	M	36	Yes	No	11	00:24:00	Education	Waterfall	Medium	High	High
14	E-14	F	48	Yes	Yes	20	00:23:06	Foods	Hybrid	Medium	Medium	Medium
15	E-15	F	42	Yes	Yes	11	00:32:23	IT consulting	Hybrid	Medium	Low	Medium

Notes: N/A – not applied/hybrid understands the application of Agile and waterfall methodologies
Source: From research data, 2020

Table 6 Interview codes

Codes	*Interviewee (s)*
Courses/online courses to update knowledge	E-13
Study focusing on the need	E-04/E-06/E-08/E-15
Corporate university	E-04
Coffee break	E-11/E-15
Create/use talent bank	E-04
Seek coaching help/hire consultancy/hire knowledgeable people on specific activities	E-01/E-09/E-12/E-13/E-14/E-15
Problem formulation – storytelling	E-04
War room	E-10
Use tools (Jira, Wiki, Lesson Learned Repositories)	E-01/E-05/E-08/E-11

Source: From research data, 2020

identify these codes in the interviewees' statements, the analysis considered "skills, processes, procedures, organizational structures, decision rules, and distinct disciplines". Additionally, we considered daily procedures, combining and recombining existing knowledge with other sources, updating, replicating, learning by doing, monitoring, scanning and having an inspirational leader for identifying other microprocesses (Dixon *et al.*, 2014).

Among the 15 respondents, interviewees E-02 (27 years of experience in the BPO project area), E-03 (9 years of experience in the financial sector project area) and E-07 (20 years of experience in the education sector project area) did not provide any contributions, beyond what was already uncovered in the literature. It is plausible that there is a link between the activities and processes associated with the area of operation and the levels of project complexity and innovation. Concerning the criticality level, interviewee E-12 stressed that it is important for those carrying out the project and for those who hire the service. This statement is consistent with Jordão *et al.* (2015), who stated that this level might vary according to the perspective of the observer.

Interviewee E-07, who is a public service professional, mentioned that the levels of project complexity, innovation and criticality are not applicable to his area of expertise since the projects are small and follow a pattern. On the other hand, interviewee E-04, who works with industrial automation, mentioned that these project levels make considerable contributions to PM. The interviewee also reported that the corporate university disseminates courses, seminars, and lectures, which we considered an event.

In addition to the microprocesses identified in the interviewees' discourses, they also mentioned the microprocesses uncovered in the literature (Table 3). Thus, once we identified all of the microprocesses, they were grouped into categories according to their similarities. Notably, given that codes often present subtle differences, this process was one of the most delicate parts of this study.

However, despite this complexity, it was possible to separate the microprocesses into three groups, which included events, social interactions and the use of tools and techniques by analyzing how the microprocess actions occur. The microprocesses, as well as the microprocesses considered to be an integral part of other microprocesses (indentations), are summarized in Table 7. For better visualization, we only considered the first line of each microprocess, but the indented microprocesses are also included in the corpus of analysis.

We would like to emphasize that the separation process is a way of identifying the actions that need to be performed in response to the need of each process and/or activity. While only the microprocesses involved in the AC acquisition phase are listed, the interviewees also mentioned other microprocesses associated with different KM phases during the interviews.

Table 7 Microprocess composition

Group 1 – events	*Group 2 – Social interaction*	*Group 3 – use of tools and techniques*
Courses	Networking practice	Creation or use of a talent bank
Online/in-person	Contact network	
Training	Coffee break	Seeking help from an experienced professional
	Happy-hour	
Events	Integration of people and activities	Learning by doing
Seminars	Mix people who never worked together	Trial and error
Workshops	Work in pairs	
	Perform interaction activities	
Corporate university	Professional accompaniment – mentoring	Skills and process mapping
		Profile
		Identify the need
	Staff and manager rotation (job rotation)	Monitor and scan processes
		Observe quality and result
	Visit other customers	Research in general
		R&D
		Internet/social networking/email searches
		Community of practice research
		Research in academic articles
		Maturity/interdisciplinary research
		Perform assessment
		Interview employees
	Exchange information between people, firms, suppliers – benchmarking	Analysis and document review
	Refer to third party memory (transitive memory system)	Coding of knowledge and past experiences
	Meetings	Problem formulation – storytelling
	Meetings to follow/understand/observe the process	
	Lessons learned meetings	
	Brainstorming meetings	
		War room
		Use of software
		Jira/Wiki/SharePoint/OneDrive
		Repositories
		Workplace – Facebook

Source: From research data, 2020

5. Discussion

As shown in Table 7, after analyzing the 15 interviews, we were able to group 24 codes and separate them into three groups. Group 1, called events, includes microprocesses such as courses, training and events. The corporate university mentioned by interviewee E-04 was also considered an event. We found that interviewees, who mentioned Group 1 microprocesses, consider events a beacon of knowledge and a major factor in knowledge identification.

These observations corroborate the SECI model proposed by Nonaka (1994), which, in this case, is the internalization of knowledge through the participation or realization of events. Additionally, from the perspective of AC of Zahra and George (2002), together with the SECI model, it can be said that the acquisition of the performed capacity occurs with greater intensity when internalized. Therefore, based on the evidence for the composition of Group 1, it is noted that the internalization phase of the SECI model occurs by transforming knowledge from explicit to tacit (Silva *et al.*, 2014), a process that frequently happens in courses, training, and events.

The microprocesses that comprise Group 2 deal with social interactions, or in other words, microprocesses that lead to more significant interactions between/among people. In this

situation, knowledge creation occurs when there is a shift from tacit to explicit knowledge (Nonaka, 1994). Interestingly, the microprocess coffee break may seem simple, but this "contact" is extremely important since it provides the employees with an opportunity to socialize with one another and leads to the exchange of information during a moment of relaxation and pleasure. As a consequence, they sometimes recognize a coworker's talent and/or identify new knowledge (Faccin and Balestrin, 2018). Group 2 has the second-largest number of microprocesses and contains actions that integrate people and activities through the consultation of professionals within their respective networks or with individuals who have already worked on a project. As evidenced by activities such as networking, personal conversations and information-sharing activities, people-to-people interactions is the reoccurring theme in Group 2 microprocesses. Indeed, when employers place people to work in pairs or mentor employees, there is a clear sense of socialization and a combination of knowledge (Nonaka, 1994). Moreover, in both Group 1 and Group 2 microprocesses, knowledge is externalized and perceived by individuals through the events and the various actions described by the interviewees. Furthermore, more than half of the knowledge-oriented microprocesses that focus on social interaction and communication are present in Groups 1 and 2 identified in this study.

Herein, we observed that there is complementation between the microprocesses of the AC acquisition phase (Zahra and George, 2002) and Nonaka's (1994) knowledge spiral model. In this study, we separated the microprocesses into the three groups and showed that they could represent the levels of knowledge in the ontological dimension of the Nonaka's model. The ontological dimension corresponds to the level of knowledge transmitted from the individual to the group, followed by the organizational and inter-organizational dimensions (Nonaka and Takeuchi, 1995). It is also noteworthy that this transition between the different levels of knowledge occurs mutually and concomitantly.

Group 3 refers to the use of tools and techniques, which are microprocesses that create or use a talent bank to evaluate employees' skills in relation to needs and often involve seeking help from an experienced professional. In this case, coaching, consulting or even hiring people with know-how are specific examples of such activities. Another technique included in this group is the practice of learning by doing, or trial and error. When considering Nonaka's (1994) SECI model, these Group 3 microprocesses are related to the externalization phase, and thus require transforming tacit to explicit knowledge. Indeed, according to Nonaka and Takeuchi (2009), obtaining tacit knowledge occurs through the use of tools or techniques.

Moreover, Group 3 microprocesses require a certain level of skill to apply the techniques or use the tools and to recognize and measure available knowledge. This prerequisite know-how is particularly relevant in inter-organizational relations since barriers such as the clash between cultures can occur.

Therefore, to identify the knowledge, according to the microprocesses in Group 3, it is necessary to identify and map aspirations, ambitions and perspectives at the junior and senior hierarchical levels and place the most competent people in the right positions in the project development process (Jordão *et al.*, 2015, p. 292). Additionally, it was mentioned by the interviewees that monitoring and scanning the processes and observing the quality of the result are other ways to achieve this objective.

Finally, other practices considered in Group 3 microprocesses included coding knowledge, past experiences, problem formulation, war room, storytelling as well as the use of software such as Jira, Wiki and the various repositories of lessons learned.

We emphasize that the microprocesses identified in this study contribute to minimizing the loss of knowledge in projects since the application of systematized microprocesses can improve the organization's competitiveness following the identification of the deficiencies in

the area (Chen *et al.*, 2012). Unfortunately, there is still a long way to go before organizations can carry out KM processes in their projects.

This study also demonstrates that properly selected microprocesses can contribute to levels of project complexity, innovation and criticality. For example, the company's processes and activities will be positively affected when the project manager chooses the best microprocesses for the project. In this sense, the microprocess groups, in the form they were systematized, provides the managers with a choice based on the project levels.

6. Pratical implications

This study found that the non-systematization of the knowledge identification phase means that the current phases, which support this type of activity, are not well utilized or very accurate (Minbaeva, 2013). Consequently, the failure to take advantage of the existing KM phases results in the loss of potential innovation processes (Haas and Ham, 2015). Since the origin of knowledge is in the minds of the people, the act of converting subjective (tacit) knowledge to objective (explicit) knowledge creates favorable situations that lead to the creation of new knowledge (Davenport and Prusak, 1999).

In this sense, identifying the sources of knowledge in the processes and activities makes it is possible to transfer this knowledge throughout the company and obtain a competitive advantage (Nonaka and Takeuchi, 1995). Typically, this transfer occurs through lessons learned from previous projects (Duffield and Whitty, 2016; Ali *et al.*, 2018). Indeed, organizational learning results from the knowledge of its members or by the inclusion of new members who have the knowledge that the organization lacks (Simon, 1991).

However, this study demonstrates that lessons learned is not the only process for identifying knowledge. In fact, we showed that systematization of the microprocesses present in the AC acquisition phase could help companies identify knowledge in their processes, activities and employees. In addition to the systematization of these microprocesses, this study detected new microprocesses during the analysis of the interviews of PM professionals. These results are summarized in Figure 3 and show that there are three groups – events, social interactions and use of techniques and tools – of microprocesses present in the AC acquisition phase that contribute to the identification of knowledge during project development.

Therefore, Figure 3 serves as a starting point for companies that want to improve their knowledge identification processes and activities. Moreover, the information presented in this figure can help the project managers identify the types of knowledge (tactic or explicit) depending on the microprocesses used in knowledge identification and to determine, through the processes, which area requires more attention or better performance.

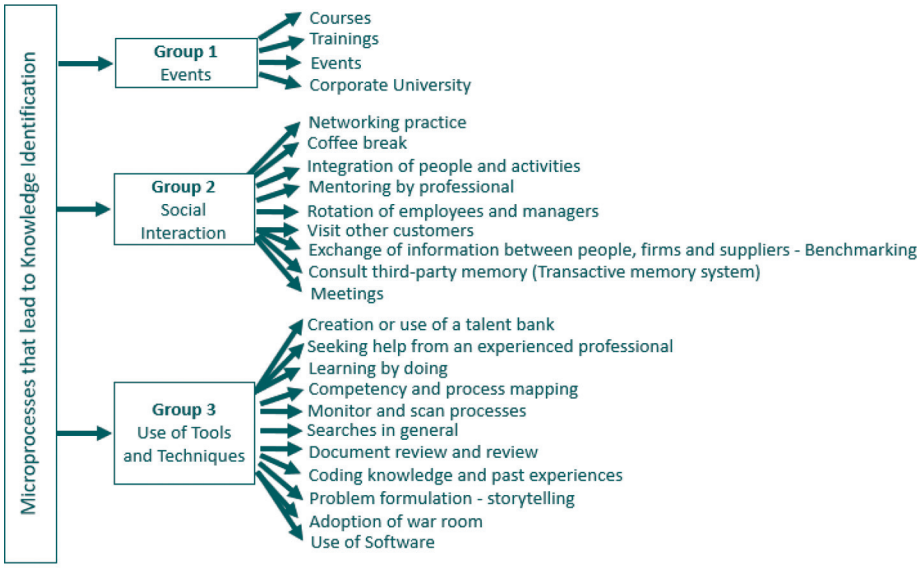
This study also demonstrates that when the project manager chooses the optimal microprocesses, the project complexity, innovation and criticality can be positively impacted. Therefore, the microprocess groups, in the form they were systematized, provides the managers with the ability to choose the best microprocesses depending on the specific project.

7. Conclusion

The SLR approach used in the present study detected a lack of systematization in the knowledge identification phase of the KM in PM. Additionally, the theoretical review showed that AC microprocesses could contribute to knowledge identification since companies depend on actions taken through their processes and activities. Furthermore, we found that knowledge identification relies heavily on the social interactions of its employees.

The main results of this study showed that microprocesses could be grouped into three groups, namely, events, social interaction and the use of techniques and tools. In addition

Figure 3 Groups of microprocesses of the AC acquisition phase



Source: From research data, 2020

to identifying the microprocesses, we were also able to systematize them, thus facilitating their utility. The model presented in Figure 3 summarizes the groups of microprocesses (i.e. actions or initiatives) that can identify new knowledge. As a consequence, companies can use this model as a means to accurately and adequately select to optimal microprocesses according to their priorities and activities.

Since the previously published information does not deal with project complexity, innovation and criticality levels, the interviews made it possible to understand that knowing which levels the company's projects fall into will make it easier to choose which microprocesses to adopt. Thus, by following the systematization that this study delivers, project professionals can make the microprocess-related decisions that best suit their company's processes and activities. Finally, the implementation of these microprocesses can help companies gain an advantage over their competitors since they will be able to increase their knowledge and optimize other phases of their existing KM practices.

Until now, organizations were only able to transfer knowledge through the use of lessons learned from previous projects. Indeed, our study shows that there are several other factors in the knowledge identification process. For example, in addition to the microprocesses identified through the SLR including research and development (R&D), problem formulation, use of networking, brainstorming sessions (Latukha, 2018; Felin *et al.*, 2015; Li-Ying *et al.*, 2016; Alford and Duan, 2018), events (Costello and McNaughton, 2016; Gao *et al.*, 2018), benchmarking, interdisciplinary research, networking (Schneckenberg *et al.*, 2015), activity replication and processes, meetings, workshops, seminars, learning by doing, monitoring and scanning processes (Lewin *et al.*, 2011), we were also able to identify new microprocesses by analyzing the interviews of the project professionals.

Thus, our study, based on the results revealed by the qualitative research approach, identified microprocesses that had not yet been included in the literature. We propose that future studies focus on testing the newly discovered microprocesses involved in knowledge identification and incorporating them into the systematization. It is plausible that these

microprocesses will influence knowledge identification and improve the AC acquisition phase.

Despite the notable contributions to the field of KM, this study only interviewed 15 PM professionals. Additional studies with a more significant number of participants could further reinforce our results and perhaps identify other relevant microprocesses, which could lead to new frameworks or models that contemplate the steps for knowledge identification and serve as a guide for new approaches.

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