UNIVERSIDADE NOVE DE JULHO
PROGRAMA DE MESTRADO PROFISSIONAL EM ADMINISTRAÇÃO
GESTÃO DE PROJETOS

APPLICATION OF A FRAMEWORK FOR GUIDING INTEGRATED USE OF SOCIAL MEDIA TO SUPPORT KNOWLEDGE MANAGEMENT IN PROJECT MANAGEMENT

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São Paulo

2017

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APLICAÇÃO DE UM FRAMEWORK PARA GUIAR O USO INTEGRADO DE MÍDIAS SOCIAIS NO SUPORTE À GESTÃO DO CONHECIMENTO EM GERENCIAMENTO DE PROJETOS

APPLICATION OF A FRAMEWORK FOR GUIDING INTEGRATED USE OF SOCIAL MEDIA TO SUPPORT KNOWLEDGE MANAGEMENT IN PROJECT MANAGEMENT

A research project submitted to the Master's Degree Program in Administration with emphasis on Project Management of Nove de Julho University – UNINOVE, as a partial fulfillment for the degree of Master in Administration.

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São Paulo
2017

Narazaki, Rosana Yasue.
Application of a framework for guiding integrated use of social media to support knowledge management in project management. / Rosana Yasue Narazaki. 2017.
176 f.

Dissertação (Mestrado) – Universidade Nove de Julho - UNINOVE, São Paulo, 2017.
Orientador (a): Profª. Drª. Cristiane Drebes Pedron.

1. Project management. 2. Knowledge management. 3. Project knowledge management. 4. Web 2.0. 5. Social media
I. Pedron, Cristiane Drebes. II. Titulo.

CDU 658.012.2

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Dissertação apresentada ao Programa de Mestrado Profissional em Administração: Gestão de Projetos da Universidade Nove de Julho – UNINOVE, como requisito parcial para obtenção do grau de **Mestre em Administração**, pela Banca Examinadora, formada por:

São Paulo, 14 de dezembro de 2017

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I dedicate this dissertation:
to my father Yasuo and my mother Sakae (in memory),
sources of wisdom;
to my beloved husband Edgard and my lovely daughter Olivia,
that even with my absence, they did not give up on me;
to my faithful squire Yago (in memory),
who took care of me and accompanied me all the days of his life;
and off course, my creepy cat Whisky,
who distract me to make me relax.

ACKNOWLEDGEMENT

This study would not have been done without the encouragement, sharing of experiences, and ideas of the people with whom I lived during the Professional Master's Degree in Administration and Project Management at the Nove de Julho University.

My sincere thanks to all the professors of this course, represented here by Professor Cristina Dai Prá Martens (PhD). Without their foundations, this work would not stand. I also thank the Secretariat, especially Ms. Layane Ribeiro, for her kindness and support.

My special thanks to the Military Police of the State of São Paulo, represented in the person of Lieutenant Colonel Daniele Cristina Oliveira de Freitas, and all his staff of the 6th Section of the General Command, who welcomed me and allowed me to carry out this work with efficiency and effectiveness. I could not fail to mention Major Carlos Eduardo, Captain Souza, Captain Beatriz, Lieutenant Beserra (Software Factory), Sergeant Favarão, Sergeant Jorge, Cabo Moreira and Soldier Amaral. I will never forget the companionship, the cakes and the troop´s inspections we spent together. Military Police, you can trust!

I thank my dear and very competent research partner, Ms. Miram Ikemoto, who with her intellectual brilliance has given us the basis for this study. To classmates from 2015, and especially to my classmates from 2016, thank you for sharing with me the wonderful moments of student life.

I appreciate the invaluable help in English review from my friends Luiz Phillipe Sarrouf and Igor Golger. Forgive me for my poor English! They did their best!

My eternal gratitude to Professor Cristiane Drebes Pedron (PhD) and Professor Marcirio Silveira Chaves (PhD). What would become of me, of research, and of the world without you? You spared no effort to transfer your knowledge, which made this study grow in importance, depth, and technique.

To all who are mentioned here explicitly, and those that I tacitly keep in my heart, my thanks to you!

ABSTRACT

Knowledge management (KM) is essential for keeping and developing knowledge as an asset of organizations. Project team is becoming more decentralized, requiring technology to support KM in project management (PM) activities. The premise to the flux of knowledge to happen is to have a 'ba' (shared space) and this should be supported by a set of collaborative tools, such as social media (SM). Nevertheless, best practices in PM do not deal with the KM dynamics explicitly which has caused lack of traceability and loss of explicit and tacit knowledge during the project lifecycle. In addition, individuals desire ease of use and accessibility and yet no longer want a tool to manage, suggesting that SM should be integrated. For this purpose, this research analyzed a solution by a technical instrument, under Design Science Research approach, with the intention of answering the research question: **How does the integrated use of SM support KM in activities related to PM in a project of a public security organization?** The SM4PM (Social Media for Project Management), a prescriptive framework for guiding integrated use of SM in PM, was instantiated to evaluate KM in PM in a project of public security organization. Data collection was done through four techniques: 1) Interviews, 2) Direct observations, 3) Document analysis and 4) Focus group. These data were analyzed in five stages with the support of the MaxQdaPlus qualitative analysis software: 1) Compilation, 2) Decomposition, 3) Recomposition, 4) Interpretation and 5) Conclusion. Results showed that SM support KM in activities related to PM giving strong evidence that SM4PM framework can be generalized to solve a class of problems, such as collecting lessons learned naturally during the project lifecycle, managing the knowledge in PM, understanding relationship among processes and their integration. As a contribution, the study empirically applied 'theory to practice' by instantiating a technical instrument based on 'theory of doing well' and applied 'theory from practice' to refine this technical instrument. The use of SM4PM framework can benefit project managers, team members and project stakeholders.

Keywords: Project Management; Knowledge Management; Project Knowledge Management; Web 2.0; Social Media; Prescriptive Framework; Design Science Research; Technical Action Research.

RESUMO

A gestão do conhecimento (GC) é essencial para manter e desenvolver o conhecimento como ativo da organização. A equipe de projeto está se tornando mais descentralizada, exigindo tecnologia para suportar a GC nas atividades de gerenciamento de projetos (GP). A premissa para o fluxo do conhecimento acontecer é ter um '*ba*' (espaço compartilhado) e este deve ser apoiado por um conjunto de ferramentas colaborativas, como as mídias sociais (MS). No entanto, as melhores práticas em GP não lidam com a dinâmica da GC de forma explícita, o que tem causado falta de rastreabilidade e perda de conhecimento explícito e tácito durante o ciclo de vida do projeto. Além disso, os indivíduos desejam facilidade de uso e acessibilidade, contudo não querem mais uma ferramenta para gerenciar, sugerindo que as MS devam ser integradas. Nesse propósito, o presente estudo analisou uma solução por meio de um instrumento técnico, sob a abordagem *Design Science Research* (DSR), com a intenção de responder à questão de pesquisa: **Como o uso integrado das mídias sociais suportam à GC nas atividades relacionadas ao GP em um projeto de uma instituição de segurança pública?** O artefato SM4PM (Social Media for Project Management), um *framework* prescritivo que guia o uso integrado de mídias sociais para apoiar atividades relacionadas ao GP, foi instanciado para avaliar GC no GP em um projeto de uma instituição de segurança pública. A coleta de dados foi feita por meio de quatro técnicas: 1) Entrevistas, 2) Observação direta, 3) Análise documental e 4) Grupo focal. Estes dados foram analisados em cinco etapas com o suporte do software de análise qualitativa MaxQdaPlus: 1) Compilação, 2) Decomposição, 3) Recomposição, 4) Interpretação e 5) Conclusão. Os resultados mostram que as MS suportam a GC em atividades relacionadas ao GP, dando uma forte evidência de que o *framework* SM4PM pode ser generalizado para resolver uma classe de problema, tais como coletar lições aprendidas naturalmente durante o ciclo de vida do projeto, gerenciar o conhecimento no gerenciamento de projetos, entender o relacionamento entre os processos e a sua integração. Como contribuição, o estudo aplicou empiricamente a 'teoria para prática' pela instanciação de um instrumento técnico baseado na "teoria de fazer bem' e aplicou a 'teoria que vem da prática' para refinar este instrumento técnico. O uso do *framework* SM4PM pode beneficiar os gerentes de projeto, os membros da equipe e as partes interessadas no projeto.

Palavras-chave: Gerenciamento de Projetos; Gestão do Conhecimento; Gestão do Conhecimento do Projeto; Web 2.0; Mídias Sociais; Framework Prescritivo; *Design Science Research*; Pesquisa-ação técnica.

SUMMARY

LIST OF FIGURES

LIST OF ABBREVIATIONS AND ACRONYMS

AR	Action Research
BALLISTIC 2.0	Ba Lessons Learned Information Technologies 2.0
CFG	Confirmatory Focus Group
CSF	Critical Success Factors
DSR	Design Science Research
EPM	Enterprise Project Manager
FG	Focus Group
GT	Ground Theory
HK Funnel	Holistic Knowledge Funnel
IPMA	International Project Management Association
IS	Information System
IT	Information Technology
IT-based	Information Technology Based
KA	Knowledge Acquisition
KI	Knowledge Identification
KM	Knowledge Management
KPI	Key Performance Indicator
KS	Knowledge Sharing
KT	Knowledge Transfer
LL	Lessons Learned
NPO	Non-profitable Organization
OoS	Object of Study
PCO	Pesquisa de Clima Organizacional (Climate Organizational Survey in Portuguese)
PDM	Product Data Management
PKM	Project Knowledge Management
PM	Project Management
PMESP	Polícia Militar do Estado de São Paulo (Military Police of the State of São Paulo in Portuguese)
PMI	Project Management Institute
PMIS	Project Management Information System

PMO	Project Management Office
SCEM	Supply Chain Event Management
SECI	Socialization, Externalization, Combination and Internalization
SLR	Systematic Literature Review
SM	Social Media
SM4PM	Social Media for Project Management
SYLLK	Systemic Lessons Learned Knowledge
TAM	Technology Acceptance Model
TAR	Technical Action Research
UNINOVE	Nove de Julho University
WBS	Work Breakdown Structure

1 INTRODUCTION

In the competitive environment, organizations should have a differentiation that brings more market share. Creating differentiation is a mind exercise and demands knowledge and background experience. Because it is unique, intangible, difficult to copy and rare, knowledge has strategic value, becoming a vital resource and a new economy currency (Ragab & Arisha, 2015).

In order to understand knowledge value, it is necessary to understand knowledge Tuomi (1999) state that information turns knowledge in the individual minds. From this view, knowledge is narrowly connected with the individual (Alavi & Leidner, 2001).

Knowledge enhancement needs a face-to-face relationship (Al Saifi, Dillon, & McQueen, 2016) and a local where individuals have the opportunity to meet each other. This place is called 'ba' – shared space – (Takeuchi & Nonaka, 2008) by the Orientals. Communities of practice join standards as a best practice of project management (PM) (Blomquist, Hällgren, Nilsson, & Söderholm, 2010; Bredillet, Tywoniak, & Dwivedula, 2015). These standards assert that projects are organized and grouped in knowledge areas, "a complete set of concepts, terms, and activities that make up a professional field, project management field, or area of specialization" (PMI, 2013, p. 60). According to PMI (2013), there are ten different knowledge areas totalizing forty-seven processes. For a better organization, processes are grouped in phases intrinsically related to the project lifecycle (PMI, 2013).

Although intrinsically related, the processes groups are not the project lifecycle. Processes interact among them, inside or outside process group. The nature of the project imposes the interaction and, consequently, group process are not necessarily executed in the order of the project phases (PMI, 2013). The knowledge of the project (experience of previous projects) can be stored and recovered in the organizational knowledge base (organizational memory) and should be collected during the project lifecycle.

Knowledge, like any other value, should be held and developed to grow. In this sense, the knowledge management (KM) is necessary. KM is a multifaceted discipline (Alavi & Leidner, 2001). Along the years, KM studies were developed under different lens: looking deeply at activities such as create, retain and transfer (Alavi & Leidner, 2001; Argote, McEvily, & Reagans, 2003); exploring individual characteristic, perceptions and behaviors (Connelly, Ford, Turel, Gallupe, & Zweig, 2014); considering organization (Lancini, 2015), group and individual (Topping, 2016) as unit of analysis.

In the Levy's (2009) view, KM has four components: process, technology, context and culture. Alavi and Leidner (2001) include a knowledge application process, giving relevance to applying the knowledge. Analyzing the set of ideas of the mentioned authors, they are aligned with Wiig's knowledge management aims definitions (1997, p. 2): "the overall purpose of KM is to maximize the enterprise's knowledge assets and to renew them constantly". In these perceptions, this study consider the KM definition: a management of the knowledge with process, technology, context and culture components (Levy, 2009) with the objective to create, store/retrieve, transfer and apply the knowledge (Alavi & Leidner, 2001) to achieve the purpose to maximize the enterprise's knowledge assets and to renew them constantly (Wiig, 1997).

Being a part of the technology component of knowledge, SM make people interact performing a connection due to two-way interaction route (Lomas, Burke, & Page, 2008). The SM connectivity characteristics bridge team members and intergroups, enabling knowledge sharing (KS) and giving voice to the individuals (Lopez & Esteves, 2013). Virtual 'ba' and virtual face-to-face relationship is an environmental for SECI (Socialization, Externalization, Combination, Internalization) to take place (Takeuchi & Nonaka, 2008), a mechanism in which individual externalizes knowledge that combines with another's knowledge, creating new knowledge that is finally internalized in the individual again.

Knowledge process is also affected by SM because these tools enable knowledge creation (Addas & Pinsonneault, 2014), knowledge sharing (Schneckenberg, 2009a), exchange of knowledge (Lancini, 2015) and share tacit knowledge (Al Saifi et al., 2016). With the use of SM, knowledge can be captured and registered to construct organizational memory (Levy, 2009; Rathi, Given, & Forcier, 2014), this being an organization knowledge database that can be retrieved and reused. Communication and sharing foster a landscape of learning (Cheong & Tsui, 2011) supported by new technology (Hubert, 2012), a favorable ecosystem to enlarge organizational knowledge (Maier & Schmidt, 2015).

Through KM component (process, technology, context and culture), KM process (creation, transfer, store/retrieve and application) and goals, it is possible to find evidence that KM and PM are convergent. PM creates new knowledge that results in a product/service developed in a period of time (PMI, 2013). During PM, knowledge is constantly created, transferred and stored to applied in the future. So KM supports PM systematizing the management of the project knowledge with a powerful and assertive SM that facilitate promotion of the knowledge use, re-use, transfer, exchange and storage.

In a project, knowledge flows inside project team or across the organizational level to be applied on the project. The management of the knowledge across the organization and inside/outside the project is called Project Knowledge Management (PKM) (Gasik, 2011). In PKM, during project execution, knowledge is applied and registered for sharing.

PKM requires tools to support its processes. After a two-literature review with SM's roles in PM and KM, the result was crossed and findings led to the conclusion that the SM purpose of use has overlapping to attending activities in PM and in KM. This context shows that SM support KM in activities of PM. This conjunction can solve a class of problems explained in the next section. Before that, it is important to point out that culture is an important and complex dimension (Pandey & Dutta, 2013). However, it will not be highlighted in this research due to it deserving a specific, personalized and profound study.

1.1 CLASS OF PROBLEMS

Although knowledge is a strategic key for organizational development (Perrott, 2015), organizations still have difficulties in taking advantage of it. KM emerges to give a background and a framework for the purpose of overcoming this barrier but some issues surround the KM process in PM, turning it hard to pass through and in the limit, led the process to failure.

The first issue to be discussed is individual behavior. Organizations have the challenge of making individuals use the SM in the same way as they do in their private lives (Schneckenberg, 2009a). However, organizations are concerned with information security and lack of seriousness in social use by individuals leads to a misperception of the use of SM. The SM application, such as Facebook, serves the same purpose for both individuals and organizations. On the contrary, individuals do not have these perceptions. Studies were developed to understand these behaviors. Garcia-Perez and Ayres (2010), looking for the reason a wiki application fails, pointed that the lack of time was the reason for not increasing the body of knowledge, decreasing the will to share it. Their respondents also said that a lack of interesting and outdated themes did not motivate them to revisit the repository. Some of them complained that the repository accessibility was not easy, requesting a link on their desktop computer or an intranet home page. Expanding the Garcia-Perez and Ayres (2010) study, Mariano (2010) argues that another common behavior is that individuals prefer to express their preferences and viewpoints by applying external links or sharing the post of another than creating their own. The same author also indicates that individuals prefer to comment on

everyday work topics in the digital ‘ba’, avoiding discussion of a more focused or predetermined subject. Because of misperception of the organization and the passive individual’s behavior, the knowledge in the organization does not have a natural flow. Individual intrinsic intention to share knowledge was mapped by Topping (2016) that found eighteen factors: autonomous motivation, ability to share knowledge, inability to acquire knowledge, self-efficacy, enjoyment of knowledge sharing, network, motivation to defend Ego, lack of trust, lack of reciprocity, attitudes towards sharing knowledge (Self), attitudes towards sharing knowledge (Others), sociability, friendship, incentives, minority group, hierarchical position, perceived level of interest from learner and professionalism. Topping (2016) and Mariano (2010) overlap the same conclusion about incentives: financial reward is not the motivation to share knowledge (Mariano, 2010) and at the limit, reduce it (Topping, 2016). Achieving success in KM, knowledge managers should be concerned about the individual intrinsic intention to share knowledge.

The second issue to be discussed is technology. Considered to be a KM enabler, SM applications are not that simple. Tools should be chosen taking into account the group dynamics (Garcia-Perez & Ayres, 2010). A right tool (Garcia-Perez & Ayres, 2010) is the success factor to ensure individual intention to use it and flows the knowledge. Sometimes a domestic solution is more suitable, although it can be costly to develop and implement (Forcier, Rathi, & Given, 2013). In this matter, Mariano (2010) emphasizes that a complex tool decreases the motivation and it is aggravated by the absence of a training program. Moreover, there are good studies about SM and its utilities, suggesting that users should choose a convenient set of tools (Maier & Schmidt, 2015) however it will take time for users to learn this process. Different levels of technological tools to be adopted are implemented according to the organization’s maturity level (Levy, 2013).

The third issue is process. As explained by PMI (2013), the PM’s processes groups are not a path that needs to be followed in sequence. Although this advice suggests that a process can be resumed, managers execute projects until its ends and record the important knowledge at *post mortem* meeting. Doing so, the tacit knowledge that emerges along the project and the informal knowledge can be lost. The main reason for this fact is that the activity of record the lessons learned are inside a closing project or closing process phase, which belongs to the closing group process. This gives the wrong evidence that important project knowledge record activity should only happens at project closing. The most important is not registering the knowledge but collect it during the whole project lifecycle. Further, absence of holistic process

view makes team members look inside the box, solving a specific problem, which does not allow knowledge flows and enhancement.

Lack of specific knowledge area about KM in PM does not favor best practice in this subject. As a result, KM cannot be discussed and contemplated as a standard by the community of practice. Consequently, there is a lack of knowledge process measurement, which makes it difficult to diagnose and evaluate performance.

Other issues in process are the lack of learning mechanism, project operation document with poor data, inefficiency of information forecasting and communication, long period to record lessons learned and, at last, project by project, the team members are regrouped decreasing mutual relationship. Therefore, there is not a motivation to share knowledge. Looking from another point of view, well-done project output (project success analysis, routines, reports and projects results) enhances KM (Todorović, Petrović, Mihić, Obradović, & Bushuyev, 2015). It is a challenge to match a PM process and KM process as PM and KM seems to dependent variable of each other but on the other hand, it seems that both processes contribute to each other.

The fourth issue is to connect individuals, technology and process in a framework. In the light of knowledge, both KM and PM have coincident goals. SM give technological benefits to support KM in PM activities (Oun, Blackburn, Olson, & Blessner, 2016). Looking from individuals' point of view, they do not want another tool to manage, as reported by the respondents of Evans, Gao, Mahdikhah, Messaadia and Baudry research (2016). Respondents also request for accessibility with at least a given link to their computer or intranet home page access (Garcia-Perez & Ayres, 2010). Both claims advocate that individuals no longer want a tool to manage. Instead, a tool that can integrate a set that is being used. A determinant factor of a wiki supporting KS failed in the Garcia-Perez and Ayres (2010) study was accessibility, which suggests that authors neglected tool integration.

It is a challenge to attend all claims to construct a framework with integrative use of SM supporting KM in PM, the target of the systematic literature review (SLR) of this study. The SM role in the KM processes was highlighted. It emerged that SM are more than tools adoptions, they are strategy and people behavior (in his nature, a human faculty of exchange and collaboration) (Fernando, 2010). SM integration improves KM and allows the knowledge development in organization, giving relevance to the proposed theme. However, the vast literature contributes with information about SM as an individual tool without much evidence of its use in an integrated way.

The approach of the phenomenon exploration is focused on the solution. It is necessary to know the problem well in order to satisfactorily solve an organizational class of problems. Validating a framework of integrated use of SM to support KM in PM will bring light to start out closing this gap, given Topping (2016, p. 19) which suggests research that "enable a holistic view of the knowledge lifecycle within organizations."

Some claims about improving systematization of tool use came from practitioners. Practitioners want facilities and easy access (Garcia-Perez & Ayres, 2010). Therefore, systematization of KM in projects by a framework should consider integrated use of SM. For this purpose, SM4PM (Social Media for Project Management), a prescriptive framework for guiding integrated use of SM in PM, developed by Ikemoto (2017), is been considered in the current study.

Ikemoto (2017) constructed SM4PM with four categories: communication, dissemination, repository and control. Integrated use of SM provides collaboration landscape and increase productivity (Ikemoto, 2017). As a practical contribution, the same author recommended SM for each framework category, accentuating that evolution of SM can bring new tools and technologies. Figure 1 shows the SM4PM framework.

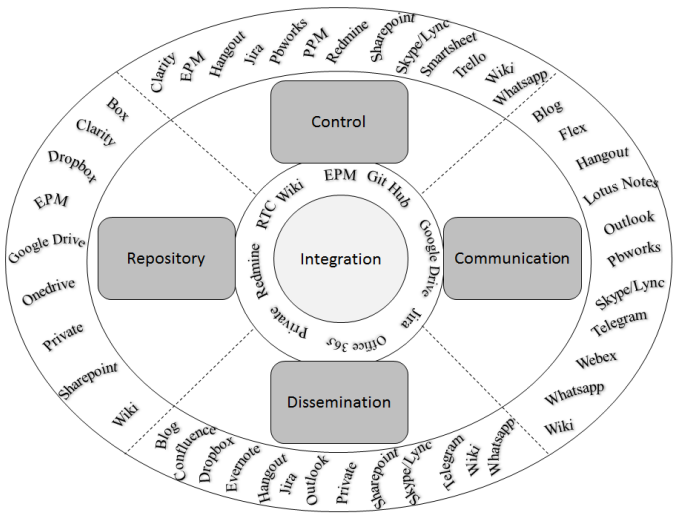


Figure 1: SM4PM - a prescriptive framework for guiding integrated use of SM in PM
Source: Ikemoto (2017, p. 71)

SM4PM framework is used as an artefact (technical instrument) by this study. It is a people-driven solution, based on theory and on preceding research that will have a desired interaction with context (Wieringa, 2014). Applying the artefact in a real world is a way to give meaning to the researcher's study that has the responsibility to enlighten the knowledge, not

only to understand but also to solve organizations' problems, approaching researchers to practitioners. Doing so, a class of problems begins to be solved.

In this purpose, SM4PM was instantiated in a project of a public security organization. This is a sensitive organization in which information has some confidentiality. This organization has the following prerequisites: has a PMO, a report system is established, uses a report's framework, responsibilities are addressed, and there is a formal data collection, analysis and distribution method (Todorović et al., 2015). These prerequisites allowed to evidence the results of this study.

Last, this study intends to apply a framework for guiding integrated use of SM in the KM support in PM to answers the research question: **How does the integrated use of SM support KM in activities related to PM in a project of a public security organization?**

1.2 OBJECTIVES

The main objective of this study is to evaluate the integrated use of SM support KM in activities related to PM in a project of a public security organization.

The specific objectives of this study aim to:

- Instantiate the SM4PM artefact in a project of a public security organization;
- Assess the SM4PM instantiated artefact;
- Investigate the effects of the SM4PM instantiated artefact in the KM in PM;
- Refine SM4PM instantiated artefact.

1.3 JUSTIFICATION

This practical research was driven to solve organization's class of problems by validation of a solution provided by theory constructed in academy. The practical application gives the opportunity to investigate the application of the theory under qualitatively different conditions. The context in which the theory was applied reacted and served as a base to a new chance to improve and advance the theory. This strategy came to meet the claims of the authors who seek to reconcile the theory with the practice that brings as a benefit the theoretical and practical contributions of the study (Ahern, Leavy, & Byrne, 2014; Blomquist et al., 2010; Whetten, 1989).

Calls for practical research in PM come from existing literature. Bell, Van Waveren and Steyn (2016) formulated a framework to guide knowledge transfer with six recommendations. But with lack of practical application of the framework, Bell et al. (2016) could not evaluate the impact in the organization, the framework efficacy, nor the effect of value assurance. Another difficulty was presented by Ahern, Leavy and Byrne (2014) that empirically followed two organizations with complex projects to unveil their modes of organizing of the learning approach. In order to complement the understanding of the case, the authors argue for future empiric research focusing on how these modes may facilitate making a project a learning organization. In this same line, Reich, Gemino, and Sauer (2014) asserted that KM is an instrument to enhance project performance, if aligned to the considered knowledge. Nevertheless, authors research's respondents were only project managers, with no consideration of an important stakeholder, the sponsor. Yet, Park and Lee (2014) found by a quantitative method that dependence and trust have strong impact for knowledge sharing (KS) and request further studies of various levels of relationship.

The main current study differentiation is to consider that the shortcomings of previous studies will be minimized by practical application. Blomquist et al. (2010) request for a practice approach, arguing that being together with practitioners, researchers can better understand "the reasons for doing what they do" (Blomquist et al., 2010, p. 13) and how people solve a real problem, giving significance to findings.

In the same line, Svejvig and Andersen (2015) study about rethinking project management gave the idea that rethinking practice emerges as a subject that concerns with alternative learning methods, to achieve reflexive practitioners. Another subject that emerged was actuality of projects that urge for more empirical study as a research start point (Svejvig & Andersen, 2015). Moreover, the rationally constructed project plan (traditional view) also serves the purpose of broadening understanding, promoting negotiations (rethinking the vision), which shows evidence that more empirical study is required to bridge this gap (Svejvig & Andersen, 2015). Closing the study, Svejvig and Andersen (2015) urge for more practice-oriented studies.

The last authors, Ahern et al. (2014) move from a rational paradigm to a social-technical framework, categorizing three groups around PM practice: "1) theory ABOUT practice (project complexity); 2) theory FOR practice (projects as social processes, project value creation, project conceptualization); and 3) theory IN practice (practitioner development)" (Ahern et al., 2014, p. 2). The author's research testify a practice approach using the three categories around PM

practice described by Ahern et al. (2014). The current study can be characterized as the theory that balances technical rationality with social interaction, producing a flexible work structure for projects that considers the three groups categorized by Ahern et al. (2014).

The present study is a practical research that considers a previously formulated theory. Using technical action research (TAR) methodology, the theory is applied by a technical instrument in which researcher can act to improve it and assess the actors and the theory involved. Action research happens locally in a small group or in large-scale (Dick, 2007). This methodology is appropriated for the Design Science Research (DSR) approach that is adopted for this study, with the intention of generalizing the solution to solve a class of problems (Wieringa, 2014).

Once practical research approach is justified, the current study applied the SM4PM artefact (Ikemoto, 2017). In short, 11 frameworks related with SM and KM or SM and PM were dissected and compared. Some frameworks proposed a unique tool to cover the whole SM functionality (Câmara, Chaves, Soares, & Tessi, 2015), highlighting the simplicity and costless solution, but inability to cover all needed functions and activities needs could be a barrier to engage its use. Other frameworks were constructed for specific knowledge area and would be difficult to generalize it (Bell et al., 2016; Dokkun & Ravesteijn, 2016; Shang, Li, Wu, & Hou, 2011). Two frameworks were considered to fit the current research needs: Ballistic 2.0 (Chaves et al., 2016) and SM4PM (Ikemoto, 2017). SM4PM was selected because it considered the integrated use of SM in a simple framework (Ikemoto, 2017). Additionally, the integrated use of SM attends previous researchers and respondents claims. The application of SM4PM framework benefits project managers, team members and stakeholders of the project.

Finally, this study is part of the research project UTILITY: Use, Adoption and Integration of Web 2.0 Tools in Information Technology Projects, supported by CNPq under the process number 448998/2014-9. UTILITY project has two goals: 1) develop an artefact with integrated use of SM in projects and 2) assess the artefact and its interaction in the context. Ikemoto (2017) developed SM4PM - A Prescriptive Framework for Guiding Integrated Use of Social Media in Project Management, to attend the first goal. The current study has the purpose to accomplish the second goal.

1.4 DELIMITATION OF THE RESEARCH

This research considered the Project Management Institute (PMI) standard. Stakeholders are team members, partners, PMO members, sponsors that are strictly involved with the studied project. Aspects of social factors will be considered, although organizational relationship and culture will not be highlighted.

1.5 RESEARCH STRUCTURE

This research is organized in six chapters. In the Chapter 2, Project Knowledge Management (PKM), Social Media (SM) and Integrative SM framework are deeply scrutinized to support the understanding of the subject and to allow to face up to data analysis. The Chapter 3 describes the methodological approach used to collect and analyze the data, and clarifies the strategies to be used for validating the accuracy of findings. Chapter 4 presents discussion about the result of data analysis. Theoretical and practical contribution is shown in Chapter 5. Lastly, conclusion, limitations of this research and suggestions for future studies are given in the Chapter 6.

2 THEORETICAL BACKGROUND

Knowledge is an asset that organizations concern to retain and enlarge. Knowledge flow happens in any part of the organizations daily by means of a project. The knowledge systematization enables cycles of knowledge to be executed in a project, meeting the organization's goals (retain and enlarge). This systematization is called Project Knowledge Management (PKM). Once the concept of the PKM is formed, a second pillar, SM is explored to shed light of how it can support the PKM. Closing this theoretical background, a study about frameworks was performed tying up loose ends of KM (process), SM (tools) and PM (process) that are applied in the PKM.

2.1 PROJECT KNOWLEDGE MANAGEMENT

In the purpose of building the systematization of knowledge in PM, the KM process is explained by connecting it with project concepts. Then, PM concept was reconstructed (Ahern et al., 2014) clarifying the importance of knowledge in PM. After that, PM and KM are merged materializing Project Knowledge Management.

2.1.1 KNOWLEDGE MANAGEMENT

Manage knowledge is the practice to manage individual knowledge (Mariano, 2010). Interaction among people followed the dichotomy tacit/explicit/tacit as showed by Takeuchi and Nonaka (2008) in the SECI (socialization, externalization, combination and internalization) mechanism. This mechanism explains the human process of knowledge flow. In the SECI mechanism, individual needs another individual to interact. This peculiarity makes knowledge also flows per team as it is formed by individuals. In the SECI mechanism takes place a knowledge creation by insights from the tacit-explicit-tacit cycle (Takeuchi & Nonaka, 2008). On the other hand, USA's point of view diverges from Japan arguing that only existing knowledge should be stored in a IT device and managed (Lloria, 2008), neglecting that the creation of new knowledge begins in the individual's mind. As a reflection of the North American approach, new knowledge also comes by the interpersonal idea combination in the SECI model, bringing the value of sharing and transfer knowledge.

Exchange (sharing) knowledge among individuals provides collaboration within group (intra) and between group (inter) (Cheong & Tsui, 2011) enabling to enlarge existing knowledge on projects and on organizations. Trying to define knowledge sharing (KS) and knowledge transfer (KT) by reviewing the literature, Paulin and Suneson (2012) assert that these two terms are still blurry, having a tendency to make a differentiation focusing KS on individual and KT on organizations. KS is based on knowledge in the individual mind or found in the organization memory (Stein & Zwass, 1995). In the repository (organization memory), knowledge is stored and retrieved whenever it is necessary, conducting to a sustainable process, enabling organizational efficiency and innovation (Filieri & Alguezaui, 2015), configuring a process called knowledge restore/retrieve.

Theoretical approach of knowledge flow demonstrates that knowledge is useful connecting individual into collective knowledge (Mariano, 2010). Taking into account of the human knowledge flow (SECI) that supports the KM, Alavi and Leidner (2001) constructed a KM with four processes (knowledge creation, knowledge transfer, knowledge storage/retrieval and knowledge application). Reviewing the concepts, the knowledge creation occurs in the flow of the SECI mechanism, with the recombination of individuals' knowledge generating a new idea (Takeuchi & Nonaka, 2008). Knowledge transfer is the process that individuals exchange or at least, send their knowledge (Paulin & Suneson, 2012). Knowledge storage/retrieval is the process that concerns to store organization knowledge for future re-use, constructing the organization memory (Stein & Zwass, 1995). Lastly, the knowledge application is the use of knowledge (Alavi & Leidner, 2001). The KM processes (Alavi & Leidner, 2001) is adherent of this study due to a process that considers the knowledge in a practical approach. The Alavi and Ledner (2001) processes of KM, interdepend and interrelated (Mariano, 2010) is depicted in Figure 2.

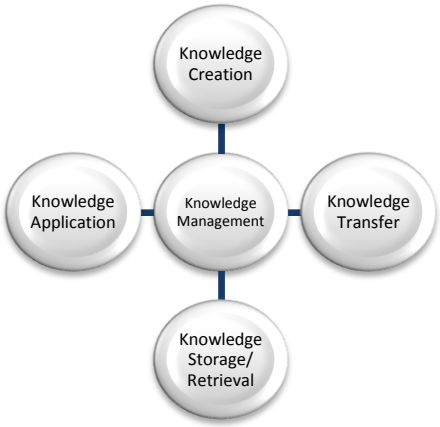


Figure 2: The knowledge management process
Source: Adapted from Alavi and Ledner (2001)

Interested in revealing the relationship between KM and PM, Oun et al. (2016) conducted a survey with 128 participants with PM experience. The authors proposed two sets of hypotheses: positive association between KM system and PM knowledge areas, and positive association with KM pillars (leadership, organization, technology and learning) and PM. Regarding to PM knowledge areas, Oun et al. (2016) concluded that project human resource and project stakeholder have a strong positive association with KM system. Considering that team member is also a stakeholder, this finding suggests that managers should give attention to individuals by providing skills development, task support, infrastructure (synchronous and asynchronous communication tools) and promotion of trust (Oun et al., 2016).

Another finding was the strong association of KM with the process integration of projects confirming the importance of KM in supporting integration in processes that "identify, define, combine, unify and coordinate various project management processes and activities" (PMI, 2013, p. 90). In this view, Oun et al. (2016) assert that the use of a PM software as a KM tool benefits the management of projects "to schedule, manage and control project information and activities to guarantee compliance with the project management plan and with the project scope of work" (Oun et al., 2016, p. 190). Likewise, the use of KM system to monitor and control projects promotes collaboration among team members, increasing the trust and the knowledge sharing (Oun et al., 2016). In the second set of hypotheses, Oun et al. (2016) confirmed strong association between PM and KM pillars (organization and technological), concluding that organizations have a significant role in KM strategy and equally, PM perceive benefits in technological platform and information technology support to accomplish project objectives (Oun et al., 2016).

2.1.2 PROJECT MANAGEMENT

The project environment can foster a knowledge creation. Project is defined as a collective effort during a period to deliver a product, service or exclusive result (PMI, 2013). The community of practice PMI defines the best practices of PM in a book of knowledge (PMBoK) as a standard that practitioners can follow to get success in their projects. PMI (2013) considers ten knowledge areas in PM: project integration, scope, time, cost, quality, human resources, communication, risk, procurement and stakeholder. All knowledge areas have pertinent processes and can have an overlay among areas (PMI, 2013). Knowledge area processes are organized in five process groups: initiation, planning, executing, monitoring and

controlling, and closing (PMI, 2013). For each project lifecycle stage, Bell et al. (2016) listed the knowledge required. These results came from a research supported by a Delphi methodology as depicted in Figure 3.

Analyzing the authors list of knowledge, each project stage needs specific knowledge. Initiation knowledge is for a project setup with scope definition, business and cost evaluation, and others issue clarification. It is clear from the authors that it is not foreseen the re-use of previous project knowledge in the initiate stage. The re-use knowledge is provided only in the closing stage, corroborating with the issue described in the Class of Problem section.

Stage	Knowledge required
Initiate	Interface with experts, options identification and elimination, cost and technical viability, commissioning and construction philosophy, scope definition clarification and context, control base, philosophy, plan on how the project should be approached, project setup, opportunity analysis, business evaluation, technical philosophy, sponsor mandate, business/ operational and market knowledge, problem definition, business structure
Develop	Process engineering and assurance, keep process intent as developed previously, design, ensure technical changes are feasible, adjust the execution plan according to project requirements, use of specification and standards are important, logistics, access, task duration, business case, business plan, business risk management, technology knowledge, contracting strategy
Implement	Freeze scope, project management knowledge, project execution plan, documentation required by the client, commissioning plan, construction strategy, contracting strategy, manage by objective, project governance, staff selected and trained, start-up modifications plan, quality control plan per contracting strategy, operational planning
Operate	Commissioning and stable business performance, project and business review, optimization plan, business sustainability and improvement
Close	Site re-use and analysis plan, business exit strategy (resources and environmental and client considerations), remediate site and monitor plan, termination of contracts, financial close-out

Figure 3: Knowledge required per project lifecycle stage
Source: Bell et al. (2016, p. 26)

The list of knowledge by Bell et al. (2016) is mainly constructed with explicit knowledge registered in documents. Traditional manner to manage project believes that following the standard (explicit knowledge) it is possible to get project success. But the concept of PM has been expanded to encompass relationship with stakeholders and business environment. Based on an inductive analysis of 74 contributions, Svejvig and Andersen (2015) assert that a new concept of PM embeds classical concepts, rather than sort it out. The authors identified six categories (contextualization, social and political aspects, rethinking practice, complexity and uncertainty, actuality of projects and broader conceptualization) in which contextualization expand the PM concepts to enclose organizational strategy, multiple projects and environment. This contextualization results in a broad view of the project in the organization rather than a framework that conducts a team to deliver a product or service in

time by means of tools, processes and people (PMI, 2013). In a broader context, organization portfolio is formed by decision making to choose a project related to the market, product, technology and business judgment, all aligned with strategy (Cooper, Edgett, & Kleinschmidt, 1999) as mentioned by Svejvig and Andersen (2015). Likewise, PMI created a talent triangle, joining the classical skill and technical expertise to leadership with strategic management and business. This shows an evidence of the value of PM in today's organization (PMI, 2017b).

Value added to a classical PM concept came from fundamental tensions between theory and practice (Ahern et al., 2014; Blomquist et al., 2010). Communities of practice collect and update a body of knowledge, frameworks, rules, guidelines and activities (PMI, 2017a) that should be used as a previous knowledge (Ahern et al., 2014) in any kind of project to be effectiveness and efficiency (IPMA, 2017). Additionally, in IPMA's (2017) view, standards create an environment for collaboration and it is crucial for a current complex world. PMI (2017a) and IPMA (2017) have a consequentialist view (Bredillet et al., 2015) and do not consider that there are projects that do not have all the project's previous knowledge, nor that the process that enables the knowledge emerges by means of projects. This happens independently of the project size and complexity.

Additionally, organizations have their peculiarities and some frameworks cannot fit them. So, are these projects fated to fail impacting in the organization strategy? Complex projects are those that cannot be fully specified in advance (Ahern et al., 2014). Conversely, Bredillet et al. (2015) criticize PMI (2017a) and IPMA (2017) standards, giving a new view that theory should come from practical experience. From this standpoint, Ahern et al. (2014) suggested that the missing knowledge can be generated coming as an emergent knowledge if a project team behave as a community of learning that learns over the project lifecycle to solve complex problems. These authors reconceptualized project as a process of knowledge and as a PM practice that organizes (explicit knowledge that comes from standard) and learns (tacit knowledge, know-how) by means of knowledge uncertainty, reconciling theory and practice in an organizing-learning perspective.

In this view, Terzieva (2014) updated with explicit and tacit knowledge the list of knowledge per project lifecycle stage presented by Bell et al. (2016). Explicit knowledge in project are documents, tools and materialized project knowledge. On the other hand, tacit knowledge, although sometimes come from physical objects (videotaping is an example), it comes from relationship (network, coaching, interview, training). Figure 4 presents explicit and tacit knowledge in projects.

Explicit Knowledge	Tacit Knowledge
Demand / Project Management Software tools	Networks (internal social networks or communities, knowledge sharing forums)
Shared project folders, shared drives	Interactive Project Management training
Intranets, portals, shared networks	Coaching and mentoring programs
Shared Project Management manual	Videotaping
Formal training program content	Storytelling
Project Management documentation templates	After action reviews, project status reviews, project post-mortem sessions etc.
FAQs	Exit Interviews
Shared status reports, program/portfolio master plans, etc.	Emeritus or alumni programs (whereby retirees are still kept "connected" to the organization)

Figure 4: Explicit and tacit knowledge in projects
Source: Terzieva (2014, p. 1090)

Knowledge flows through the team in the project. Outlining the behavioral mechanism that strengthens team members to share knowledge, Park and Lee (2014) used a cross-sectional survey and provided empirical evidence that feeling of dependence and trust are the drives of knowledge sharing (KS). Another finding of that study shows that the level of dependence is positively affected by project complexity because the solution needs to be too much discussed. Level of dependence and trust are also affected by the individual's expertise in similar project (Park & Lee, 2014). Lastly, communication frequency between team members influences dependence and trust, suggesting that this should be a team activity to improve of KS (Park & Lee, 2014). Although Park and Lee (2014) argue that frequent communication and use variable expertise enhance trust, they also defend that manage the dependence is more effective. As an organizing-learning (Ahern et al., 2014), it was suggested to join team members in a project with similar value as a problem-solving exercise (Park & Lee, 2014) as preconized by Ahern et al. (2014).

Until this point, PM was classified as a management that aligns project to an organization strategy and as a practice of organizing-learning which learns with knowledge uncertainty (knowledge whose need will be known in the future). Based on these findings, Reich et al. (2014) verified the impact of KM on the projects' performance. Empirically, the authors confirmed that KM matters if it is concentrated in knowledge alignment, achieving business value. Thus, managing project knowledge cannot be undervalued.

Oun et al. (2016) concluded that PM and KM have a strong association and for this reason, it is possible to connect project lifecycle with Alavi and Ledner (2001) process of KM. Seeing from this perspective, Gasik (2011) presented a consistent framework of Project Knowledge Management (PKM), based on the knowledge scale (micro-knowledge and macro-

knowledge) and knowledge lifecycles which are in line with Alavi and Ledner (2001) processes of KM. Knowledge lifecycle was classified by levels of individual, project, organization and global (Gasik, 2011), being presented in this study the level of the project. Gasik (2011) merged KM and PM to construct PKM, that is deeply explained next.

2.1.3 KNOWLEDGE MANAGEMENT FOR PROJECT MANAGEMENT

The scale of knowledge has two value: micro-knowledge (a knowledge necessary to perform a task) and macro-knowledge (a total knowledge possessed by the individual) (Gasik, 2011). Macro-knowledge has four sub-values, considering to whom the knowledge belongs: individual macro-knowledge (team member), project team macro-knowledge, organizational macro-knowledge and global macro-knowledge.

The purpose, in the light of knowledge management, is to conduct processes to provide the necessary expertise of each macro-knowledge sub-values (individual, project, organization and global) in each scale (micro-knowledge, macro-knowledge) meaning that each process has its own lifecycle (Gasik, 2011).

Micro-knowledge lifecycle is formed by the knowledge identification (KI) and the knowledge acquisition (KA) (Gasik, 2011). Once the knowledge necessary to execute a task is identified (KI), the necessary knowledge is sought within the organization. It can be recovered from organization memory (repository) or absorbed from training by an expert inside the team/organization or outside the organization (KA). Acquired knowledge socialized with owner of the knowledge and combined with both knowledge (individual and knowledge owner) creates new knowledge that will be applied to solve a real problem (Gasik, 2011). As knowledge is immaterial, it is documented in the organization repository to guarantee that organizations will not lose this asset. Yet, the knowledge documentation is usually undervalued. It cannot be considered only a register on the repository. Documentation process requires knowledge classification such as identification of the piece of knowledge that is new, definition of knowledge unit, externalization to share with team members and registration (Gasik, 2011). This knowledge can be used in the identical/analogous situations that are to come, consequently increasing organization capability.

The transmission of the new knowledge has two main ways: transfer and sharing (Gasik, 2011). Transfer is a one-way flow of knowledge, an act of a communication of codified or noncodified knowledge in which an individual receives it and executes socialization in his

mind. Sharing is the act to allowing individual knowledge to flow interactively to those who will need it. Sharing can be passive if the knowledge is disposed in the repository or can be active by means of social interaction (Gasik, 2011).

Micro-knowledge lifecycle at project level starts when the project manager analyzes the knowledge possessed by team members to perform the project task (Gasik, 2011). The necessary knowledge is acquired from an external source or at the repository, but requires the authorization from PM team for cross-activities flow. Instruments, tools and dynamics methodology are ways to induce a collective creation (Gasik, 2011). With necessary knowledge, new idea comes and knowledge is applied in the project. In the hereby process of knowledge transfer, the project team collectively discusses the new micro-knowledge created by the team. Micro level lifecycle flow is represented in Figure 5.

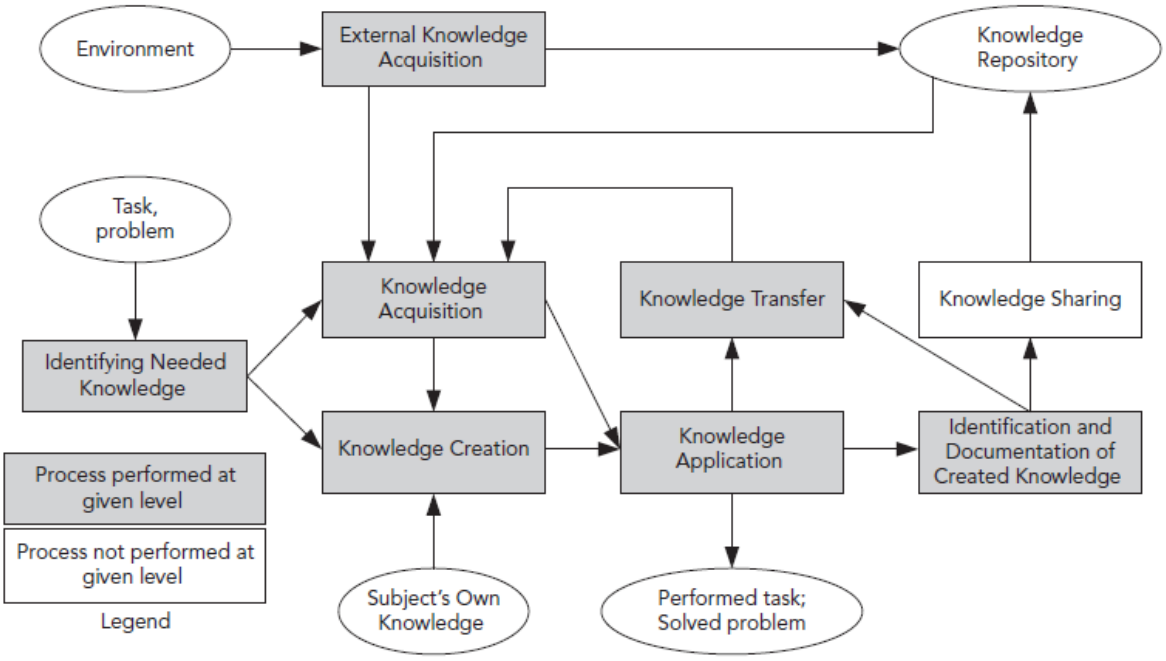


Figure 5: Micro-level lifecycle processes at project level
Source: Gasik (2011, p. 29)

Knowledge has a vertical flow between organizational levels. Organization provides the project standardization following a certificated body of knowledge and a strategy of knowledge development (Gasik, 2011). Bottom up direction is traveled by the created knowledge to serve other projects. Top down direction happens in recovering knowledge from organizations memory. In Figure 6, vertical knowledge flow is showed.

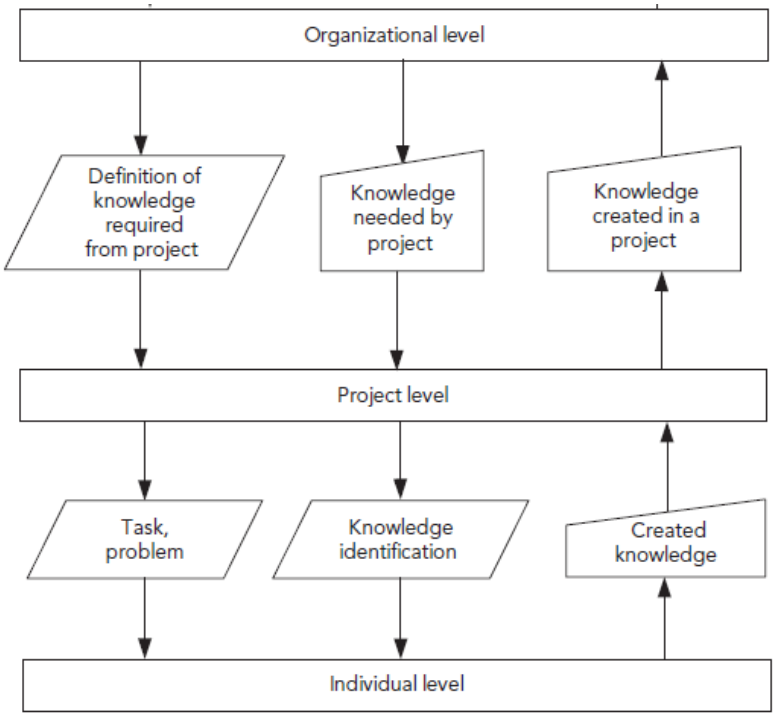


Figure 6: Vertical project knowledge flow
Source: Gasik (2011, p. 32)

Once understanding micro-knowledge lifecycle and vertical flow of knowledge, Gasik (2011) constructed a project-level macro-knowledge lifecycle with four main phases: organizational knowledge analysis, knowledge management preparation, executing knowledge management and knowledge summarization. In the organization knowledge analysis, it is analyzed the knowledge environment, the place to collect it and the organization knowledge strategy. In the next phase, knowledge management preparation has two processes: project understanding and KM planning. In the project understanding, the necessity of knowledge is mapped (project's initial macro-knowledge). Once the knowledge need is defined, the planning process addresses the individual knowledge gap to be covered and the technics of KM aligned with project needs (Gasik, 2011). Executing knowledge management has processes of knowledge mobilization and knowledge development. Mobilization makes efforts to acquire the knowledge requirement while development process creates specific knowledge for executing project activities. Knowledge summarization has the role to collect and register the knowledge created. Each phase produces a product (initiated project at organizational knowledge analysis phase, KM plan at KM preparation, used knowledge at executing KM and obtained knowledge at knowledge summarization). Figure 7 depicts the project-level macro-knowledge lifecycle and its relationship with project's group of process.

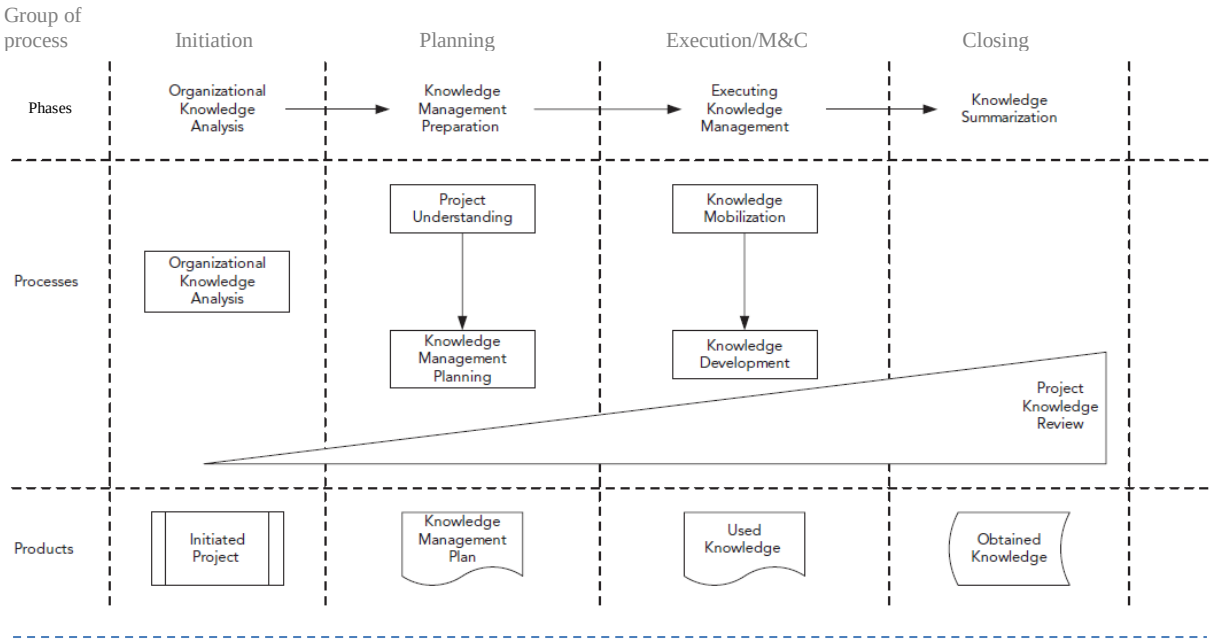


Figure 7: Project-level macro-knowledge lifecycle
Source: Adapted from Gasik (2011)

A complementary study was grouped to Gasik's (2011) one. Todorović et al. (2015) showed a contrary view to this subject. A view that producing a well-done final project report improve KM in the project. The authors proposed a framework in which project report is a project success analysis, gathering information of project performance. For this aim, the critical success factors (CFS) should be defined. Attached it, key performance indicators (KPI) are also defined to measure the CFS. The measured results are registered during all project lifecycle and finally, at the end of the project, a final project report rich of knowledge is generated and turns to an organization asset.

By means of KA and KT processes (Gasik, 2011), the knowledge base increases and it is essential for future projects (Todorović et al., 2015). Consequently, it will enhance problem-solving and acquisition/transfer knowledge from previews project to current one. Another important finding in Todorović et al.'s (2015) research is that communication efficiency is not correlated with the KA and KS method, point the conclusion that communication enhances itself independent of the structured and systematic method of KA. The Todorović et al. (2015) framework is illustrated in Figure 8.

There are some organizational prerequisites, according to Todorović et al. (2015) to implement project success analysis framework: the organization has to have an orderly project

management process, a reporting system established, a project reports framework, a defined responsibilities and a method of data collection, analysis and distribution.

The discussion offered by Gasik (2011) that KM improves PM, looks like to have in opposite view of Todorović et al.'s (2015) discussion in which it is said that is PM that improves KM. However, Todorović et al. (2015) view was constructed over Gasik (2011) methodology and one cannot be annulled by other, enabling to use both methodologies to enhance PM and KM.

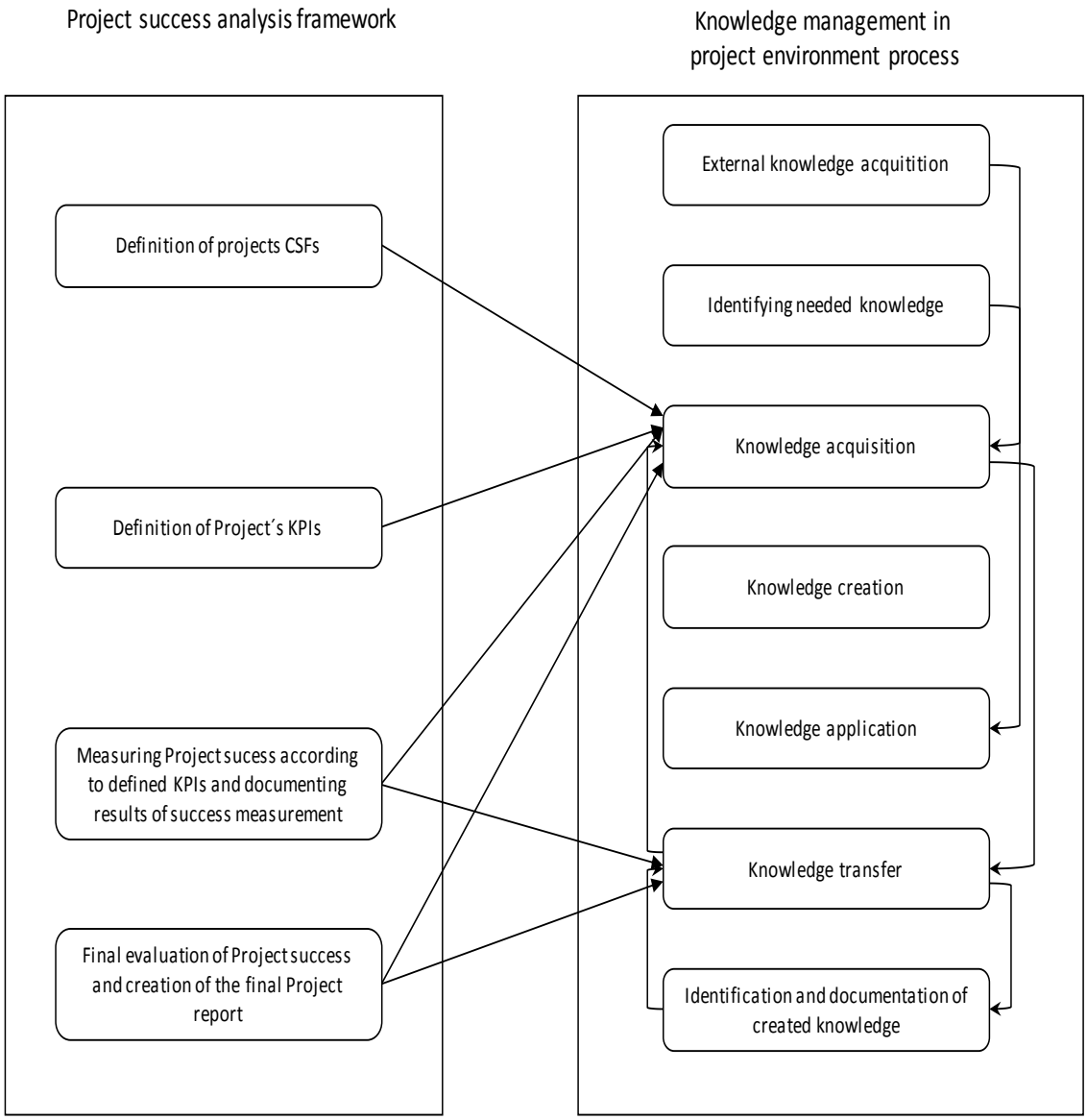


Figure 8: Project success analysis framework
Source: Adapted from Todorović et al. (2015)

The theoretical pillar of PKM motivated an interest in the review of PM and KM processes, also revealing the relation of individual behavior to knowledge sharing. Besides process and people, the management needs tools to support it. The application of technology brings infrastructure and environment to actualize, enhance and reinforce (Alavi & Leidner, 2001) process of PM and KM. SM are a class of tools that encourage knowledge sharing, enabling interaction and make people meet in a virtual 'ba' (Levy, 2013), which support KM in PM and is explored in the next theoretical pillar.

2.2 Social media

Social media (SM) are internet-based applications in which communities are motivated to create and exchange knowledge, interacting and collaborating with each other (Kaplan & Haenlein, 2010). There are four social media characteristics (Panahi, Watson, & Partridge, 2012): user-friendly communication, one-to-many communication, interaction by means of co-creation, and using all kinds of multimedia support. On this platform people can modify, criticize and validate the information, making themselves part of the process (Kaplan & Haenlein, 2010). The organization transforms knowledge management, sharing it by means of clouding, mobility and low cost (Von Krogh, 2012). SM motivate people's relationships, context creation and its modification, triggering an organization's learning and knowledge development, the perfect environment for the SECI mechanism. As collaborative interaction has a two-way direction, the extension "2.0" was added to the word "web", producing the expression Web 2.0 as a synonym for SM. The concept of Web 2.0 was popularized by Tim O'Reilly and Dale Dougherty at the O'Reilly Media Web 2.0 Conference in 2004.

SM have their own characteristics and functionalities which are useful to KM. Organizations desire workers to interact and collaborate on SM in the same way as they do individually (Schneckenberg, 2009a). Although this is an individual process (Takeuchi & Nonaka, 2008) where individuals interact with each other in a virtual shared space, they do not have the motivation to fulfill organizations desire. Thus, the people connection cannot be ignored (Levy, 2013). To achieve the organization's requirement, first level active users should catalyze the usage (Levy, 2009). Figure 9 was designed with the aim of supporting this idea, crossing the most common individual use and IT project application by tool and understanding the concept from both social and technological perspectives (Liu & Rao, 2015).

Tool	Definition	Most Common Individual Usage	Application in IT project
Blogs	Two-way web-based communication tool.	To share my personal notes and ideas	• To collaborate with team members in a distributed software team (one-to-many collaborative tool) • To find and exchange new ideas and brain storming • As an employee profile • Team members or customer interaction
Wikis	A many-to-many communication/ collaboration tool.	As a reference and source of information	• To collaborate with team members in a distributed software team (many-to-many collaborative tool) • Information repository • Documentation repository • Source of new ideas • Workflow management • To monitor the process
Social Networks	Virtual community links globally for companionship, information, and social support from their homes and workstations (Wellman at al., 1996)	To keep in touch with my family and friends	• To collaborate with team members in a distributed software team • As an employee profile • To connect to groups of experts
Mashups	Web page or Web site that combines information and services from multiple sources on the Web.	As video and photo mashup	• To integrate data from variable sources of information • To access easy and ready applications on the Web • To use map to trace and monitor each team working progress • To use different source of statistics about the team/project/resources • To customize and integrate online applications as a new resource for project
RSS Feeds	A family of Web feed formats used for linking and organizing content from blogs or Web pages.	To use it in my blog or profile	• To update information about distributed software team/project
Social Bookmarks	Online service which enables users to add, modify, and delete bookmarks of interesting web documents (Noll & Meinel, 2007)	To store/manage/ search bookmarks of Web pages related to my academic studies	• To store/manage/search bookmarks of Web pages related to distributed software team/project

Figure 9: Social media definition and application
Source: Adapted from Gholami and Murugesan (2011).

KM workers have to choose an application according to such organization factors as size, location, culture, intensity of collaboration, time influence, agreed language, organization assets and law (Baxter, 2014; Bolisani & Scarso, 2016; N. Evans, 2012; Olajide, 2015). With the purpose of managing knowledge in an organization and promoting an organization's learning, executives have to make decisions about which tools to choose for what kind of collaborative group service.

Hereafter, it is presented the role of the SM in Knowledge Management (KM) and the role of the SM in Project Management (PM). With the understanding of SM in these two contexts, the justification for using the same SM for both roles were demonstrated.

2.2.1 SOCIAL MEDIA FOR KNOWLEDGE MANAGEMENT

The content of this topic was generated by a systematic literature review (SLR) whose method is described in Appendix I. Six dimensions emerged from the data analysis whose concepts are applied in this study: 1. ideological and technological foundations, 2. effort, 3. KM process, 4. infrastructure, 5. systematization, and 6. SM application. Some articles contributed to more than one identified dimension. Each dimension is described in the following sections.

- Ideological and Technological Foundations

Mapping of the articles was carried out considering the use of SM in KM. The findings begin with a view of Benbensee et al. (2011), which gives a new concept of KM. The benefit of using SM in KM does not come only from the advances in technology. It arrives from a new way of unbounded collaboration, based on user contributions, leading to a new understanding of KM, the KM 2.0 (Bebensee et al., 2011). Adopting organization theory, Maier and Schmidt (2015) evoked Kaplan and Haenlein (2010), which gave the background of this concept as the dichotomous approach with ideological and technological foundation. Ideological foundation is characterized by transparency of the action that motivates engagement between individual and community in networking (Maier & Schmidt, 2015). Diversely, technological foundation considers the infrastructure of SM tools. Findings of the present research advocate the point of view in Kaplan and Haenlein (2010) that merge both foundations, which is confirmed by the intersection of the dimensions showed in Figure 10.

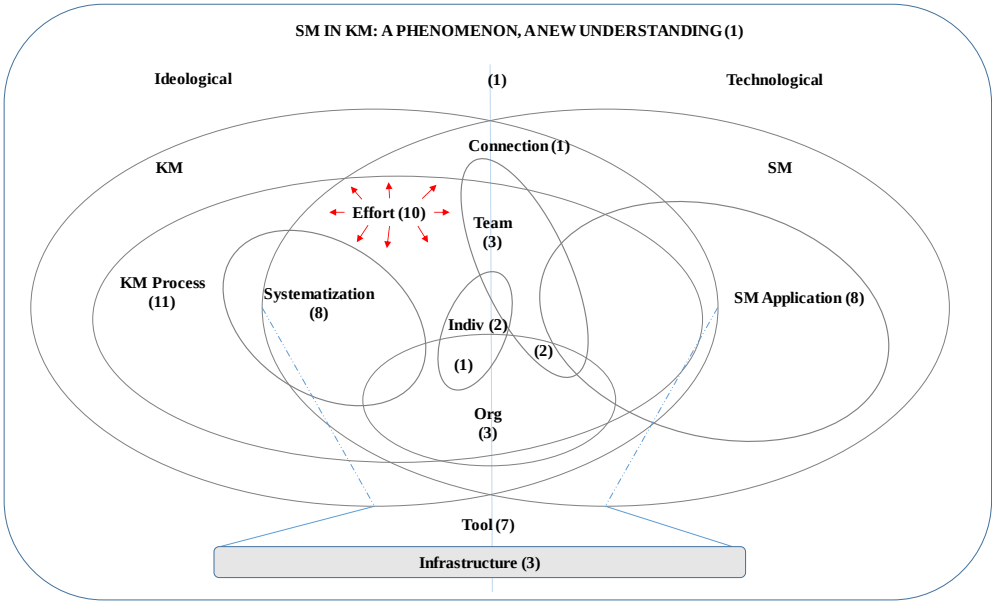


Figure 10: SLR overview
Source: Author

- Effort

Effort means the work carried out by knowledge workers, a critical mass (Margaryan, Boursinou, Lukic, & de Zwart, 2015), using SM to engage the KM process (Forcier et al., 2013). As a result, this effort allows a widening of knowledge boundaries, as showed by the multidirectional arrows in Figure 10. The effort has served the needs of the organization and it is also expected to be used by individuals in the organization (Schneckenberg, 2009a; Levy, 2009, 2013). SM contribute to the strengthening of both individual knowledge management and skill in making use of such tools in the authorized boundaries of the organization (Cheong & Tsui, 2011). SM also play a role providing a context that leads individuals into a landscape of learning, contributing with a favorable environment to acquire knowledge (Cheong & Tsui, 2011).

By a case study in a third sector organization, Guldberg et al. (2013) stated that SM support successful KM, creating value with a KM framework. Nevertheless, this needs strong member relationship, organizational motivation, quality criteria, protected shared space and pattern structure. In the organizational environment, best-in-class organizations use SM in collaborative e-learning, leveraging dynamics capability (Costello & McNaughton, 2016).

Boundaries are another important SM role that enable organizations to exchange knowledge across their limits, establishing communication, coordination and collaboration with their stakeholders and partners (Lancini, 2015). The functionality of SM empowers KM in

organizations because it shares tacit knowledge and constructs organization memory, capturing working contexts and increasing trust (Levy, 2013; Rathi et al., 2014).

- Knowledge Management Process

The articles included in the dimension KM Process in Figure 10 mention that efforts are made to increase the use of SM in KM as this gives value to the KM process. Ideas can be acquired by practitioners directly from the informal use of SM (Costello & McNaughton, 2016). Of this, Breuning (2016) asserts that factors of informal learning are suitable for virtual collaboration with SM.

Criticizing Levy (2013) and Rathi et al. (2014), Bharati et al. (2015) claim that the use of SM does not lead to the forming of mutual trust, but needs interaction and collaboration to develop the perception of ability and benevolence. Besides, contesting that learning occurs in physical and real time interaction, Breuning (2016) conducted a study within a globally distributed team, learning beyond local face-to-face interaction, but not synchronous due to different time zones. Still in the Breuning (2016) study, wiki enables a hybrid KM strategy, linking virtual collaboration knowledge project tasks as well as socialization and learning for practice. Conversely, instead of highlighting how the SM tools should be used, the possibility of engaging the learning process should be offered, making users themselves appropriate the tool in which experts can choose specific tools according to their knowledge area, to promote collective knowledge (Cabitza & Simone, 2012; Maier & Schmidt, 2015). However, adopting SM tools, which is an altruistic movement, needs organizational maturity and guidance to keep knowledge under healthy control, which is the function of KM (Levy, 2013).

Following the same line, Forcier et al. (2013) stated that SM are more valued in the generation and dissemination of knowledge. In short, by applying a wiki technology, Bolisani and Scarso (2016) confirm that SM are helpful tools that address the KM process due to their capacity to manage both the explicit and tacit knowledge aspects of the exchange. Still with SM as an approach to KM, it is the human resource which targets individual behavior and its application can be local or in a virtual team, reflecting that IT support and social factors affect team-level knowledge creation positively (Addas & Pinsonneault, 2014; Hong et al., 2016). SM also have a positive relationship with structural, relational and cognitive social capital, improving social capital development, and the effect of this suggests that SM are powerful facilitators of organization knowledge management (Bharati et al., 2015). All these viewpoints lead one to conclude that knowledge flow follows a bottom up and a top down path.

- Infrastructure

In the global competitive world, where teams are distributed and knowledge is compelled to flow in real time, organizations are transforming management into collaborative way (Von Krogh, 2012) by the use of technological solutions. Technological infrastructure, according dimension presented in Figure 10, provides a virtual shared space (Forcier et al., 2013) for the individual, group and organization to expand their relationship and knowledge by the application of SM tools. Additionally, Tsui and Fong (2012) recommend the adoption of KM in the virtual shared space, such as the project workspace and SM tools, inferring that SM are a KM infrastructure. Strengthening these conclusions, SM enable KM in many ways, such as the organization's memory, they are suited to the sharing of tacit knowledge and are convenient for sharing in a bottom-up process in a distributed team (Levy, 2013). Two technological infrastructures support KM: tools and connection.

  - Tools

As a device that enables KM, shown in Figure 10, SM tools are intuitive for people to use (Levy, 2013). SM support knowledge workers in the deployment of KM processes. The use of IT tools supports sharing, communication and organization learning, and helps to manage the creation of knowledge and virtual networks efficiently and effectively (Cerchione, Esposito, & Spadaro, 2016). SM also improve tacit and explicit knowledge in the decentralized team, increasing connectedness, a tool for the practice of knowledge sharing (Margaryan et al., 2015).

Furthermore, the use of collaborative publication tools is very favorable to support the KM process in a small organization (Bolisani & Scarso, 2016). Comparing and contrasting, SM are valuable tools for public libraries that foster commitment with the public and within the organization, although the perception was that SM are fun and not conducive to serious work (Forcier et al., 2013). Another experience indicates that background knowledge in SM use as a platform is a positive aspect and the lack of infrastructure is an obstacle (Olajide, 2015). In addition, organizations should consider critical mass and time in adopting SM as a KM tool (Garcia-Perez & Ayres, 2010).

  - Connection

Technology brings another important role: connection, depicted in Figure 10. This dimension has been widely referred to in the literature in terms of reflection on individual use (face-to-face relationship), bridging (inter-team communication, internal organization communication) and bonding (external organization communication).

Connection is not only a hardware and software package but an application of human orientation (Levy, 2009) to enable one-to-many communication (Panahi et al., 2012). Synchronous or asynchronous, connection leads individuals to conduct a one-way dialogue (Hartzel et al., 2011). Similarly, face-to-face relationships make tacit knowledge sharing easier and personalization is a rich communication medium that uses individuals as a knowledge sharing mechanism (Al Saifi et al., 2016).

SM tools contribute to bonding in acquiring external knowledge and bridging internal team knowledge sharing, giving participants a voice in the organization (Lopez & Esteves, 2013). In addition, an institution's sub-group (department and business locations) may achieve success in adopting SM if they are supportive (Jackson & Klobas, 2013). Similarly, the successful use of SM in a small company is influenced by social and organizational factors (Bolisani & Scarso, 2016). Also in small companies, individual attitudes and behaviors play a decisive role in the use of SM that do not create collaboration itself. Technology plays a role but it has to be aligned with organizational principle, practice and culture (Evans, 2012). Adversely, virtual collaboration is focused on collaboration over a distance, neglecting same room collaboration (Evans, 2012). Meanwhile, SM encourage interactive behavior, which causes tension between open methodology and traditional management (Janes at al., 2014).

External environment communication happens between an organization and external stakeholders. As a consequence, organizations are increasing SM use, bonding communication with the consumer, reconstructing communication, transferring brand control from organization to customer (Hartzel et al., 2011) and elevating the consumer to an active contributor of innovation eliminating customers' reluctance towards voluntary knowledge sharing (Chua & Banerjee, 2013).

Another organizational issue is the acquisition and appropriation of knowledge. For this purpose, organization boundaries are becoming permeable allowing better interaction and knowledge exchange between partners and communities (Lopez & Esteves, 2013; Rathi et al., 2014). But contrasting behavior came from respondents to the Rathi et al. (2014) study, who present a barrier to formal collaboration and interact better through SM. Although SM support informal and semi-formal knowledge, a partnership in the private sector has formal communication preference, denoting a use of SM as a barrier to knowledge sharing (Rathi et al., 2014). Contrary, non-profitable organizations like less formal interaction, giving place to SM use.

Although a collaboration tool supports the SECI model (Takeuchi & Nonaka, 2008), it will not create collaboration without organization and individual behavior (Evans, 2012). An organization has to act so as to ensure that internal and external networks bridge potential absorptive capacity (knowledge acquisition) and realized absorptive capacity (knowledge exploitation), making knowledge boundaries permeable (Lopez & Esteves, 2013). In this perspective, organization design (shape, corporate governance structure) has an implication on SM use, fostering or inhibiting it (Lopez & Esteves, 2013). A pancake structure (flat and non-hierarchical structure where employees have autonomy) favors human relationships, leading to a better understanding of social mechanisms, the bases of organizational culture, facilitating the fostering of SM (Schneckenberg, 2009b).

- Systematization

With a view to better organizing tools and processes, frameworks have been proposed as a systematic way to manage knowledge, according to the articles displayed in. Academy is collaborating by providing some practical frameworks to encourage building KM as a strategy. Strong efforts are being made in collaborative knowledge codification, which improves the construction of knowledge (Guo et al., 2009). Observing a knowledge community creation, it was found that SM driven by the community have potential for helping companies to gain a competitive advantage (Fernando, 2010).

Breaking the paradigm, Guo et al. (2009) propose a new approach to ontology engineering. The authors revealed the dichotomy between codification and collaboration, turning to SM tools, following the route of social knowledge instead of using traditional ontology construction. Another study prescribed a semantic model describing core concepts and relevant proprieties, deducing a relationship between semantically enriched tags, reducing drawbacks related with tag sharing between users, applications or folksonomy (Kim et al., 2010).

Knowledge sharing strategy is a combination of codification and collaboration with formal and informal techniques (Dixon et al., 2009). SM were considered easy to assemble, intelligible and user-friendly tools that can overcome existing problems in the lessons learned registration (Wiewiora & Murphy, 2015). On the other hand, a team knowledge framework focused on knowledge source and integration checked that the advent of SM has eliminated the boundaries of team knowledge and asserted that IT capabilities enhance the KM process (Addas & Pinsonneault, 2014).

Presenting the categorization of usage exploratory studies proposed a categorization scheme of a microblog (Twitter) in a KM process (Shiri & Rathi, 2013) and summarizing the KM process in blog activities (Mariano, 2010). These studies showed that knowledge creation and transfer are conflicting. Blog participants prefer to share external links and references, expressing knowledge from others rather than producing posts themselves. Further, participants prefer to comment on previous knowledge instead of predetermined subjects (Mariano, 2010).

- Social Media Application

Findings that come from the SLR (see Figure 10) show that SM are being used as a medium to measure and compare different contexts. Zhao and Chen (2013) summarized the use of SM tools to measure and categorize sharing knowledge, bringing the possibility of diagnosing, visualizing and comprehending knowledge sharing status and determining problems to promote improvement.

Alberghini et al. (2014) made a similar strategy that measure individual participation and engagement in SM with a four-step method with a flexible KPI, prompting organizations to a better understanding of knowledge sharing and creation. SM were also creatively used by Liu and Rao (2015) to compare Indian and Chinese cultures, giving a practitioners guide to address KM in these countries. Another contribution was made by Kosonen and Ellonen (2010) that used SM to compare competing discussion in the newspaper industry. Also, Serenko et al. (2015) used SM to measure and compare organization maturity model, affirming that an IT structure for KM implementation is insufficient to ensure success in KM activity.

Pattern was another dimension studied by researchers. From an SM perspective, Handzic and Lagumdzija (2010) defined patterns of learning in a university community. Hansan (2008) argues that the growing popularity of SM and social technology is a milestone in recovering old-fashioned neighborhood communities to back a sensible workplace. SM were used as a medium to assert trust, describing it as ‘a person most like you’ in a 2012 Trust Barometer research presented in Davos (Kidd, 2014).

- The Holistic Knowledge Funnel

Figure 11 shows the holistic knowledge (KH) funnel grounded in this SLR. The individual, team and organization universes are represented by the funnel levels. Ideological environment is the funnel core that expands knowledge ratio (Kr) with increased knowledge by combination (Takeuchi & Nonaka, 2008).

The infrastructure encompassing the funnel is composed of walls of KM tools and SM applications in technology, which thicken as efforts are made, resulting in greater engagement

in the use of technology. The SM tools that better fit and support KM populate the space between the outer and innermost edge of the walls.

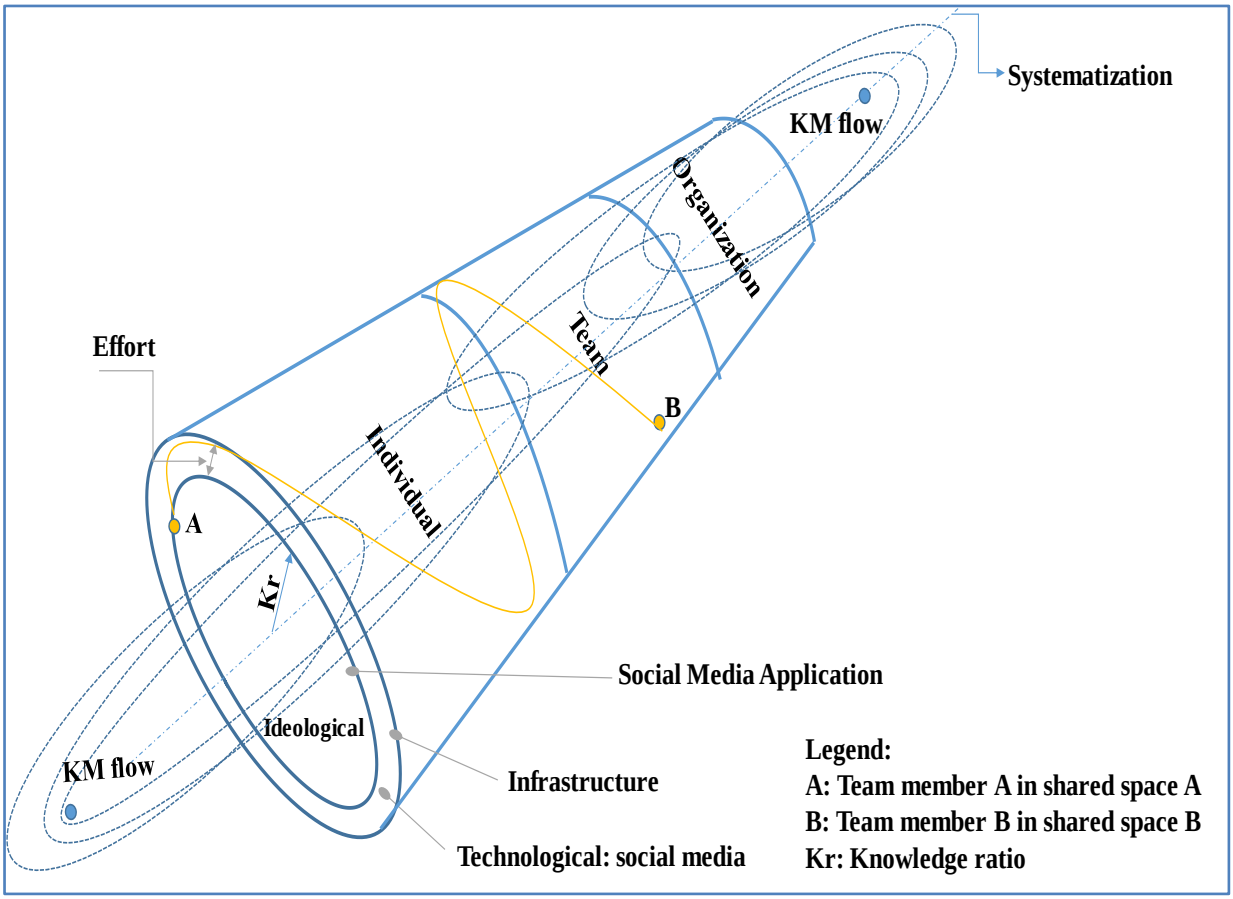


Figure 11: The Holistic Knowledge funnel
Source: Author

The funnel's outermost edge represents the infrastructure and the inner edge, the SM applications. Connection takes place through the technological infrastructure, making it possible for people to have a face-to-face relationship wherever they are, bridging knowledge flow between teams and making organization boundaries limitless. The path from point A to B shows an example of a distributed team being in touch. The more technology is used, the more permeable the funnel becomes, facilitating the KM process.

A two-flow pole represents the flow of knowledge. A bottom-up flow represents the knowledge generated by socialization, combination, creation and sharing, while internalizations generate the return flow. On the opposite funnel side (top-down), the knowledge flow enters the funnel, recovering knowledge from organizational memories and returning to the top bringing knowledge to an organizational repository.

Dimension	Description	Authors
Ideological and Technological Foundations	Ideological: transparent action that inspires collaboration and connection. Technological: the infrastructure of SM tool adoption	Maier and Schmidt (2015)
Effort	Forces that contribute to engaging KM	Schneckenberg (2009a); Levy (2009, 2013); Cheong and Tsui (2011); Forcier et al. (2013); Guldberg et al. (2013); Rathi et al. (2014); Lancini (2015); Margaryan et al. (2015); Costello and McNaughton (2016)
Knowledge management process	Value given by SM to KM	Levy (2013); Cabitza and Simone (2012); Forcier et al. (2013); Rathi et al. (2014); Bolisani and Scarso (2016); Addas and Pinsonneault (2014); Bharati et al. (2015); Maier and Schmidt (2015); Hong et al. (2016); Costello and McNaughton (2016); Breuning (2016);
Infrastructure	Technological solution to base the KM	Tsui & Fong (2012); Forcier et al. (2013); Levy (2013);
Tool	Device that enables the KM process	Garcia-Perez & Ayres (2010); Forcier et al. (2013); Levy (2013); Margaryan et al.(2015); Olajide (2015); Bolisani and Scarso (2016); Cerchione et al. (2016);
Connection	Network application of human orientation	Levy (2009)
Individual	Face-to-face relationship	Hartzet et al. (2011); Panahi et al. (2012); Al Saifi et al. (2016)
Team	Participant voice in the organization	Evans (2012); Lopez and Esteves (2013); Jackson and Klobas (2013); Janes et al. (2014); Bolisani and Scarso (2016)
Organization	Bonding organizations	Schneckenberg (2009b); Hartzel et al. (2011); Evans (2012); Chua and Banerjee (2013); Lopez & Esteves (2013); Rathi et al. (2014);
Systematization	Structure to manage knowledge organizing tool and process.	Dixon et al.(2009); Guo et al.(2009); Fernando(2010); Kim et al.(2010); Mariano(2010); Shiri and Rathi(2013); Addas and Pinsonneault (2014); Wiewiora and Murphy(2015)
SM Applications	SM usage	Hansan (2008); Handzic and Lagumdzija (2010); Kosonen and Ellonen (2010); Zhao and Chen (2013); Alberghini et al. (2014); Kidd (2014); Liu and Rao (2015); Serenko et al. (2015).

Figure 12: The HK Funnel dimensions and their descriptions
Source: Author

Finally, all components and processes need to be systematized, not only to facilitate KM but also to organize and put everyone at the same level of awareness of the KM dynamics. The dimensions, their descriptions and the references in which the HK funnel is grounded is presented in Figure 12.

2.2.2 SOCIAL MEDIA FOR KNOWLEDGE MANAGEMENT IN PROJECT MANAGEMENT

The content of social media (SM) for Project Management (PM) emerged from Ikemoto (2017) literature review in which it were analyzed 35 papers and were classified the SM by type of contribution (T - Theoretical or P - Practical). The author of the current study choose Ikemoto (2017) literature review, as justified beforehand that this practical study complement the Ikemoto (2017) theoretical study.

The Ikemoto's study (2017) showed that PM uses mainly wikis, blogs and microblogging as a support tools despite of there is a wide variety of tools available. Wiki proves to give more purpose of use in PM. Chaves, Tessi, Winter e Damasceno Jr. (2015) reported using the wiki in inherent activities in the PM, such as scoping control, task definitions and follow-up the activities. Câmara et al. (2015) narrated a wiki application supporting PM risk management. Chaves and Pedron (2015) described the use of SM helping to managed the lessons learned.

Other purposes of use, although related and necessary for PM, are common activities to communication and knowledge management processes. Authors reported using wiki, blog and microblog to share knowledge, collaborate, distribute information, exchange ideas, socialize, among other purposes cited. This is an evidence of the importance of the KM in PM.

Gholami and Murugesan (2011) corroborated with this evidence in their study about the use of IT in PM in which they affirm that SM encourage exchange new ideas and interaction between team members. The SM supporting PM is summarized in Figure 13.

Purpose of use	Social media			Authors
	Wiki	Blog	Microblogging	
Control of ccope	x			Chaves, Tessi, Winter and Damasceno (2015)
Definition of tasks	x			Chaves, Tessi, Winter and Damasceno (2015)
Storage documents	x			Chaves, Tessi, Winter and Damasceno (2015)
Follow-up activities	x			Chaves, Tessi, Winter and Damasceno (2015)
Share knowledge	x	x	x	Grace (2009); Chaves et al., (2015); Westbrook (2012); Cleveland and Ellis (2013); Gloria et al., (2014); Rosa and Chaves (2014); Shang et al., (2011); Chaves and Veronese (2014)
Manage lessons learned	x	x	x	Grace (2009); Veronese (2014); Duffield and Whitty, 2015); Chaves and Pedron (2015); Parker et al., (2007)
Communicate, collaborate and access critical workplace issue	x			Lee and Baby (2013)
Support risk management	x			(Câmara, Chaves, Soares & Tessi, 2015)
Online collaborative projects		x		(Chaves et al., 2015)
Information distribution		x		(Chaves et al., 2015)
Exchange new ideas and brainstorming		x		Gholami and Murugesan (2011)
Interaction between team members		x		Gholami and Murugesan (2011)
Share tasks			x	Riemer and Scifleet (2012)
Share opinion			x	Richter et al., (2013); Riemer and Richter (2010)
Share information			x	Riemer and Richter (2010); Chaves et al., (2015); Richter et al., (2013), Polaschek et al., (2012)
Solve problems			x	Riemer and Richter (2010)
Socialize			x	Richter et al., (2013)
Coordinate tasks			x	Riemer and Scifleet (2012); Richter et al., (2013); Riemer and Richter (2010)
Make decisions			x	Riemer and Richter (2010)
Capture knowledge instantly			x	Cleveland & Ellis, (2013)

Figure 13: Summary of purpose of use by author
Source: Ikemoto (2017, p.32)

In the intention to make clear the connection of the SM with the both roles in KM and PM, the author of the current study displayed in Figure 14 the link of the purpose of use with the SM4PM categories, to facilitate the understanding the framework application ahead.

SM4PM Category	Propose of use	Authors PM source: Ikemoto (2017)	Authors KM	Social media			
				Microblog	Blog	Publish	Productivity applications
Communication	Share information	Riemer and Richter (2010); Chaves et al., (2015); Richter et al., (2013), Polaschek et al., (2012)	Janes, Patrick & Dotsika (2014); Chua, & Banerjee (2013)	x	x	x	
	Communicate, collaborate	Lee and Baby (2013)	Breunig (2016); Jackson & Klobas (2013); Chua, & Banerjee (2013)			x	
	Socialization	Richter et al., (2013)	Maier, Schmidt (2015)	x			
	Capture knowledge instantly	(Cleveland & Ellis, 2013)	Chua, & Banerjee (2013)	x			
Dissemination	Information distribution	(Chaves et al., 2015)	Chua, & Banerjee (2013)	x	x	x	
	Shared knowledge	Grace (2009); Chaves et al., (2015); Westbrook (2012); Cleveland and Ellis (2013); Gloria et al., (2014); Rosa and Chaves (2014); Shang et al., (2011); Chaves and Veronese (2014)	Janes , Patrick & Dotsika (2014); Zhao & Chen (2013); Chua, & Banerjee (2013)	x	x	x	
	Access critical workplace issue	Lee and Baby (2013)	Breunig (2016); Janes , Patrick & Dotsika (2014); Chua, & Banerjee (2013)		x	x	
	Interaction between team members	Gholami and Murugesan (2011)	Levy (2009); Zhao & Chen (2013)		x		
Repository	Knowledge base	Chaves et al., (2015)	Breunig (2016); Janes , Patrick & Dotsika (2014)			x	
	Management documentation	Chaves et al., (2015)	Janes , Patrick & Dotsika (2014)			x	
Control	Control of Scope; Definition of tasks; Follow-up activities	Chaves et al., (2015)				x	
	Business performance		Del Giudice & Della Peruta (2016)				x
	Manage Lessons Learned	Grace (2009); Veronese (2014); Duffield and Whitty, 2015); Chaves and Pedron (2015); Parker et al., (2007)	Janes , Patrick & Dotsika (2014); Chua, & Banerjee (2013)	x	x	x	x

Figure 14: Social media for knowledge management in project management
Source: Author

2.3 INTEGRATED SOCIAL MEDIA FRAMEWORK

Managing knowledge requires a structured process, a framework, that conducts to a natural and intuitive knowledge flow. In this purpose, four requisites are needed: tools, in the role of face-to-face relationship and ‘ba’; collaborative applications for practices and for documentation enhance; virtual environment with a connection to any place; and supporting tool for product development, services enabler and control (Mariano, 2010).

Knowledge is multidisciplinary and it is present in the diverse processes and activities of PM. If considered as standalone process, it can conduct to a partitioned view, proving to be inefficient, blinding the advantage of knowledge exploitation in others areas (Argote et al., 2003). From this viewpoint, it is necessary to consider the integration of knowledge processes. In the intention to reveal a framework construction that fits better the application of SM supporting KM in activities on PM, this current research revisited the extant frameworks in the literature. Some frameworks have been studied and the findings are described hereafter.

The most popular SM usage inside organization is internal and external communication (Verheyden & Goeman, 2013). Considering communication to be a success factor (Dokkun & Ravesteijn, 2016; Levy, 2013), Dokkun and Ravesteijn (2016) recovered from literature review, three models, three frameworks and one overview of SM applications that illustrate the diversity of the use of SM in the business environment. The same authors constructed a framework for project communication, using SM supporting project communication and assert that it should be driven by norms (legislation, learning ability and output) to provide communication governance and efficiency (Dokkun & Ravesteijn, 2016). It can be noted in this author's framework that there is a lack of SM tools indications. Dokkun and Ravesteijn (2016) highlighted communication, showing one SM for external context communication, three SM for internal context communication and aggregate important advices about the application and the users’ behaviors. Additionally, the authors allege that knowledge published in SM can be recorded and used for trend analysis. In summary, Dokkun and Ravesteijn (2016) framework seems to be a template for communication knowledge area from PMI (2013) standard.

In Lech’s (2014) framework, the author crossed project phases with types of knowledge and describe specific knowledge activities to be executed for the associated actor. The benefit of this framework is the addition of the knowledge component to the traditional PM, giving it a knowledge perspective (Lech, 2014). Conversely, in the same way traditional PM

methodology, the lessons learned are recorded in the go-live and support phase, in the project end, maintained issue about lost knowledge.

Exploring the mechanism of lessons learned, Bell et al. (2016), supported by a Delphi study, had the intention to find out how to blend knowledge from projects into a PM methodology. Figure 15 reproduce knowledge-pull framework by Bell et al. (2016).

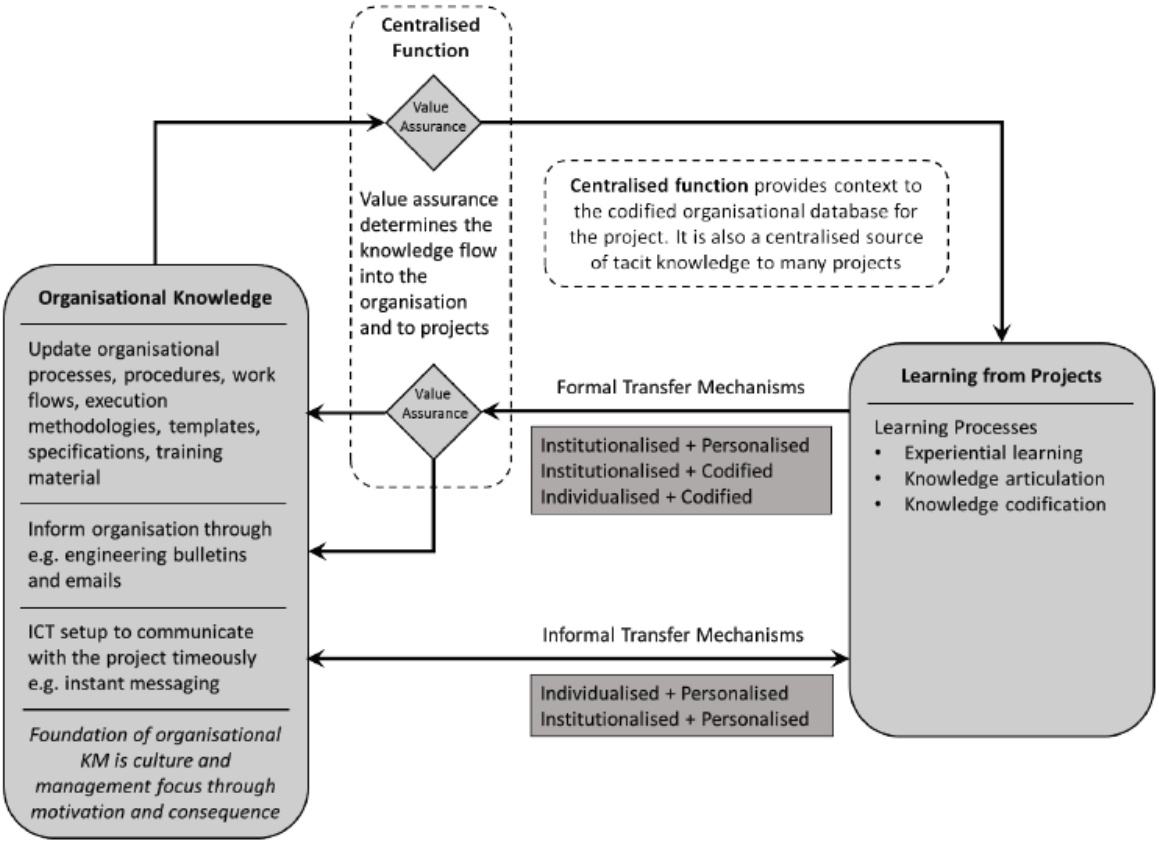


Figure 15: Knowledge-pull framework
Source: Bell et al. (2016, p. 29)

In this scenery, organization has the accountability to absorb knowledge that comes from projects, updating both database and individuals knowledge (Bell et al., 2016). According with Bell et al. (2016), organizations manage the formal (organizations) and informal (individuals) knowledge transfer mechanism. The same authors affirm that knowledge quality is assured by a value assurance step, a stage that analyzes the knowledge before register it in database. Additionally, the authors assert that the main finding of this study is that knowledge, instead of transferred direct to the database, goes to a resource with a centralized KM function that validates the knowledge and the deliverables of the project. The resource will decide when and how knowledge will be used (Bell et al., 2016). Centralized KM function has the

responsibility to update organizational knowledge assets and recognize trending of knowledge gap. In this line, knowledge, as a lesson learned, should not be simply communicated and registered into a database, it requires relevant action taken (Bell et al., 2016). Knowledge codification becomes part of the organization and of the project methodology, which means that it should be part of the routine of projects and organizations (Bell et al., 2016). About which knowledge is required for each project phase, Bell et al. (2016) affirm that the spotlight is not the phase but the project context. Project team is responsible for collecting knowledge in project lifecycle and centralized KM function has the responsibility to accept this knowledge. It is necessary to make it clear that receiving knowledge is centralized, but project knowledge update should be decentralized (Bell et al., 2016). Centralized function provides relevant knowledge for the beginning of each stage during the project and it is available for during project lifecycle (Bell et al., 2016).

Câmara et al. (2015) proposed WikiRiskMan, a framework based in a SM platform, the wiki, in the intention to support project risk management, turning the traditional one-to-many communication to many-to-many one. The authors connected an initial wiki page to five specific modules: users, interaction, documentation, models and database. Initial page has project overview and hyperlink to each module. Users module is a personal page in which users manage their personal project task, links, agenda, communication, and everything that involve the project. Interaction page is divided into two types. One for knowledge collaboration where anyone can enhance a knowledge that is already in the wiki by adding, excluding or modifying context. Another, the content is not modified but new individual interaction can be added. Documentation page stores project documents, mainly relative to risk. Lastly, a page of models is where pages of models are stored and used in the creation of news pages. Câmara et al. (2015) assert that wiki can support resource with the view to facilitate communication, follow up and updates. The use of WikiRiskMan framework, created by Câmara et al. (2015), benefits project manager decreasing his information overload by a technological support. WikiRiskMan framework seems to be practical for risk management but is still under only one tool.

Another study shows a framework supported by Project Management Information System (PMIS) in an integrated approach, attending multiple projects and extended organizations. Braglia and Frosolini (2014) proposed integrate PMIS, that is used to planning, scheduling and communicating, immediately and effectively, with Supply Chain Event Management (SCEM) that trigger a sequence of action and give alerts, performing Control Tower. It functions with Product Data Management (PDM) that is constituted by EDM

(manages design and documents) and AM (accuracy management), all supported with a collaborative technology, as depicted in Figure 16.

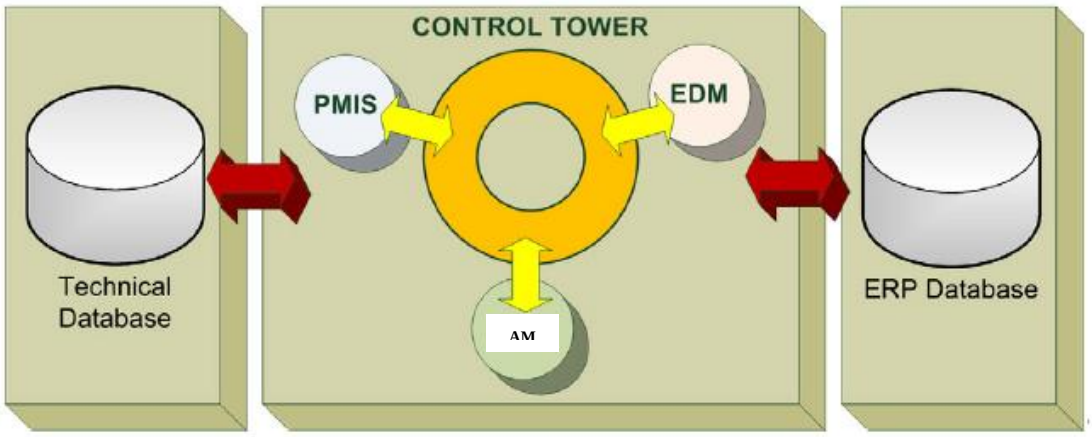


Figure 16: Braglia and Frosolini application framework
Source: Braglia and Frosolini (2014, p. 6)

The benefits of this framework are: reduction time in problem resolution, identify and alert process that is out of track, update technical documentation, reported problem linked with project documentation and facilitates document retrieval. However, the authors did not take in consideration communication among team and stakeholders.

A framework proposed by Duffield and Whitty (2016), called Systemic Lessons Learned Knowledge (Syllk), presented the distribution of organization know-how. After three action research cycles, the authors assert that there is an alignment of people and system elements where the know-how is wired. The relevance of this study is the connection between people and system, taking a conclusion that no matter how the system is automated, human presence influence organization's processes.

In the line of lessons learned framework, Carrillo, Ruikar and Fuller (2013) built a project roadmap with three main components: key elements (issues to be addressed), actions (to be engaged by leaders) and implementation guide (a checklist to provide advice for the organization). Emerged from the authors' study, a list of tools required to each process, mixing the traditional and technological tools. Yet, the study did not aim the technological tools usage.

Although the current study selected PM framework related with SM, one SM model is presented here as an exception. Shang et al. (2011) developed a SM application model from a knowledge-creation perspective. This framework provides the understanding of the SM application patterns. The authors combined SECI mechanism (Takeuchi & Nonaka, 2008) and

SM tools, affirming that the framework has four types of service: Exchanger (enable socialization and externalization), Aggregator (enable knowledge creation from socialization and externalization), Collaborator (enable knowledge creation from socialization and externalization through combination to internalization, high control), and Liberator (enable knowledge creation from socialization, externalization through combination to internalization, low control). The model presented by Shang et al. (2011) facilitates organization to design a knowledge-creating portfolio, aligned with business objective. Figure 17 summarizes each SM model.

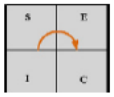
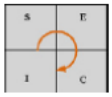
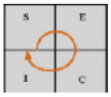
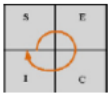
Model category	Experience-socialization platform		Intelligence-proliferation platform	
	Exchanger	Aggregator	Collaborator	Liberator
Web 2.0 applications (number of sites listed on AjaxProjects.com)	Calls & VOIP, chat, e-mails, networks (268 sites)	Blogs, bookmarking, music, photo, video, RSS, networks (613 sites)	Wikis, travel, bookmarking, business, office, programming, games (118 sites)	Business, office, programming, Web 2.0 tools, games (43 sites)
Dimension type Community knowledge-creating cycle enabled by Web 2.0 platform	Type II 	Type IV 	Type V 	Type VI 
Control mechanism	• Log	• Log • Framing • Standardization	• Log • Standardization • Systematization • Authorization • Review	• Log • Standardization
Customer value	• Exchange of instant message or data	• Share and retain information	• Share, retain, assimilate, and regenerate knowledge under specific standards	• Share, retain, assimilate and regenerate knowledge under free format
	• Extended social network	• Information sufficiency • Extended social network	• Knowledge quality • Information sufficiency • Upgraded user knowledge and skill	• Knowledge reliability • Application flexibility • Upgraded user knowledge and skill
Exemplary cases	MSN, Skype	Twitter, Plurk, YouTube, Facebook	Wikipedia, Answers.com, Salesforce.com	OpenOffice, Linux

Figure 17: Classification of different SM service model
Source: Shang et al. (2011, p. 182)

Still in the line of lessons learned (LL) and follow up processes, Rosa, Chaves, Oliveira and Pedron (2016) validated a collaborative framework, called by authors Target model, in which LL processes were supported by SM in IT projects. The authors elected four LL processes that run during project lifecycle: raising awareness, reuse, collect and verify, and store and disseminate. For each project process (conception, detailing, implementation, control and closing) the five LL processes were put in order of importance. Target model also points that SM tools are bringing more benefits to each LL processes. Rosa et al. (2016) constructed a circular model and argue that LL processes should be made during the whole project lifecycle, as shown in Figure 18.

Target model highlighted among other processes, the raising awareness. A LL process that energizes the people to understand the processes in a way that engages them to participate. As a theoretical contribution, framework of Rosa et al. (2016) connects LL processes and SM, decreasing knowledge drain problem. The continuous action of collect and verify, and reuse during the project lifecycle, conducts to a retrospective and prospective learning practice (Rosa et al., 2016). In a practical view, Target model can be applied in the organization. On the other hand, Rosa et al. (2016) raised the issue of the individual attitude in decision making of the LL use. People cannot be neglected (Rosa et al., 2016) but process and technology should be organic and intuitive in order for the flow of knowledge to occur naturally.

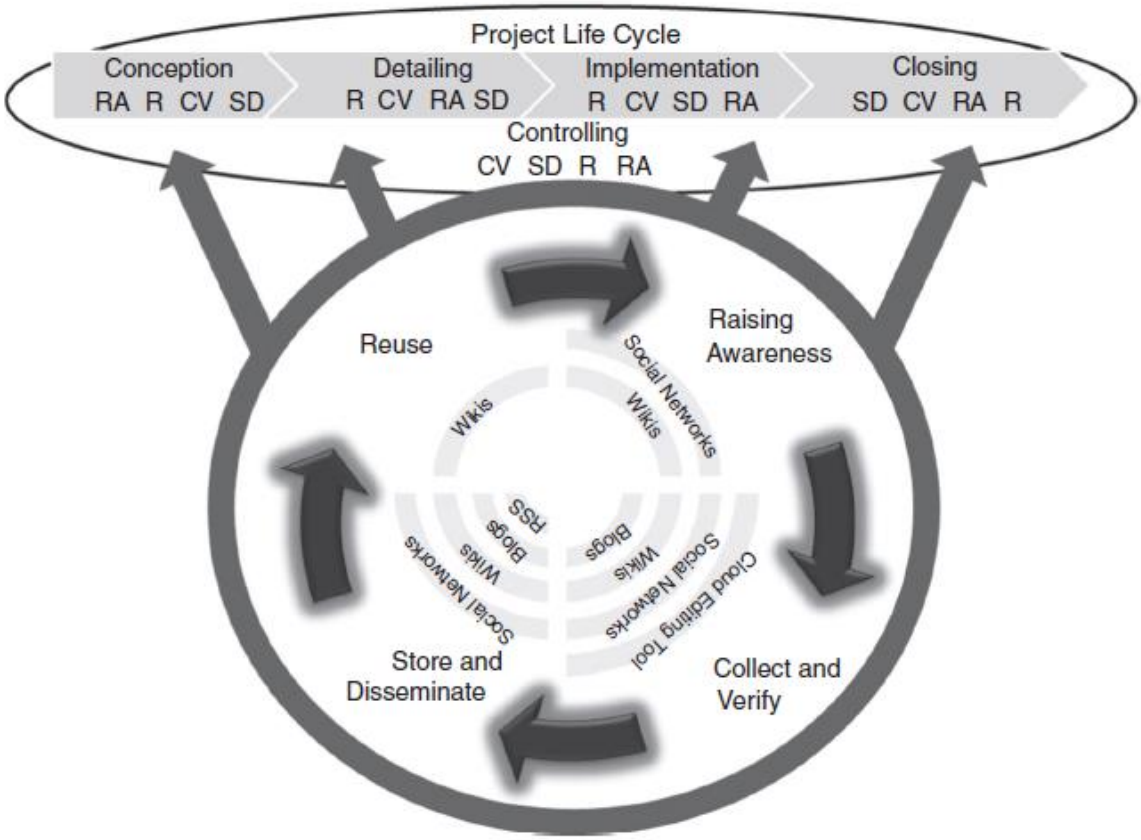


Figure 18: Target model
Source: Rosa et al. (2016, p. 667)
Notes: RA stands for Raising awareness; R stands for Reuse; CV stands for collect and verify; and SD stands for store and disseminate

Another framework studied here was that Chaves et al. (2016) called Ballistic 2.0 (Ba Lessons Learned Information Technologies 2.0), that considered process of LL by Weber, Aha and Becerra-Fernadez (2001), concepts of 'ba' by Takeuchi and Nonaka (2008) and service models presented by Shang et al. (2011). Weber et al. (2001) described LL with four processes:

1) collect LL, 2) verify LL, executed by expert to validating lessons, 3) store by using the technics to indexing, format and storage LL and, 4) disseminate to organizations or users. Chaves et al. (2016) inserted SM technology in supporting LL processes, designing the layer 1 of the Ballistic 2.0 model that is represented in Figure 19.

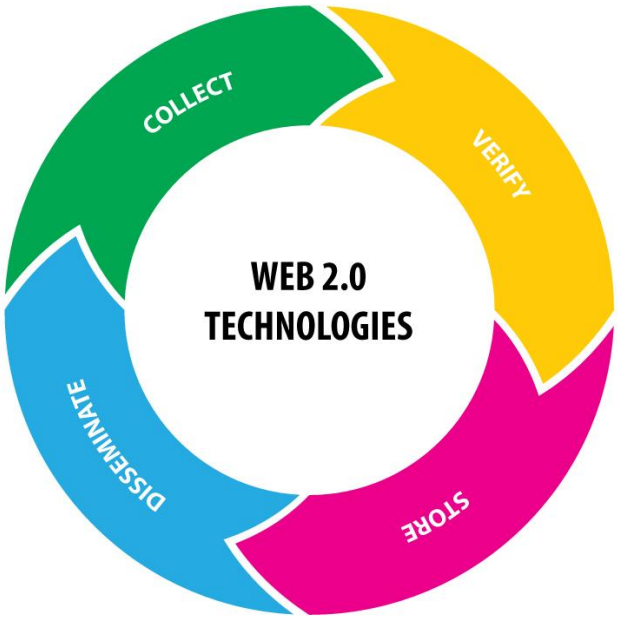


Figure 19: Ballistic 2.0 model - layer 1
Source: Chaves et al. (2016, p. 38)

Asked to focus group that participated in the Ballistic 2.0 validations, which SM could be used in this framework, blogs, wikis, mashups were cited to enhance team efficiency, and WhatsApp was mentioned to be an organic tool. The use of WhatsApp has increased in the organizations.

Continuing the construction Ballistic 2.0 framework, Chaves et al. (2016) used SECI mechanism (Takeuchi & Nonaka, 2008) plotting four ‘ba’ concepts: 1) originating, a context for socialization, 2) dialoging, a context for externalization, 3) systemizing, a context for combinations and 4) exercising, a context for internalization. These ‘ba’ were represented as a sector of a circle and lastly, it was organized in five circles, one for each five PMI (2013) project phase. According to the focus group, the usefulness of each ‘ba’ varies with the project process phase. This was represented in the framework with different ‘ba’ size at the initiating and closing phase and equal size at planning, executing and monitoring, and controlling phase. A different color was applied to in order to distinguish the interaction of the individuals and the group. In the center of the circle, LL processes were allocated suggesting that these processes

happen during all project lifecycle and LL should be collected in any project process phase performing layer 2 of the Ballistic 2.0 model which is depicted in Figure 20.

Working the LL during all phases of the project is the largest benefits of Ballistic 2.0 model of Chaves et al. (2016), although construct a two layers framework hinders the SM applications that support the model.

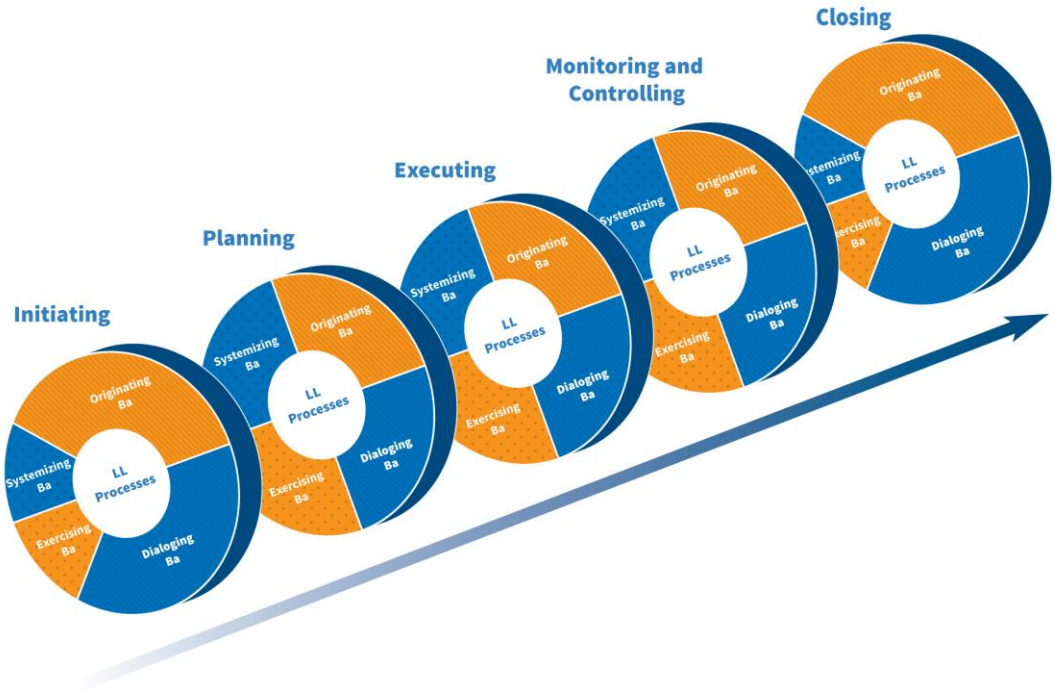


Figure 20: Ballistic 2.0 model - layer 2
Source: Chaves et al. (2016, p. 39)

The last framework to be commented on this theoretical reference is SM4PM (Social Media for Project Management) by Ikemoto (2017). This framework was proposed to create a collaborative environment and increase productivity in projects by the support of SM. Based on Ground Theory Methodology, the author collected data from a literature review based on hermeneutics and made two cycles for collecting primary data, from an exploratory focus group and interviews in the first cycle, and another interviews and a confirmatory focus group in the second cycle.

Emerged from Ikemoto (2017) research, four categories of SM that support PM: control, communication, dissemination and repository. Each category has a set of SM tools and they are joined by integration. The level of integration depends on the organization's strategy since it

can be a simple link or a complex and personalized solution. Confirmatory focus group validated the SM4PM framework that is illustrated in Figure 21.

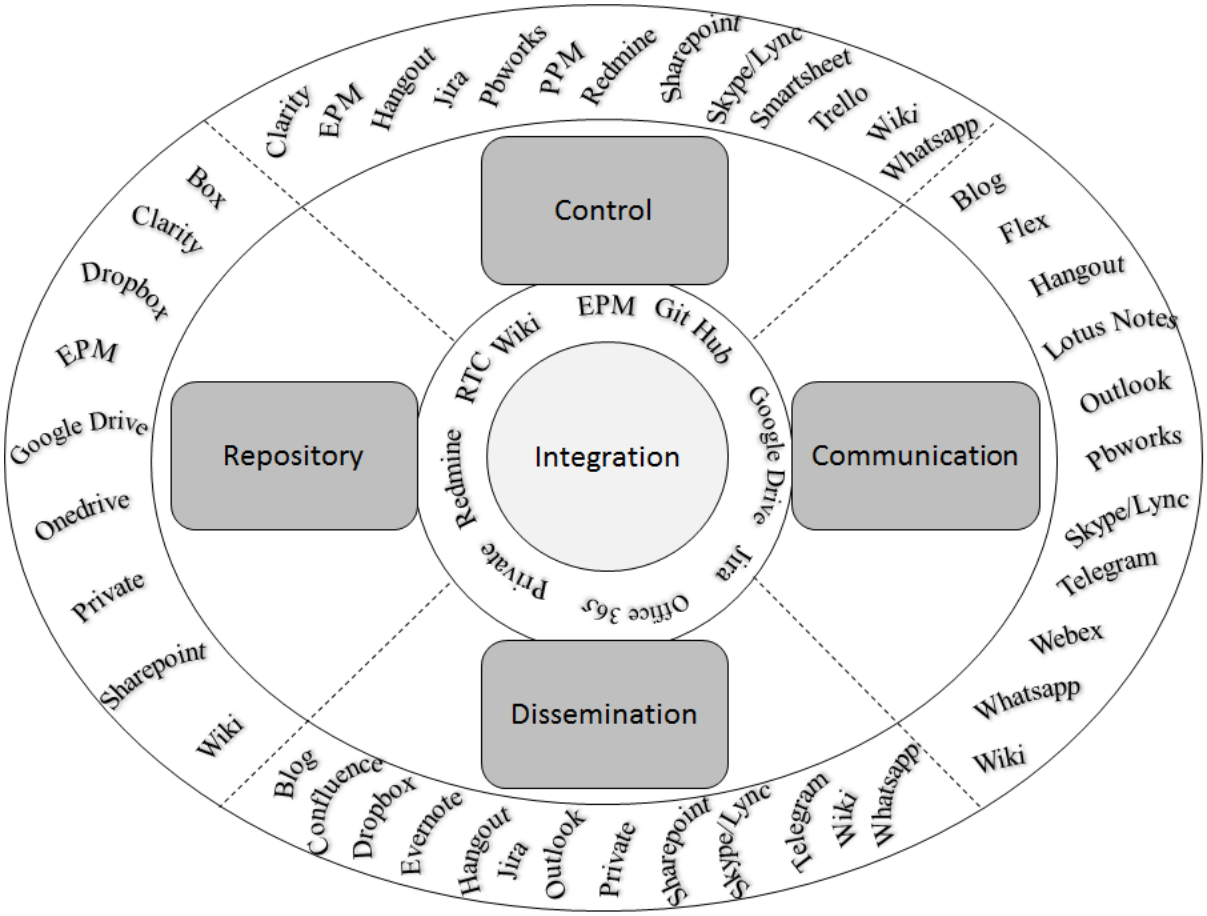


Figure 21: SM4PM - a prescriptive framework for guiding integrated use of SM in PM
Source: Ikemoto (2017, p. 71)

Ikemoto (2017) research gave theoretical and practical contributions to the academy. As an originality outcome, the author left as a legacy, a framework that guides organization to use SM to support PM and additionally, proposing SM in integrated mode to support PM activities. As a practical contribution, Ikemoto (2017) plotted SM tools in the SM4PM framework as a recommendation so that organizations can adopt the tool set that fits their needs.

In short, Figure 22 exhibits the main aspect of each framework presented in this theoretical background, allowing comparison among them. Each framework meets different needs but in the essence, frameworks can attend multiples needs, as some frameworks authors affirm.

Framework	Purpose	Strong points	Weak points	Authors
Communication	Project communication	Aligned with organization strategy. Provide communication governance and efficiency. Knowledge published in SM can be recorded and used for trend analysis.	Lack of SM. Seems to be a template for communication knowledge area	Dokkun and Ravesteijn (2016)
KM in PM	Cross project phases with types of knowledge and describe specific knowledge activities to be executed for the related actor.	Adds knowledge component to traditional PM procedure.	Lessons learned are recorded on go-live.	Lech (2014)
Knowledge-pull framework	Blend knowledge from projects into a PM methodology.	Centralized KM function and decentralized KM update in the repository and to project team.	Lack of SM	Bell et al. (2016)
WikiRiskMan	Based on a SM platform, wiki, in the intention to support project risk management.	Communication many-to-many. Decrease information overload by a technological support.	Still under only one tool.	Câmara et al. (2015)
Integrate PMIS with (SCEM) and (PDM)	Join project and documentation management with a Control Tower that triggers a sequence of action and gives alerts	Reduction of time to problem resolution, identify and alert process that is out of track, update technical documentation, reported problem linked with project documentation and facilitates document retrieval	No consideration communication among team members and stakeholders. Focused in operation.	Braglia and Frosolini (2014)
Syllk (Systemic Lessons Learned Knowledge)	Distribution of organization know-how	Connection of people and system	Lack of SM application	Duffield and Whitty (2016)
Roadmap with three main components: key elements, action and implementation guide.	Understand lessons learned mechanism	Tools list required to each process, mixed with traditional and technological tool	Did not aim the technological tool usage	Carrillo et al. (2013)
SM application model from a knowledge-creation perspective	Understanding patterns and propositions with SM usage	Facilitates organizations design a knowledge-creating portfolio, align with business objective	Lack of a link with PM	Shang et al. (2011)
Target	Validate a collaborative model with SM in which lessons learned processes were supported by SM in IT projects	SM tools that are bringing more benefits to each LL processes. LL processes should be made during the whole project lifecycle. Decrease knowledge drain problem	It raised issue on individual attitude in decision making of the LL use	Rosa et al. (2016)
Ballistic 2.0 (Ba Lessons Learned Information Technologies 2.0)	Enhance lessons learned processes supported by SM.	Working LL during all phases of the project.	A two layers' framework hinders the SM applications to support the model.	Chaves et al. (2016)
SM4PM (Social Media for Project Management)	Create a collaboration environment and increase productivity by the support of integrated SM in project management	Guides organization to use integrated SM to support PM. Tools recommendation for each framework category.	Aimed to PM activities. Lack of KM or LL process link. Lack of project lifecycle link.	Ikemoto (2017)

Figure 22: Frameworks summary
Source: Author

Analyzing Figure 22, Dokkun and Ravesteijn (2016) framework was constructed to a specific knowledge area. Bell et al. (2016) proposed a macro framework overview with minimum activity understanding. Shang et al. (2011) presented a deeply acquaintance about knowledge process, but with lack of PM link. Lech (2014) did not solve the issue about record LL only in the closing phase. Câmara et al. (2015) used a single tool that performs the integration amount of SM applications, against technological autonomy. Braglia and Frosolini (2014) focused on operation, suggesting that it could be good for execution phase. Duffield and Whitty (2016) and Carrillo et al. (2013) did not bring contribution with technological application. Although Rosa et al. (2016) framework was for LL process, it could be expanded to KM. In addition, the design of the framework is not so intuitive, and may lead to a misunderstanding of the way KM can be executed in the PM.

On the other side, Chaves et al. (2016) proposed an intuitive framework that can be expanded to support KM in PM activities and covers the entire project lifecycle. Nevertheless, it did not bring the benefit of the integration of SM. Lastly, framework of Ikemoto (2017) is simple, focused in the integrated use of SM to support KM in PM activities but it needs to be linked with project lifecycle. Taking into account the frameworks analysis, the current research could elect Chaves et al. (2016) or Ikemoto (2017) framework as an artefact to be instantiated for the current research.

The decision making about choose Ballistic 2.0 by Chaves et al. (2016) or SM4PM by Ikemoto (2017) considered the possibility the framework adaptation for the current research's needs. The modification to be made in Ballistic 2.0 would be to aggregate SM integration into the framework. On the other hand, it is necessary to enfold SM4PM in the project lifecycle. Ballistic 2.0 is a two layers' framework. Aggregating integrated SM in Ballistic 2.0 could turn framework more complex causing a barrier to its use. Therefore, the current research selected SM4PM framework as an artefact to be enhanced and evaluated. With the purpose to support KM in activities of PM in the whole project, the author of the current study enfolded SM4PM framework in project lifecycle.

The knowledge acquisition is made by means of to collect explicitly knowledge from organization (Gasik, 2011) or learning from experience (Ahern et al., 2014). Due to childhood memories, individuals associate LL with unsuccessful experiences. Repositioning LL as knowledge takes away the stereotype allowing for less conflicting knowledge collection throughout the project life cycle. From this point of view, SM4PM can support KM in PM activities. The following are the methodological steps to achieve the goals of this study.

3 RESEARCH METHOD

The design of this research shows the strategy of the route that should be followed to achieve the objectives of this study: to evaluate the integrated use of SM support KM in activities related to PM in a project of a public security organization. These objectives have a direct relationship with action in the real world. One fact is that the framework is constructed by a theoretical background. This fact makes the framework to be ensured of its usability and brings valuable data for application of theory and assessment (Weber, 2010). Another fact is the result of a creative framework applied in a real word. Since it is prescriptive and generalizable, it can solve a class of problem, closing a gap between theory and praxis, being one more source of managerial knowledge (Aken, 2004). In that sense, this study was conducted by Design Science Research (DSR) approach and Technical Action Research method.

3.1 DESIGN SCIENCE RESEARCH

Design Science Research (DSR) has been an important paradigm and the use as been an approach is increasing (Gregor & Hevner, 2013). Some authors make distinctions about Design Science (DS) and Design Science Research (DSR). According to Dresch, Lacerda and Antunes (2015), DS is a science of the construction of the project (artefact) and DSR is a method to conduct the research.

Conversely, Wieringa (2014) conceptualize DS as a design and investigation of artefact in context and Gregor and Hevner (2013) defined DSR as a construction of a wide range of socio-technical artefacts. Those controversial views are smoothed by Goes (2014), editor-in-chief of MIS Quartely journal, that uses DS and DSR as a synonymous. The present study consider DSR as an approach, following Gregor and Hevner (2013) and uses the designation DSR with the conception of Wieringa (2014).

DSR intends to treat a real problem by an artefact (technical instrument) based on theory and previous research, having a desired interaction with problem context, likewise allow to instantiate it (Wieringa, 2014). The artefact should be assessed by its ease of use, usability and convenience (Yoon & Kim, 2007). According to Wieringa (2014), DSR has two sequential cycles: a design and an empirical one. Design cycle is related to the artefact development that consists in investigate the problem and give a treatment design and validation. Empirical cycle is related to the artefact and its interaction with the context, improving it to a best stage by

people, leading to a two more research veins in the DSR methodology: design questions and knowledge questions.

Design questions investigate the artefact as solution promoter in a context. Investigation takes into consideration the project, the context interaction, design validation and the implementation evaluation by the artefact (Wieringa, 2014). Knowledge questions investigate the social context where the artefact is inserted, examining the stakeholders, risks and acceptance (Wieringa, 2014).

Figure 23 illustrates the DSR framework. Visually, the framework has two contexts. Social context is related with stakeholders who may be affected by the artefact: users, maintainers, sponsor and others that is involved with the use of the artefact (Wieringa, 2014). Stakeholders issues are related with goals and budget that the artefact will reach. Knowledge context is an existing theory from where the artefact was constructed to meet stakeholders' needs. The artefact should be designed with existing problem solving, lessons learned and news design, answering the stakeholders' necessity, solving the problem and at the same time, being efficacy.

Lower side of the Figure 23, shows the research goals of the DRS. The left side deals with the issues and with the artefact that propose a solution to the context. The objective is to find a solution designing and redesign the artefact, looking for an answer for to reach the artefact objective, based on theory. The right side considers the interaction of the evolution of the artefact and its application in the real world, considering the stakeholders goals (solve problem satisfying the users' chain).

Although there are specific steps for each face of the framework, there is a need for interactions between both sides (social context and knowledge context|). The DSR proposed in this framework is concerned not only with validating an artefact (technological instrument) but also bringing to the knowledge of the academy, as this conjugates the technician with human relationship.

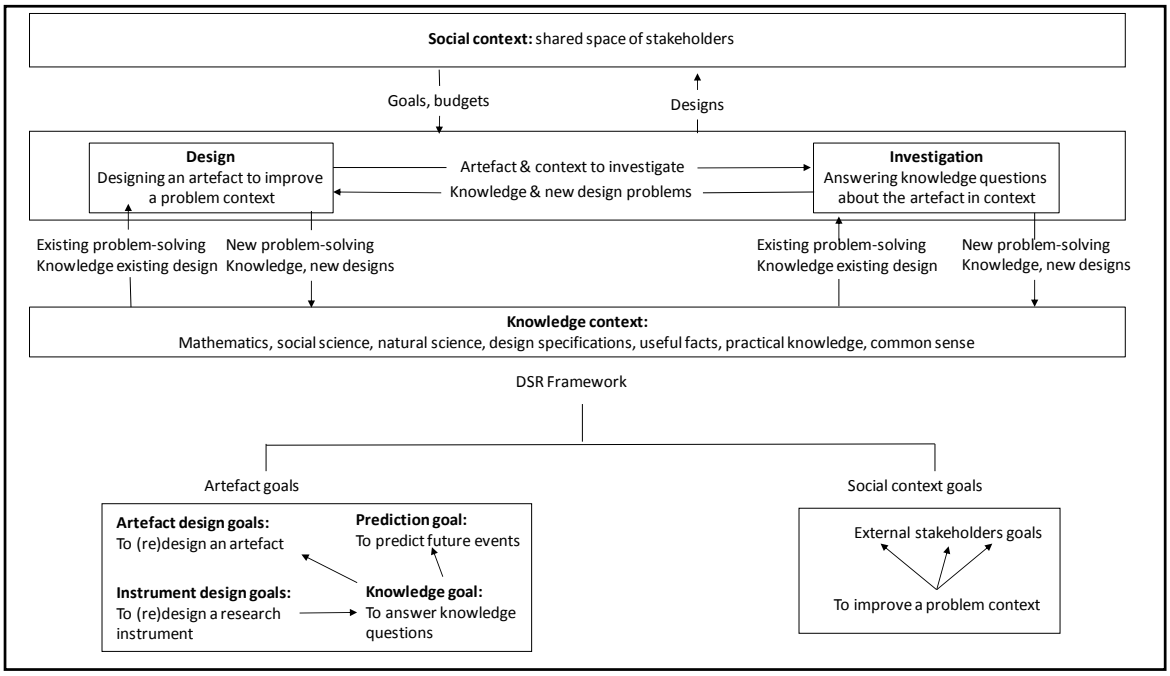


Figure 23: DSR framework
Source: Adapted from Wieringa (2014)

3.2 TECHNICAL ACTION RESEARCH

Action research integrates researcher action in the research (Dick, 2007). The action made by researcher brings understanding, giving the chance to observe the phenomena and participate in it (Baskerville, 1999). When this action is technical (artefact driven), it is called Technical Action Research (TAR) (Wieringa, 2014). As the researcher has a participative role, he studies the problem, plan and implement the action, and reflect on the result to construct the phenomenon understanding gradually (Dick, 2007).

A participative researcher matches the DSR goals since the artefact should be developed and instantiated in collaboration with the practitioners. The researcher benefit is the opportunity to develop an artefact and scale it up from desk to practice, learning from it (Wieringa, 2014). The same way, practitioners acquire knowledge, experience and potential useful result. An inner benefit is a university and organization relationship improvement (Wieringa, 2014).

The researcher plays three important roles in the TAR. As a designer that architects the artefact and its implementation, a helper supporting the artefact use and teaching the techniques, and a researcher catching the data to analysis and drawing the lessons learned (Wieringa, 2014). An important issue is to execute researcher's roles separately for not impair the quality of the research.

In the researcher designer role, problem is investigated to propose a treatment design by an artefact. After the artefact implementation action, researcher empiric role executes the research observing the field in the intention to analyze the context and find the evidence of the validations of the artefact. If the field's actor need instructions or if the researcher perceive that the artefact has the necessity to be improved, the researcher helper role emerge to solve this point. After to attend helper and design roles, researcher always return to the empiric role, avoiding making field interference. The research roles and the TAR steps are depicted in Figure 24.

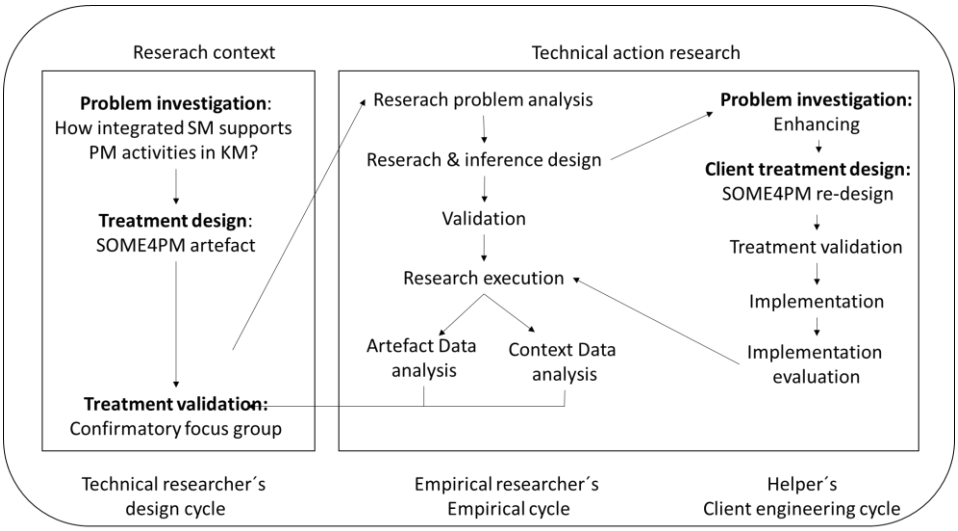


Figure 24: TAR activities
Source: Adapted from Wieringa (2014)

3.3 RESEARCH STAGES

Data quality is essential to give confidence in the findings and this is achieved by the rigor of the method. Collecting data in a systematic way allows the researcher to classify concepts in the purpose to understand the constructs. Thus, academy knowledge is mapped and areas where more studies are necessary arise (Petticrew & Roberts, 2006). These aims were achieved by a systematic literature review (SLR) as a previous research stage for current study.

The SLR evidenced that SM role in the KM. Six dimensions emerged and insights allowed the construction of a Holistic Knowledge Funnel (HK Funnel). HK Funnel presents the strong link between KM and SM simplifying knowledge flow understanding.

Complementing, the current study presented the results of the Ikemoto (2017) literature review that reflects the use of SM in PM activities. Crossing the result of the both literature

review, it was emerged that SM support both activities in PM and KM, enabling the use of the SM4PM artefact and the KM investigation in PM.

In this purpose, the current study based its research stages on Peffers, Tuunanen, Rothenberger and Chatterjee (2007) research about a 15 years of a DSR in the Information Systems (IS), which are: 1) problem and identification, 2) objectives of a solution, 3) design and development, 4) demonstration, 5) evaluation and 6) communication. These research stages are a synthesis of DSR process (Peffers et al., 2007).

The current study included more two study to update the synthesis of DSR process by Peffers et al. (2007). This update is also in line with the six DSR process stages. One study included was Gregor and Hevner (2013) who contributed to the publication of a scheme that helps researchers in DSR. Another study belongs to Wieringa (2014) that showed two interesting views in the DSR: the design assessment and the social context's investigation. Design assessment is adherent to the seminal uses of DSR that was created to validate and evaluate artefacts. Social context's investigation goes to meet the academy claims, giving a qualitative approach that contributes to social knowledge. For this reason, the author of the current study followed Wieringa's (2014) procedure. Figure 25 presents a synthesis of DSR processes.

		Common design process elements					
Authors		**1. Problem identification and motivation**	**2. Objectives of a solution**	**3. Design and development**	**4. Demonstration**	**5. Evaluation**	**6. Communication**
Archer (1984)		Programming Data collection		Analysis synthesis development			Communication
Takeda, Veerkamp, Tomiyama, and Yoshikawam (1990)		Problem enumeration		Suggestion development		Confirmatory evaluation	
Eekels and Roozenburg (1991)		Analysis	Requirements	Synthesis, tentative design proposals	Simulation, conditional prediction	Evaluation, decision, definite design	
Nunamaker, Chen, and Purdin (1991)		Construct a conceptual framework		Develop a system architecture Analyze and design the system Build the system	Experiment, observe, and evaluate the system		
Walls, Widmeyer, and El Sawy (1992)		Meta-requirements Kernel theories		Design method Meta design		Testable design process/product hypotheses	
Rossi and Sein; Cole, Purao, Rossi, and Sein (2003)		Identify a need		Build		Evaluate	
Hevner, March and Park (2004)		Important and relevant problems	Implicit in "relevance"	Iterative search process artefact		Evaluate	Communication
Gregor & Hevner (2013)		Problem definition. Literature, method	Requiriments	Description of the designed artifact		Criteria of validity, utility, quality, and efficacy	Publication schema
Wieringa (2014)	**Design**	Problem investigation	Improving a problem context	TAR	Instantiation	Perform inference	
	Context	Problem analysis	Knowledge questions in social context			Qualitative	Communication

Figure 25: DSR procedure by author
Source: Adapted from Peffers et al (2007)

This current study used an artefact that had been designed and validated in the scientific literature as a prior knowledge (Wieringa, 2014). By doing so, the design cycle is considered done and this study will conduct the empirical cycle in TAR methodology in order to assess the necessity of refinement. Research steps that was just explained is summarized in the Figure 26.

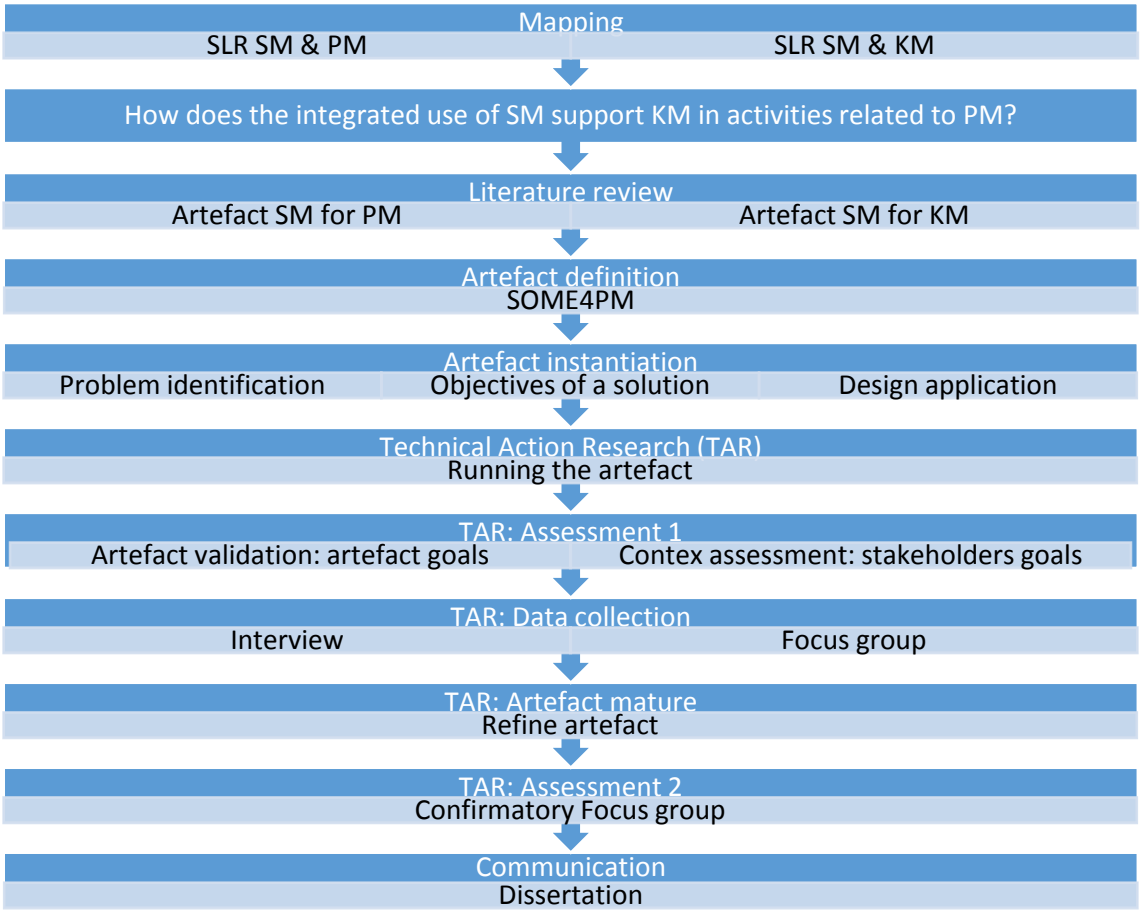


Figure 26: Research steps
Source: Author

Organize the research is a best practice that gives consistency of the planned intervention, avoiding misconceptions in the chaining and makes clear the view of the results presentation (Telles, 2001). 'Matriz de Amarração' created by Mazzon (1981) was elaborated to show the research design in Figure 27. This matrix exhibits objectively and visually the relevant way to reach the answer to the research question. The research stages are based on the Peffers et al. (2007) DSR procedure and it is presented in the column Research Stages in the 'Matriz de Amarração'. The checklist is presented by Wieringa (2014) and it is being used to design the research. Figure 27 presents the research design for this study linking for each objective, research instrument, data collect instrument and analysis technique.

Main objective	Specific Objective	DSR Cycle (Wieringa, 2014)	Research stages (Peffers et al., 2007)	Research setup	Checklist (Wieringa, 2014)	Research instrument	Collect/Data analysis technique
Evaluate the KM in PM through the instantiation of an integrative use of SM framework that supports PM activities	Instantiate the SM4PM artefact	Design cycle	Problem identification and motivation	Identify a gap	-	Systematic literature review	Articles
				Problem awareness	-		
				Identify a artefact	-	Literature review	Identify, compare and select framework
				Acquisition of the object of study (OoS)	-	Partnership agreement	-
				Problem requirement	What is the problem to be solved?	Interview	Content analysis
					What are the stakeholders' goals?		
			Objective of a solution	Solution requirement	What is the artefact's requirements that motivated the stakeholder's goal?	Interview	Content analysis
			Design and development	Treatment design (customization)	-	-	Selected framework
				Instantiation of the framework - setup	Which treatment will be applied?	Interview	Content analysis
					Which treatment instrument will be used?	Interview	Content analysis
					What is the treatment schedule?	Interview	Content analysis
					Treatment design validation?	Interview	Content analysis
				Measurement design	Variable and constructs to be measured?	Interview	Content analysis
					Data source?	Interview	Content analysis
					Measurement instrument?	Interview	Content analysis
					What is the measurement schedule?	Interview	Content analysis
					How will the measurement be stored?	Interview	Content analysis

Main objective	Specific Objective	DSR Cycle (Wieringa, 2014)	Research stages (Peffers et al., 2007)	Research setup	Checklist (Wieringa, 2014)	Research instrument	Collect/Data analysis technique
					Measurement design validation?	Interview	Content analysis
Evaluate the KM in PM through the instantiation of an SM integration framework that supports PM activities	Assessment and refine the artefact Investigation the effects of the artefact in the context	Empirical cycle	Demonstration	Assessment of the artefact and context	What happened when the object of study was selected?	Observation	Content analysis
					What happened during sampling?	Observation	Content analysis
					What happened when the treatment was applied?	Observation	Content analysis
					What happened during measurement?	Observation	Content analysis
			Evaluation	Analysis	Data preparations applied?	Checklist	Content analysis
					Data interpretation?	Register	Content analysis
					Descriptions validations?	TAM	Content analysis
					What explanations exist for the observations?	Focus group	Content analysis
					Would the explanations be valid in similar cases or populations too?	Theoretical background	Content analysis
					What are the answers to the research questions?	Confirmatory focus group	Content analysis
			Communication	Declaration of results	-	Master Dissertation Articles	-

Figure 27: Research Plan (Matriz de Amarração, in Portuguese)
Source: Author

The selected organization is Polícia Militar do Estado de São Paulo (PMESP), a governmental public security institution. PMESP has 83 799 military police in active, covering 645 cities in São Paulo State with a budget of R$ 14.185.271.187,15 for the year 2017 (Lei 16.347, 2016).

The organizational structure follows the Presidency of the Republic of Brazil. The general commander is accessed by *Estado Maior*, that is responsible for the plans and corporation's operations, elaborate and execute action plan for the general commander, make the follow-up about goals and evolution of the corporation, transform decision make in command, take the necessary steps to achieve the objectives and prepare, observing the regulatory precepts, instructions of instruction to be downloaded by the General Commander, determining the details of organization discipline and execution of all activities of the Corporation (Decreto N. 7.290, 1975).

This study occurred in the 6a *Seção do Estado Maior* (6ªEM/PM), an *Estado Maior* division that has the purpose to disseminate a new managerial philosophy to Total Quality with the following subsections: budget management (budget planning and project management); strategic management (quality management, strategic planning and management control); standardization; process analysis and improvement (Decreto N. 7.290, 1975).

PMESP has the following prerequisite which makes it eligible to this study: there is a PMO that maintains project management process orderly, with a reporting system established that uses a project report framework, where the responsibilities are addressed and have a data collection, analysis and distribution method (Todorović et al., 2015). Moreover, PMESP launched their Project Management Methodology in January 20th, 2017, which motivated to contribute to the current research.

The chosen project to be instantiated the artefact was the New Organizational Climate Survey Project. Besides the benefits to Government and PMESP, the output brings improvement of the quality of services provided by PMESP to the citizen. This project is aligned with the strategic objective of the multiannual plan 2016-2019, number 11: innovative and efficient public management, committed to the planning and execution of quality public programs and services, which describes the importance of promoting actions that increase the quality of public services, by ensuring transparency and efficiency in the processes and use of human, material, technological and financial resources. The project aims to restructure the organizational climate survey process in PMESP, developing a new questionnaire and multiplatform computerized system. Thus, the project is expected to deliver: redesign and work

instructions of the approved organizational climate process; computerized multi-platform system homologated and apply a pilot. Ten members compose the project team: sponsor, PMO manager, project manager, project manager (substitute) and six team members. The duration of the New Organizational Climate Survey Project was eleven months.

3.3.1 SM4PM ARTEFACT INSTANTIATED

The unit of analysis of the present study is the SM4PM in the context. The instantiation process of SM4PM started by an interview with PMO manager and project manager to explore the problem to be solved. In updated scenery, PMESP uses Enterprise Project Manager (EPM) platform to control projects. EPM integrates collaborative tools for project control (MS Project), repository of project documentation (Sharepoint) and a chat (Sametime). Although chat is for informal communication, PMESP often uses it as formal communication showing the evidence that there is a lack of collaborative 'ba' to transfer knowledge. Also, another communication tool used is Lotus Notes. When a team member is allocated to a task, automatically an e-mail by Lotus Note is addressed. Lotus Note is used for formal communication and it is asynchronous, performing a passive communication. Besides, Lotus Note does not have a practical manner to record the team member communication, in which harms knowledge analysis and registration. The PMESP Project Management Methodology gives organizational knowledge about project to project team.

During problem investigation, PMO manager also presented another platform called PM Social. PM Social is the nickname of an IBM Connection platform. PM Social runs a social role in which community can open itself to transfer knowledge. In PM Social, individual creates communities to join another individual to discuss around common subjects. In this purpose, participants have blogs, wikis and documents repositories integrated in the PM Social platform. Individuals use it more for social subjects than professional one.

One strong issue pointed by interviewees was lack of knowledge dissemination. Although project information is stored in Sharepoint in EPM platform, EPM does not have a virtual place to present in a structured and focused way, the knowledge from the project.

Synthesizing, PMESP has two platforms: EPM and PM Social. EPM is a platform constructed under collaborative strategy. The project control role is well executed by this platform but it fails to leave lessons learned to the organization. On the other hand, while PM

Social is a well-structured platform to present knowledge, discussing and enhancing it, individuals are not engaged to use it for professional purpose.

Once the PMESP problem is mapped, under DSR approach, a solution should be presented by an artefact. Analyzing the problem, solution comes by combining both platform. PM Social will contribute with EPM to complete the knowledge transfer process. In this purpose, the artefact selected SM4PM (Ikemoto, 2017) was instantiated. This artefact has four categories of SM tools for PM: communication, dissemination, repository and control. EPM integrates three categories: 1) control, 2) communication and 3) repository and PM Social was used to dissemination category.

Communication and dissemination tools for PM support process of knowledge creation and knowledge transfer. Communication category has a set of tools to execute an active communication where knowledge flows allowing the SECI mechanism (Takeuchi & Nonaka, 2008) in which knowledge is transferring between individual, group or organization. The combination and re-combination of tacit-explicit-tacit knowledge enhance it, creating a new knowledge. For this tool category, communication, the SM4PM was instantiated with two SM tools. One is Lotus Note that is already integrated in EPM and it is used for formal communication. The second is WhatsApp, in substitution of Sametime. WhatsApp is an instant and organic communication tool, a channel where informal communication flows. By this channel, the knowledge can be presented and discussed in real time. In WhatsApp, it is easy to record the whole dialog in the repository because WhatsApp application has this affordance. Sametime, an instant communication tools that is already integrated in the EPM will not be used because it is difficult to record the content and individuals misuse it as a formal communication. The proposition to modify this culture would take time.

The category dissemination is instantiated with a Blog in the PM Social platform. According to Ikemoto artefact (2017), dissemination category tool for PM is used for knowledge that is already explicit. This category tool completes the knowledge transfer process. The interaction is asynchronous where individual goes seeking knowledge and can contribute discussing and enhancing it.

Repository category tool store the knowledge base, a virtual place where project and management documentation is placed (Ikemoto, 2017). This SM tools for PM supports processes of knowledge store and retrieve. The SM4PM repository SM tools category was instantiated with Sharepoint, the tool that is already integrated in the EPM platform.

Knowledge application process in KM is the use of knowledge. In this current context, the use of knowledge in PM. Using best practices in PM, a knowledge that is already available increases the chance of the success of the project (PMI, 2013). The output of control a project is a way to assess if the knowledge application occurred. In this view, category tool for Control in SM4PM artefact was instantiated by MS Project, an expert software that manage the project.

The same way as PM process group, KM processes are not sequential. Both PM and KM processes happen during the whole project lifecycle. Knowledge creation, transfer and application process flow constantly as project activities are dynamic. The purpose of the SM4PM instantiated is capture the knowledge of the project by the SM tools used in PM during the whole project lifecycle, attending PMESP needs. Representing the knowledge flow capacity, the edge of the SM4PM artefact was turned dotted line, delimited by Project Lifecycle, as shown in Figure 28.

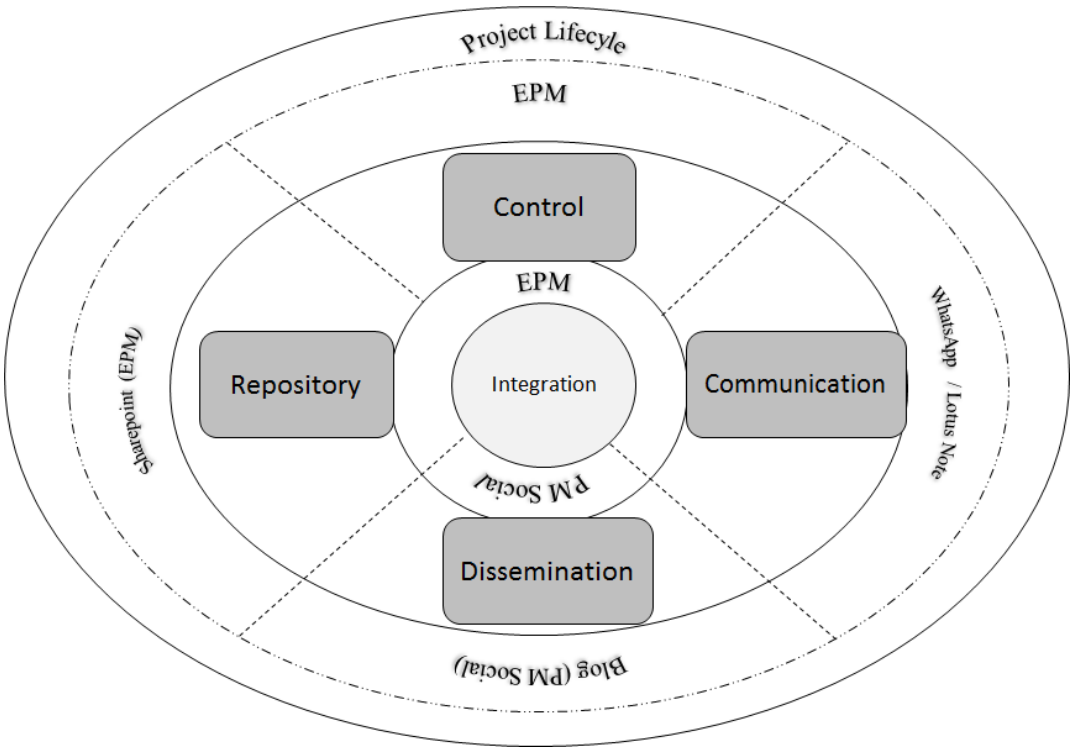


Figure 28: SM4PM artefact instantiated in PMESP
Source: Author

Once the artefact was instantiated, it was applied at the project. The New Organizational Climate Survey Project is not only sponsored by 6ªEM/PM but also this PMESP's section has the responsibility to apply it in the whole organization. The old Organizational Climate Survey was very extensive to answer. Besides, the survey showed the instant photography of the

situation but did not give the opportunity to make a new small survey in the area that some action was made to enhance the climate. As a result, even if an action was made, it could not be measure. The lack of the feedback of the survey lead policemen do not trust in it. The goal of this project is to recover the policemen trust in this strategic instrument and allow them to answer remotely by smartphone, tablet or even in their personal computer.

The requisite of the project was elaborated by 6ªEM/PM and the development of the system is the responsibility of the Software Factory, a Data Processing Center division. According to the project manager of the New Organizational Climate Survey Project, in the initiating, planning and execution phase of the project, few information's exchange happens among team members. This is the characteristic of PMESP military system. Communication is made by e-mail with Lotus Note between project management, Captain of the 6ªEM/PM and the Lieutenant responsible for the Software Factory. Hierarchy order the communication flow. Complex issues are discussed in a meeting with the presence of the principal representatives.

Military are driven by mission: given mission is accomplished mission. The New Organizational Climate Survey Project has fifteen system maintenance report with the requisites of the project. Since the mission to develop the new survey system and requisition is given, the Software Factory executed the project with few exchanging communications. The project control is made by the situation report. If schedule begins to scape, the communication is restored.

The instantiated artefact SM4PM was applied in the validation of the requisitions of New Organizational Climate Survey Project. The goal of this part of the project is to collect and register, fast and easy, the inconsistencies of the project with the most volunteer's interaction as possible. First, project manager thought to test the new survey system only with project team. But the responsibility to recover trust brought the necessity to stress the test of the project. The project manager decided to ask all people from 6ªEM/PM to participate in what he called First Wave of Test. A community called New Organizational Climate Survey was opened in the PM Social and the project requisites, the fifteen-systems maintenance report were stored there. Additionally, it was mounted a WhatsApp group with project team members, sponsor and the participants of the First Wave of Test, with the total of 32 participants.

In total, 28 military from 6ªEM/PM participated and the instruction was given in a meeting. The test consisted of answering the New Organizational Climate Survey using different platforms (Windows Chrome, Firefox and others) and equipments (smartphone, tablet and personal computer). During the test, if some inconsistency happened, it should be reported

in the WhatsApp group or in the community of PM Social. If some participant had doubt about the requisites, he could recover it in the repository of PM Social. The First Wave of Test lasted a week.

3.3.2 DATA COLLECTION TECHNIQUES

Four data collection techniques were used in this current study: 1) semi-structured interview, 2) direct observation, 3) document analysis and 4) focus group. Each method has a specific rule and objective to collect data.

The literature on Project Knowledge Management (PKM), Social Media (SM) and Frameworks show a variety of approaches that is being used to the current study. An initial research stage begins collecting deep impression and practitioners' perceptions about issues that involves the research objective by means of a data collection tool, the interview. Interview is a direct interaction, face-to-face in real or virtual environment, between researcher and practitioner (Yin, 2016). It was used a semi-structured interview that follow a script in which new questions could be included. This kind of interview promotes a social relationship. With more open questions, practitioners had the opportunity to use their own words to discuss the theme proposed by the researcher and a consistent and relevant report was possible to emerge (Yin, 2016). The number of interviews was considered enough when the answers returned with no new information. On the other hand, new interviewees can be invited if they have new contribution to be added. The interviewees were chosen by convenience considering, experience, subject interest and project role.

At the beginning of the interview, the current researcher explained the main research concepts and asserts to the practitioner. In an informal environment, the researcher made a self-presentation and explained the researcher work, objective and interview dynamics. At the same purpose, participants were motivated to introduce themselves with directed questions in which participant can be categorized. It is also informed the ensure anonymity. Interview recording was made only under practitioners' permissions. Through this data collect instrument, the perception of the use of the artefact in different project process was compiled. These impressions guided the adjustments of the instantiated artefact to reach a better outcome.

Interview protocol was based on the Yoon and Kim (2007)'s study. By means of TAM (Technology Acceptance Model), the SM4PM instantiation was evaluated in its ease of use, usability and convenience in each framework dimension, as presented in Appendix A.

Nineteen participants composed the interviewees sample, as depicted in Figure 29. Except interviewee I10, all participants are military. The average age is 39 years with the average years dedicated to PMESP around 18 years. The experience in PMESP indicates that this sample are well adapted with military system. The total duration of interviews was more than 14 hours with the average of 46 minutes per interviewee. These recording were transcribed and marked with timestamp in the interview talk to secure the accuracy of the conversation and capture the emotion and behavior of the interview moment. The longest interviews were made with team members who worked with the entire instantiated artefact.

Codename	AGE	Years in PMESP	Dept.	Years in Dept.	Graduation	Eduaction level	Role in PCO project	Experience in Project	Experience comproved by	Interview duration
I1	43	24	EM/PM	12	Captain	Master	Project Manager	Y	Project manager	1:16:26
I2	28	10	Software Factory	3	Lieutenant	MBA	PO	Y	Team member	0:24:22
I3	44	24	EM/PM	5	Captain	Master	User	Y	MBA	0:25:18
I4	41	22	EM/PM	0	Captain	MBA	User	N		0:41:00
I5	41	20	EM/PM	7	Cabo (*)	MBA	Team member	Y	Team member	0:40:40
I6	40	19	EM/PM	6	Sergeant	College	User	Y	PMO collaborator	1:05:44
I7	31	8	Software Factory	1	Soldier	Graduated	PO	N		0:34:22
I8	44	27	EM/PM	2	Lieutenant Colonel	PhD	Sponsor	Y	Sponsor	0:55:19
I9	33	11	EM/PM	1	Soldier	Graduated	User	Y	PMO collaborator	1:06:38
I10	29	4	Software Factory	4	Civil	Graduated	Developer	N		0:37:28
I11	41	24	EM/PM	1	Captain	Master	User	Y	Team member	0:34:49
I12	44	24	EM/PM	0	Cabo (*)	Graduated	User	N		0:32:15
I13	42	25	EM/PM	12	Major	Master	User	Y	PMO Manager	2:26:48
I14	44	25	EM/PM	2	Major	Master	User	Y	Team member	0:30:49
I15	37	15	EM/PM	5	Sergeant	Graduated	User	Y	Team member	0:45:21
I16	33	11	EM/PM	3	Sergeant	Graduated	User	N		0:19:22
I17	41	21	EM/PM	1	Sergeant	Graduated	User	N		0:52:50
I18	40	20	EM/PM	2	Lieutenant	Graduated	User	N		0:25:44
I19	38	15	EM/PM	0	Sergeant	College	User	N		0:23:46

Figure 29: Interviewees profile
Source: Author
Note: the symbol (*) indicates that there is not a corresponding graduation in English

Another factor analyzed in the participants profile is the time working by department. Figure 30 illustrates the average, mode and median time per group. Considering the total of the sample, average time dedicating in these departments, 6ª EM/PM and Software Factory is 3,5 years, mode is 1,0 year and 3,0 years as a median. 6ª EM/PM has average of 3,7 years and median in 2,5 years but mode with 12,0 years, which indicates that seniors in this department guide the less experienced ones. Although Software Factory average and median is not so high, both project members group and PMO showed to be more experienced with average in 7,3 years and median 7,0 years for project member and average in 6,3 years and median in 6,0 years, which is expected from who is responsible for the PMESP strategy.

Measures of descriptive statistics (years)	Sample	6ª EM/PM	Software Factory	Project members	PMO
Average	3,5	3,7	2,7	7,3	6,3
Mode	1,0	12	-	-	-
Median	2,0	2,5	3,0	7,0	6,0

Figure 30: Years of experience by department
Source: Author

The education level of the sample is high, as showed in Figure 31. Only two interviewees that's represent 11% of total sample does not have graduation. This fact demonstrates the concern about the professional individual improvement of the organization.

Education level	Sample	6ª EM/PM	Software Factory	Project members	PMO
PhD	5%	6%			
Master	26%	31%		33%	33%
MBA	16%	13%	33%	67%	
Graduated	42%	38%	67%		33%
First school	11%	13%			33%

Figure 31: Education level of the sample
Source: Author

The result of the interview was presented to two focus groups that were carried out with seven practitioners in the focus group 1 (FG1) and seven practitioners in the focus group 2 (FG2). Focus group is a group discussion formed by individuals with common experience that participated in the project, whose group interaction will bring consolidated knowledge, which is not possible from individual interviews (Flick, 2010; Yin, 2016). The composition of each confirmatory group is listed in Figure 32.

FG1	FG2
I2, I3, I5, I9, I11, I13, I15	I1, I7, I10, I12, I14, I18, I19

Figure 32: Composition of the focus group
Source: author

The researcher was the group moderator and had the responsibility to keep group dynamic and interest in the discussion, allowing all participants to interact evenly. In focus

group, to validate the SM4PM instantiation, it was evaluated by the value perception and contribution of KM in PM. In addition, some piece of advice may arise from the discussion group.

Results of FG1 and FG2 gave contributions that were applied to mature SM4PM instantiated artefact. Once again, the artefact was presented to two confirmatory focus groups.

After finished the interviews, the researcher codified and organized data from interviews to find meanings and themes that represent the interviewers' experience in the SM4PM artefact instantiated. The codification was carried out with the support of a MaxQdaPlus software. The confirmatory focus group protocol was constructed over SM4PM instantiation assessment with the result of the interviews. Two focus group gave insurance about the findings, avoiding research biases (Tremblay, Hevner, & Berndt, 2010). The focus group protocol is described in Appendix B .

During the research, the activities and the observations were recorded in a field journal. Following the registration of knowledge dissemination during project lifecycle and observing the individuals behavior, it will emerge evidences, confirming or bring new issues, complementing qualitative research method (Yin, 2016). The guarantee of the rigor of the research is given by the relevance of the observations. Avoiding biases and lack of representativeness, observations should be made on multiple occasions (Yin, 2016). Appendix D presents the observation protocol that was used to construct the field journal based on Souza (2016). This protocol was chosen because the author made a research in the same approach of the current study, design science.

Lastly, collecting artefacts, documents, reports, print screen or even notes from documents that cannot be copied, bring value data about real and social environment (Yin, 2016). Data from interviews can be influenced by reflexibility (influence over the participant or the participant over the researcher). Documents are not subject to reflexivity but it is necessary to pay attention of the motivation for the document generation (Yin, 2016) because documents are produced for someone, for some propose to someone else (Flick, 2010). These will unveil the document subject and will bring light to the research. Document analysis protocol is depicted in Appendix E.

3.3.3 DATA ANALYSIS TECHNIQUES

Assuring the research rigor, it is necessary to verify frequently the data accuracy and make an in-depth analysis, avoiding researcher biases (Yin, 2016). Data collected from field are distributed in field notes, documents, print screens, transcriptions from the individual interviews and focus groups (Ritchie & Lewis, 2003). Data should be organized so that the main idea leaps to the researcher's eye but also in a different meaning that allows researcher make connections to capture phenomena and reveal their impact in context (Bardin, 2011; Ritchie & Lewis, 2003). Data analysis requires creativity and inspiration using a systematic process. In this purpose, data was treated in a dynamic and interactive process with five stages: 1) compilation, 2) decomposition, 3) recomposition, 4) interpretation and 5) conclusion (Dey, 2003; Ritchie & Lewis, 2003; Yin, 2016).

The whole of data collected is the research database. The database should be compiled (organized) neatly defined by the researcher (Bardin, 2011; Yin, 2016). This means that compilation and classification happen at the same time. Categorization devotes to determine the meaning in context (Bardin, 2011; Dey, 2003). In the compilation, the researcher becomes more acquainted with the data and realizes that a set of data can be grouped according to concepts or categories identified (Bardin, 2011; Ritchie & Lewis, 2003).

After classification, the data is fragmented is a small piece (data fragment), which is considered decomposition, cleaning and focusing on the core meaning (Bardin, 2011; Dey, 2003; Ritchie & Lewis, 2003; Yin, 2016). A new code can be used in this procedure and it emerges from the understanding of the meaning in data analysis (Bardin, 2011; Dey, 2003). The decomposition can be made several times as a trial and error process in the intention to test the codification (Bardin, 2011; Yin, 2016) to find a better way to organize data. With this organization, data fragments can be examined by similarities, differences, regularities, variations and singularities (Dey, 2003). Numbers, in qualitative analysis, shows the importance of the concept or event and is useful for meaning analysis (Dey, 2003).

Using inspiration (Bardin, 2011; Ritchie & Lewis, 2003), data fragments are reorganized in diverse sequences (recomposition) in the purpose to find patterns that make sense with the objective of the research (Bardin, 2011; Yin, 2016) and contributes to understanding singularity (Dey, 2003). It is possible to see if the connection of fragmented data can be deduced (Dey, 2003).

Recomposition gives new material to look through. The interpretation of the recomposed data creates a new narrative about the studied phenomena (Bardin, 2011; Yin, 2016). In other words, it is possible to verify an evidence explained by data, why this happens and the nature of the connection with another event (Dey, 2003). The interaction and interconnection between events can be materialized using graphics tools and tables (Dey, 2003; Yin, 2016), effective tools for catching meaning (Dey, 2003). The qualitative analysis is slowly constructed (Bardin, 2011; Dey, 2003; Ritchie & Lewis, 2003; Yin, 2016). Sometimes a return to an earlier phase or even to the beginning of the search is necessary and beneficial since its refresh-view and can reveal other connections (Dey, 2003).

The last phase is the conclusion, which is extracted the completion of all the study related to data interpretation (Bardin, 2011; Yin, 2016). Qualitative analysis can use different approaches, depending on how the data is used and the concepts constructed (Ritchie & Lewis, 2003). However, the researcher should not allow himself to be restricted by the use of an approach in the inquisition of others because such behavior limits the researcher's view of the studied phenomena, preventing inspiration from finding connections over other facets (Dey, 2003).

As asserted, the qualitative analysis uses a large amount of data and the use of technology is useful (Bardin, 2011; Dey, 2003; Ritchie & Lewis, 2003; Yin, 2016). There are some specialized software in the marketplace that shapes the qualitative analysis (Bardin, 2011; Dey, 2003), realizing classification, codification, combination and recombination (Bardin, 2011; Ritchie & Lewis, 2003; Yin, 2016). In this way, qualitative analysis software records the data text location and reference. Categories are always up-to-date and software allows accesses to or retrieves from category or combinations of categories (Bardin, 2011; Dey, 2003). In short, qualitative analysis software is helpful and supports heavy tasks of analysis but it is still the researcher’s the role of making the data analysis. The current study used the five-stages procedure to analyze the collected data and was supported by a qualitative analyses software MaxQDAPlus.

After following the interactive process, the author of the present study ends the codification with seven categories: PMESP, communication, dissemination, repository, control, integration and SM4PM instantiated. These categories have up to four subcodes levels. In total, it were created 228 codes with 699 segments highlighted. Using cross matrix browser in MaxQdaPlus, it was possible to construct the Figure 33, that presents the number of codes and segments by cathegory.

CATEGORY	*SEGMENTS*	*CODES*
PMESP	19	5
Communication	332	94
Dissemination	129	50
Repository	36	22
Control	86	39
SM4PM instantiation – Integration and Project Lifecycle	97	18
TOTAL	699	228

Figure 33: Quantity of codes and segment per category
Source: author

During the explanation about the process of codification of this study, the number inside the parenthesis is the quantity of segments of the code or subcode. The category PMESP characterizes the organization under interviewees' view. It has one code and four subcodes level one. Figure 34 presents PMESP characteristic category code.

Category code	Subcode level 1	Subcode level 2	Subcode level 3	Subcode level 4
PMESP Characteristic	Centrilizer (6), bureaucracy (5), flexibility of PMO (2), hierarchy (6)	-	-	-

Figure 34: Codes and segments associated with the PMESP characteristic category
Source: Author
Note: The number inside parenthesis is the quantity of segments

For visual representation of the relation among category code and subcodes, it was used MaxMap from visual tools of MaxQdaPlus to generat the Map of PMESP characteristic category code outlined in the Figure 35.

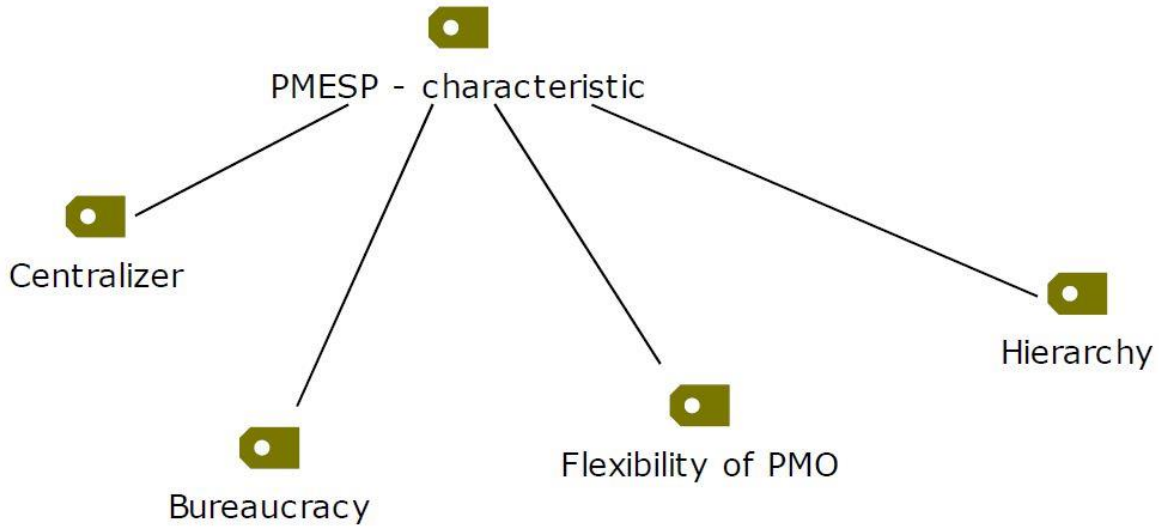


Figure 35: Map of PMESP characteristic category code
Source: author

The Communication category explores three subcode level 1: WhatsApp, Lotus Note and others. WhatsApp has five subcode level two: Context, Feature, Purpose of Use, Issue and Objection.

Context has with four subcode level three. Feature has four subcode level three: People environment, Technical environment, Interaction environment and Work environmet. Each of the subcode level three have subcodes level four. Purpose of use has two subcodes level three: PM activities and KM activities. Each of the subcode level three have also subcodes level four. Issue is a subcode itself and Objection has subcodes level three.

Returning to subcode level one, Lotus Note, it has three category: Feature, Issue and Purpose of use. Feature has two cubcode level three: Technical environment and Interaction environment, each with subcodes level four. Issue is a subcode itself and Purpose of use has two subcodes level three: PM activities and KM activities, each with subcodes level four.

The last in the Communication category is Others in which another communication tools was mentioned and agregated in this category, that generated four subcode level two. The Communication category code can be found in Figure 36.

Category code	Subcode level 1	Subcode level 2	Subcode level 3	Subcode level 4
Communication	WhatsApp	Context	Appreciation (4), avoid objection (1), trust (3), acceptance (10)	-
		Feature	People environmet	Spontaneous visualization (3), empowerment (1), intimicy (1), trust (1), social behavior (3)
			Technical environment	Repository (2), online (2), quality of information (3), easy of use (easy: 25, difficult: 2), usefulness (16), convenience (convenience: 9, not convinience: 1), availability (3), syncronous (1), virutal shared space (2), speed of information (30), efficiency (6)
			Interaction environment	Face to face (1), one to many (6), informal (7), mural (1), diversity (1), anti-hierarchy (3), different view (2)
			Work environment	Enhance (1), optimization (2), evidence (7)
		Purpose of use	PM activities	Update (1), report (7), feedback (4), debbuging information (1), team integration (5), follow-up activities (4), share issue and questions (10), register (5), interaction (8)
			KM support	Socialization (1), internalization (1), externalization (3), tacit knowledge (12), knowledge creation (3), knowledge sharing (26)
		Issue (7)	-	-
		Objection	Not a tacit knowledge (3), lack of process definition (1), structure (1), over communication (3),	-

Category code	Subcode level 1	Subcode level 2	Subcode level 3	Subcode level 4
			misused (3), private resource (11)	
	Lotus Note	Feature	Technical environment	Traceability (1), reability (1), usefulness (4), convenience (convenience: 2, not convenience: (1)
			Interaction environment	Hierarchy (2), formal (12), one to few (3)
		Issue		Size limitation (2)
		Purpose of use	PM activities	Task designation (2), schedule meeting (2)
			KM support	Knowledge sharing (1), storege/retrieve (1)
	Others	Sametime (6), informal meeting (4), phone (5)	-	-

Figure 36: Codes and segments associated with the Communication category
Source: Author
Note: The number inside parenthesis is the quantity of segments

Figure 37 presents the relation among code and subcodes of the category Communication. This category generated four subcodes level which turned the visual map crowded by codes but still usefulness to understand the category.

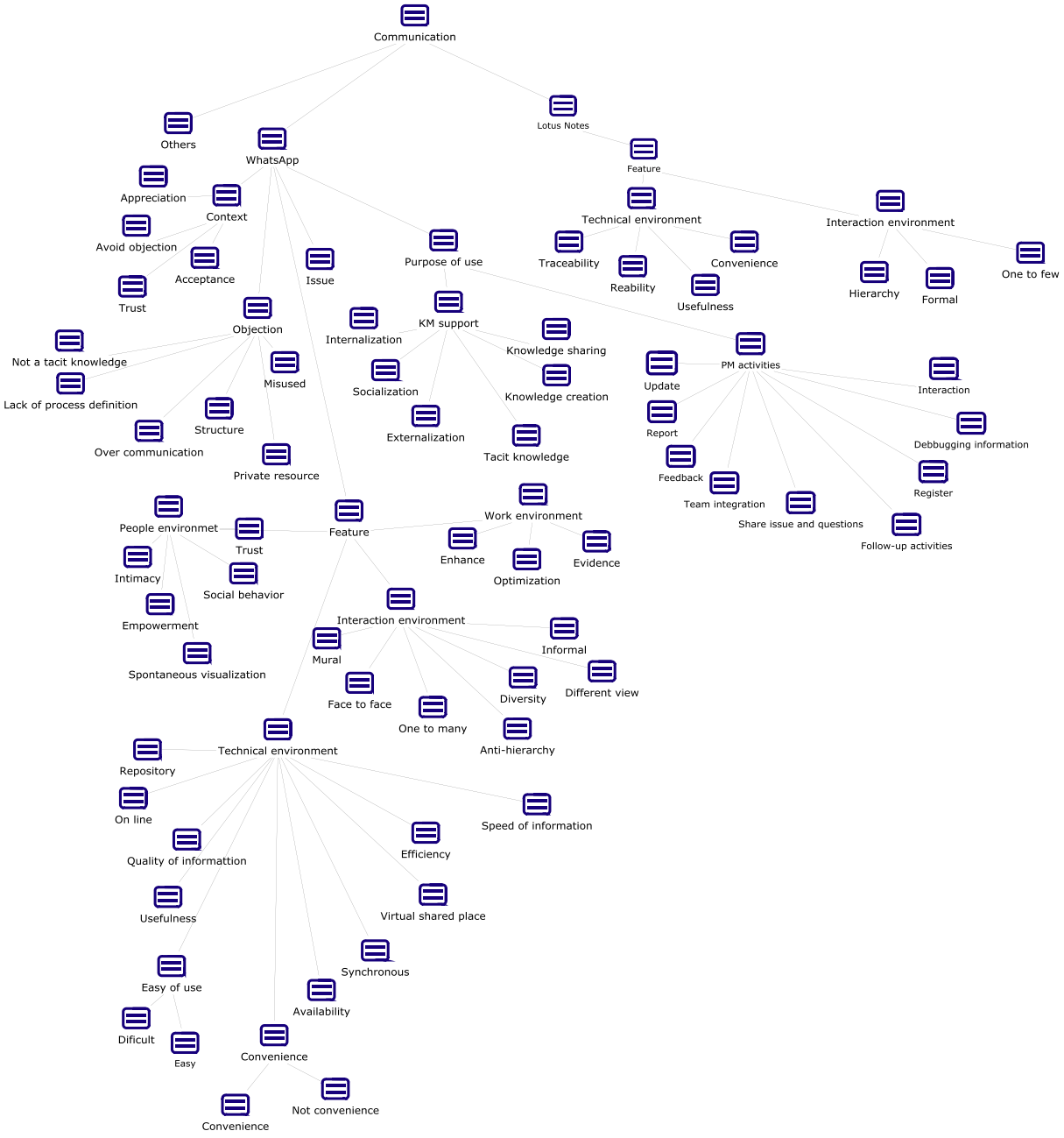


Figure 37: Map of Communication category code
Source: Author

The next category code to be explained is Dissemination. This category has one subcode level one: PM Social. PM Social has four subcodes level two: Feature, Purpose of use, Issue and Barriers. Feature has three subcodes level three: Technical environment, Interaction environment and Work environment, each with subcodes level four. Issue is a subcode itself and Purpose of use has two subcodes level three: PM activities and KM activities, each with subcodes level four. Barriers has subcodes level three. Such Dissemination category code is depicted in Figure 38 and the code map is showed in Figure 39.

.

Category code	*Subcode level 1*	*Subcode level 2*	*Subcode level 3*	*Subcode level 4*
Dissemination	PM Social	Feature	Technical environment	Traceability (1), easy of use (easy:5, difficult: 7), convinience (4), usefulness (11), acess control (3), speed information (3), security (2), affordance (2), knowledge organization (2), search (1)
			Interaction environment	Skip steps (3)
			Work environment	Institutional tool (2)
		Purpose of use	PM activities	Register (2), lessons learned (4), update information (2), access project asset (2), interaction between team members (1), report (5)
			KM support	Extenalization (1), briding (1), Knowledge transfer (14), knowledge sharing (5), virtual shared space (3), tacit knowledge (4)
		Issue (5)	-	-
		Barriers	Lack ofavailability (3), unfamiliarity (9), characteristic of PMESP (1), lack of privacity (2), burrocracy (1), lack of automony (1), personal (3), direction (1), private resource (1), lack of security (2)	

Figure 38: Codes and segments associated with the Dissemination category
Source: Author
Note: The number inside parenthesis is the quantity of segments

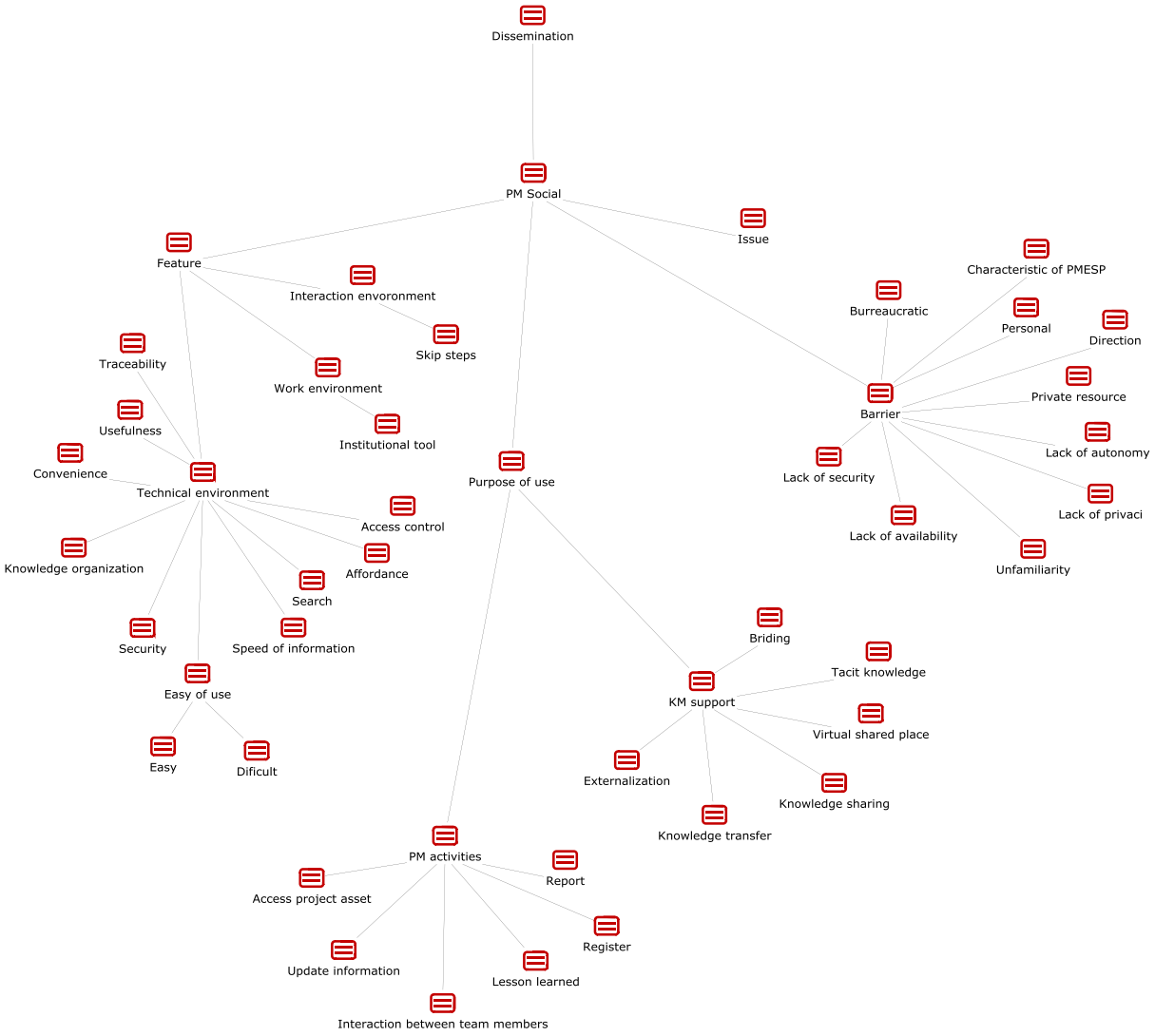


Figure 39: Map of Dissemination category code
Source: Author

Repository category has one subcode level 1, called Sharepoint. This subcode has three subcodes level 2: Feature, Purpose of use and Barriers. Feature has one subcode level 3, Tehcnical environment and its subcode level 4. Purpose of use has two subcodes level three: PM activities and KM activities, each with subcodes level four. Barriers has subcodes level three. Figure 40 presents the Repository category code.

Category code	Subcode level 1	Subcode level 2	Subcode level 3	Subcode level 4
Repository	Sharepoint	Feature	Technical environment	Storage (2), convenience (convenience: 1, not convenience: 1), device (8), asyncronous (1)
		Purpose of use	PM activities	Storage project document (5), lessons learned (5)
			KM support	Storage/recover (3), knowledge transfer (2)
		Barriers	Avoid externalization (1), access control (5), overcome barriers (2)	-

Figure 40: Codes and segments associated with the Repository category
Source: Author
Note: The number inside parenthesis is the quantity of segments

The code and subcodes in the category Repository was mapped and generated a drawing with relations among them. Such relations are illustrated in Figure 41 and reflects the codes and segments associated with the Repository category.

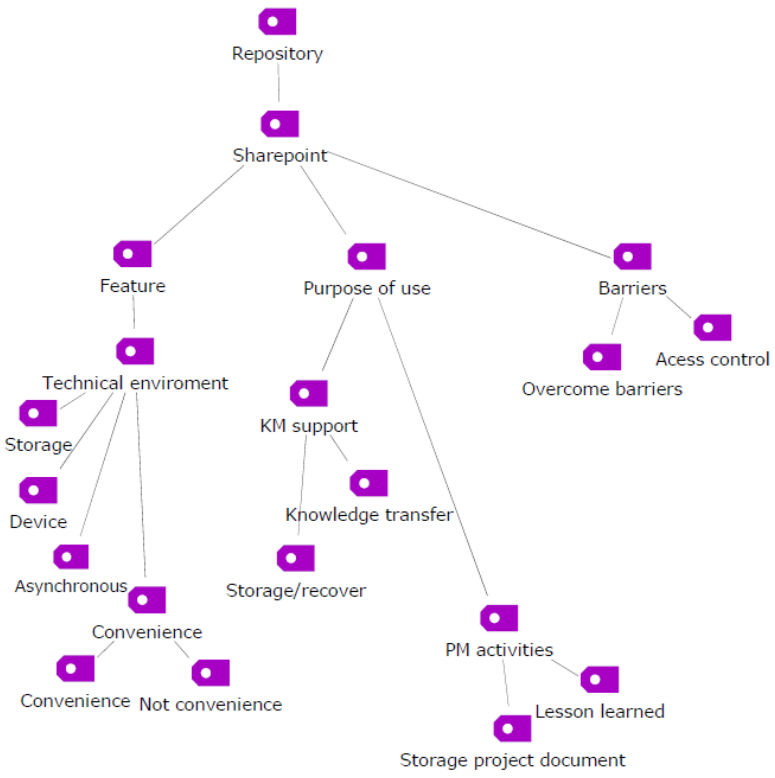


Figure 41: Map of Repository category code
Source: Author

Control category has one subcode level 1, called EPM. This subcode has four subcodes level 2: Feature, Purpose of use, Issue, Barriers and Acceptance. Feature has three subcode level 3: Technical environment, Iteraction environment and Work environment and its subcode level 4. Purpose of use has two subcodes level three: PM activities and KM activities, each with subcodes level four. Barriers has subcodes level three. Issue and Acceptance do not have subcode. Figure 42 presents the Contro category code.

Category code	**Subcode level 1**	**Subcode level 2**	**Subcode level 3**	**Subcode level 4**
Control	EPM	Feature	Technical environment	Easy of use (difficult: 1), usefulness (4), convenience (7), structure (2)
			Interaction environment	Formal (2)
			Work environment	A guide (2)
		Purpose of use	PM activities	Critical path (1), human resource control (1), alocate resource (1), up-date project information (4), planning (2), activity control (4), report project progress (7), cost control (4), time control (6), PMO protocol (1)
			KM support	Combination (1), briging (8), knowledge transfer (9), knowçedge sharing (1)
		Issue (2)	-	-
		Barriers	Unfamiliarity (1), access control (13)	-
		Acceptance (2)	-	-

Figure 42: Codes and segments associated with the Control category
Source: Author
Note: The number inside parenthesis is the quantity of segments

The relation among code and subcodes of the category Control is delineated in Figure 43. This category generated 39 subcodes distributed in four subcodes level and the map is helpfulness to understand the category.

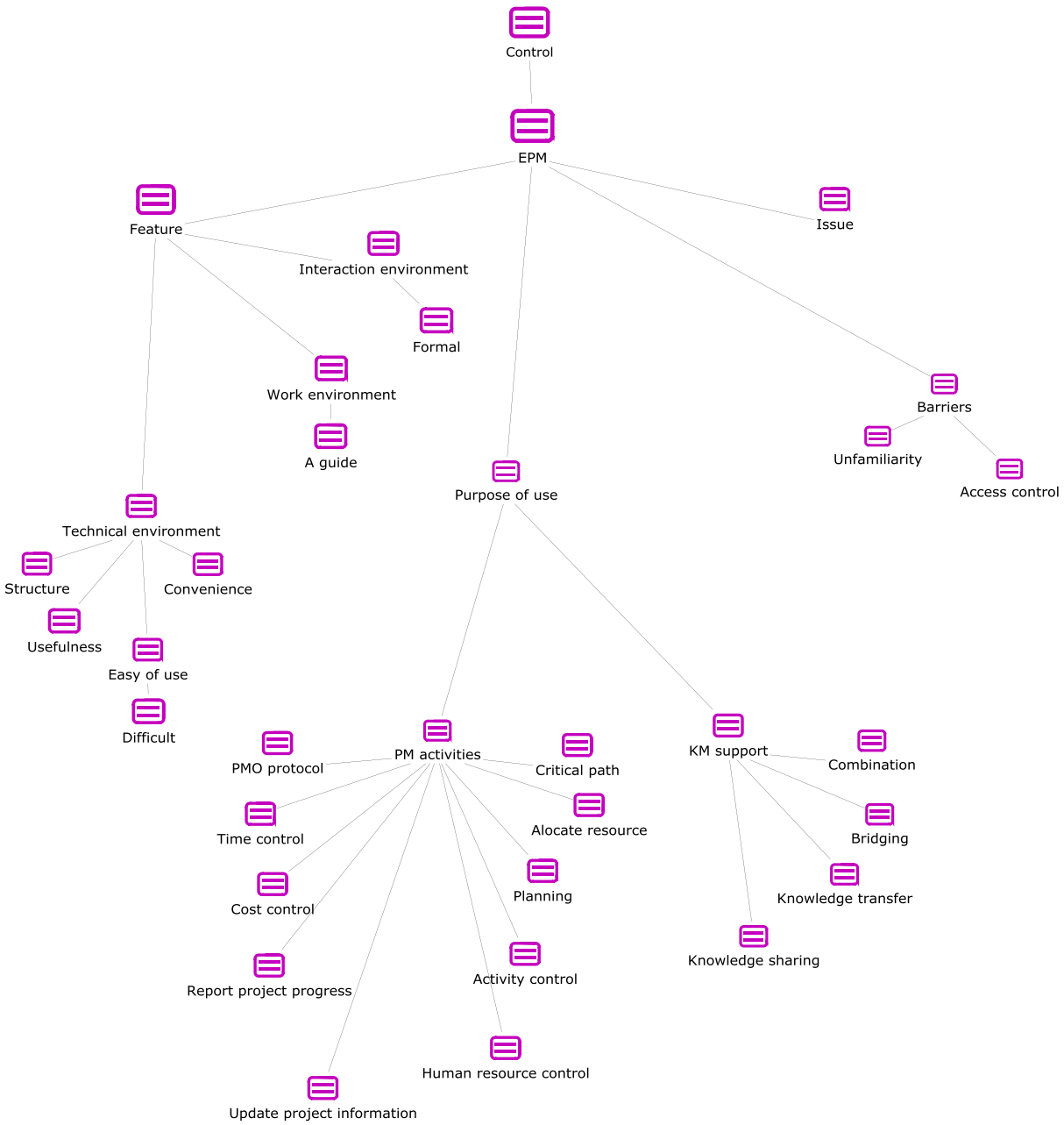


Figure 43: Map of Control category code
Source: Author

SM4PM Instatiated - Integration and Project Lifecycle category has two subcodes level: Perception and Issue. It is presented in the codes and segments associated with the SM4PM Instatiated category presented in Figure 44 and the relation of codes and subcodes is depicted in Figure 45.

Category code	Subcode level 1	Subcode level 2	Subcode level 3	Subcode level 4
SM4PM instanciated - Integration and Project Lifecycle	Perception	Acceptance (12), usefulness (7), virtual shred space (1), structure withou SM (8), benefit (2), project life cycle (3), convenience (2), process (7), preformance (2), facilitate communication (1), cover process gap (1), trust (1), integration (integrated: 30, not integrated: 5)	-	-
	Issue (15)	-	-	-

Figure 44: Codes and segments associated with the SM4PM Instantiated - Integration and Project Lifecycle category
Source: Author
Note: The number inside parenthesis is the quantity of segments

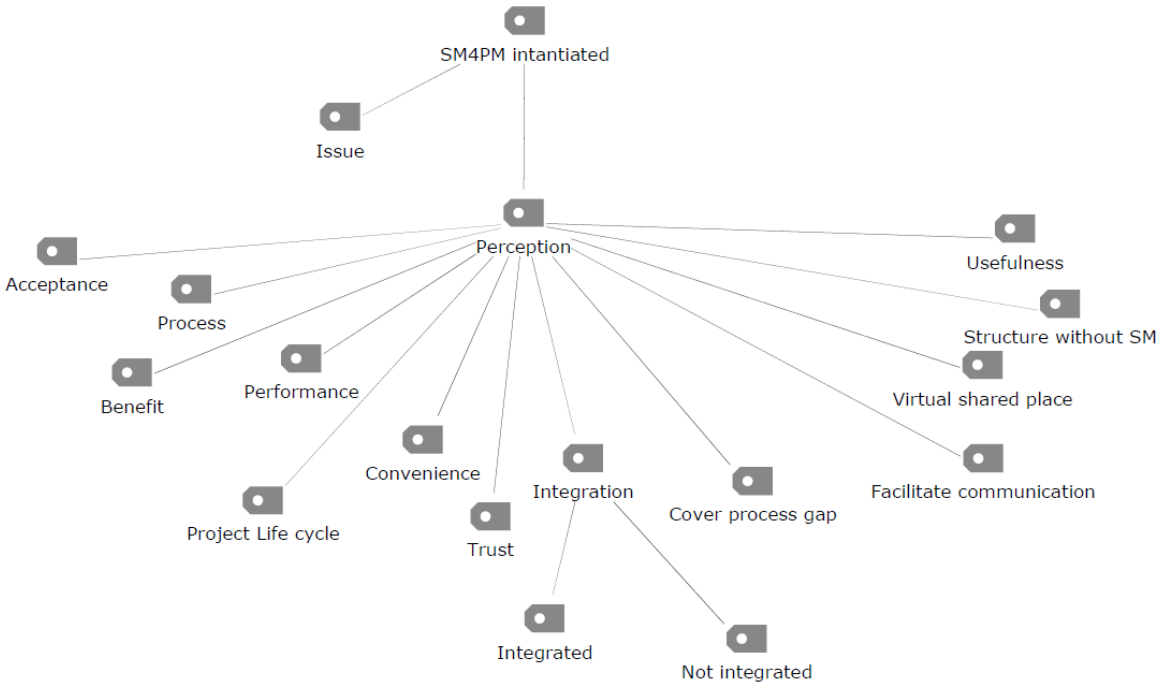


Figure 45: Map of SM4PM Instantiated - Integration and Project Lifecycle category code
Source: Author

During the all the codification process, the author of this study used the four windows provided by MaxQdaPlus in the disposition displayed in Figure 46.

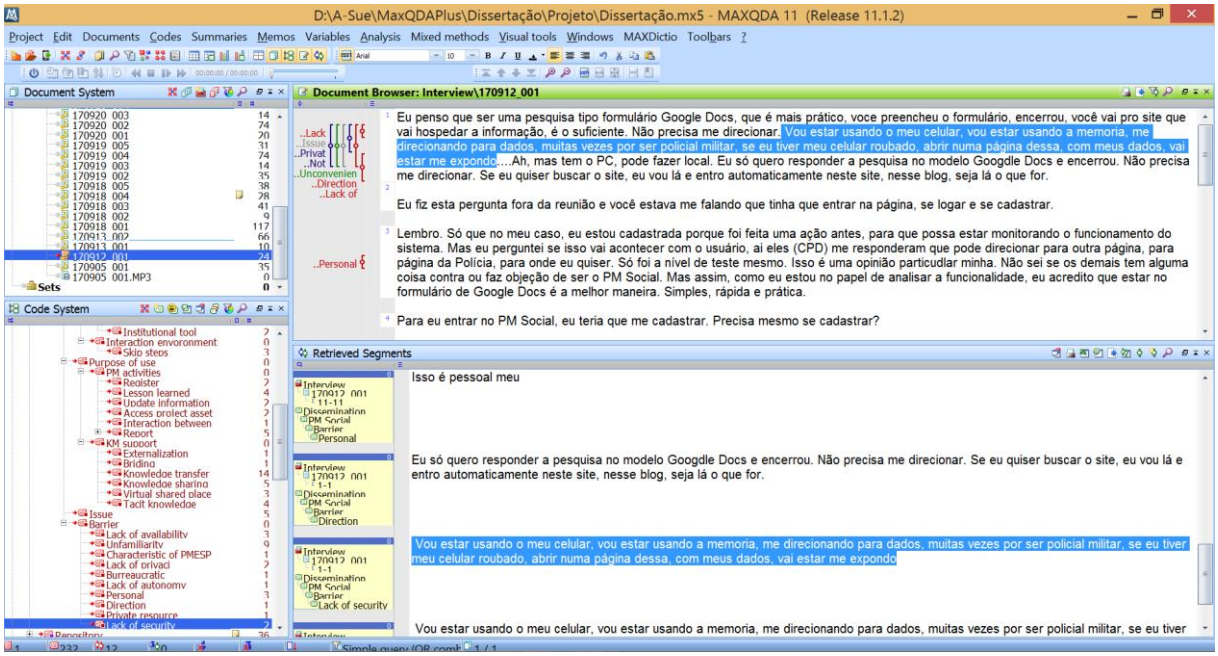


Figure 46: Print screen of project in MaxQdaPlus
Source: Author

After decomposing, recomposing and organizing the data, a narrative about the phenomenon SM4PM instantiated emerged and the impact in the context is reveled (Ritchie & Lewis, 2003). It is reported in the next section, data analysis result.

4 DATA ANALYSIS OF RESULTS

This section shows the result from nine months research of the New Organizational Climate Survey Project research under the responsibility of 6ª EM/PM that belongs to PMESP. The project charter (Appendix J-6) was approved formally in March, but verbal authorization was given to PMO to start the project on January. The partnership between the academic institution UNINOVE (Nove de Julho University) and the PMESP has established by document called Ofício Nº PM6-165/31/17 (Appendix F) and a term of non-disclosure and commitment to maintain confidentiality (Appendix G).

In the stage research problem identification and motivation (Figure 27), an initial meeting was accomplished with the intention to explore context and the problem to manage the knowledge in PM. PMO and project managers explained the environment of the project is carried out: organization chart, structure, PMESP project methodology and the objective of the New Organizational Climate Survey Project. The output of the New Organizational Climate Survey Project is a digital survey known as PCO (Organizational Climate Survey in Portuguese). Managers shared that with the test was going to use 28 participants to validate the project requirements. The intention of the test was to collect inconsistencies to report to Software Factory, the developer.

Once the problem was started, the framework SM4PM was presented in the research stage objective a solution (Figure 27). Together with researcher, managers began to position PMO's tools in the SM4PM. The tool EPM, composed by EPM server (MS Project on the web) and EPM client (MS Project on the personal computer) already implements Control, Repository and Communication category because EPM is integrated with Sharepoint (document repository) and Lotus Note (e-mail). Asked about the recurrent problem in the project environment, the managers listed project results dissemination outside the boundary of 6ª EM/PM. The group discussed on how to solve it in this project of short period. It was defined to use the PM Social blog, an official collaborative tool of PMESP, to cover Dissemination category. However, low level of the usage of the PM Social was a barrier because few military know how to use it, requiring training. Therefore, they do not have the habit to verify it constantly. Perceiving the immaturity of the users but still with the desire to use the Dissemination tool to encourage its use, researcher and managers prescribed the use of the PM Social blog as dissemination tool to support EPM.

In this study experiment, PM Social blog has the role of collecting any discussion about the project. During the closing phase of the project, a document will be appended with content of the PM Social blog, and it will be stored in the Sharepoint. The use of the PM Social blog is in line with Forcier at al. (2013) in which PM Social blog gives a virtual shared space and a workplace where people can meet and work as reported by Tsui and Fong (2012).

After the discussion about Dissemination, the theme turned to Communication. Managers agreed that the use of Lotus Notes and Sametime is satisfactory. However, Lotus Notes is a formal communication tool and has rules to be used, predetermining that Sametime, the chat of Lotus Note, is ruled by the same regulation. Hence, Sametime is used with a formal language as Lotus Note. Managers also informed that it is common to use WhatsApp as a quick communication tool while it is not official. Researcher explained that according to literature, WhatsApp is an organic tool that lead to spontaneous interaction and cold generate more data, compared with Sametime. Also, the whole message can be extracted from WhatsApp easily to compose a document to be stored. Managers expressed their interest to use WhatsApp instead of Sametime. The Sametime's limitations are the impossibility to construct a group, the necessity to make a login (WhatsApp is always available in the smartphone) and shows difficulty to create a document to store in the repository. The decision was reached to use WhatsApp together with Lotus Notes in Communication category.

In the stage design and development (Figure 27), the researcher played the technical researcher role in the Technical Action Research methodology, instantiating the SM4PM framework, as displayed in Figure 28: SM4PM artefact instantiated in PMESP, page 74. Pre-setting meetings were recorded with the permission of the participants and generated six hours with transcriptions and timestamps.

The current study was welcome by PMESP that contributed with a collaborative environment, giving support to the needs of the researcher. The participants of the present study were always available by planning their appointment schedules to meet the demands of the study. At the same line, researcher combined all the action beforehand to not disturb the participants' routine. None of the information was denied. Figure 47 provides compelling evidence of the good reception of the study by PMESP. It was constructed from two journals registers. One journal registered a complete workstation made available to the researcher throughout the period of the data collection. Another journal registered the Commander, third in the line of succession of the PMESP, in the inspection of the troop, knowing that the researcher was there, made a point of greeting the researcher personally.

Journal\20170829\11:00	Journal\20170927\08:00
After the kick off meeting with project manager, I was introduced to workers of the 6ª EM/PM. I5 was selected to support me and there was a complete work station beside E5 work station. This position benefits me.	I was in the reception, waiting for I13. Commander came to my direction and asked me if I was the 6ª EM/PM researcher. He showed me the satisfaction to have a university doing a research study in the PMESP and thanked our support.

Figure 47: Evidence - good reception of the study by PMESP
Source: Author

The research setup instantiation of the framework setup (Figure 27), project manager planned the test of the PCO and called it First Test Wave. This test had the objective to validate the PCO's requisites that is written in fifteen system maintenance reports. The duration was one week and all military of the 6ª EM/PM was invited to participate, totaling 28 participants. The project manager gathered the participants to brief the purpose of the test and the importance of the participants' collaboration. Participants would play the role of the user, i.e. the respondent. Participants were asked to make all the possible interactions during the test, using the most diverse remote platforms. Two tools have been made available to report inconsistencies: WhatsApp and the PM Social blog. For this purpose, a WhatsApp group was created with the trial participants, project team and representatives of the Software Factory. In the same way, a community was opened on the PM Social blog, with the same goal.

The First Test Wave is the research stage demonstration (Figure 27) in which the assessment of the artefact and context is done. In this stage, researcher in the role of Helper was available but participants preferred the helper of E5, as E5 supports the project and knows the whole process. With the end of the First Test Wave, researcher spent a period collecting data through interviews. The semi-structured interview protocol was fitted, molding itself to the profile of the interviewee. For the interviewees that belong to the PMO, project team and those who presented knowledge on projects or EPM (I1, I2, I3, I6, I9, I11, I13, I14, I15), the entire interview protocol (Appendix A) was explored. I5 is team member but does not use EPM, that is the reason this interviewee was not considered in this group. The researcher had the freedom to include open questions to clarify some important point given by the interviewee, to better understand the phenomenon. The semi-structured interview protocol was used with other interviewees according with the experience of the interviewees in the First Test Wave. This strategy allowed to get the perception of part of the artefact by the views of these interviewees.

Once the data colletion finished, the research stage evaluation (Figure 27) begins. According to the interviews conducted in this study, there was a characterization of PMESP

perceived through the established attitudes and rules in the use of collaborative tools. There is no focus on this study, on organizational or cultural aspects, yet this is an opportunity to understand the context of First Test Wave.

4.1 PMESP CHARACTERIZATION

In the composition of WhatsApp group and PM Social community, only two participants belonged to Software Factory, both military. The ones responsible from Software Factory prefers to receive the insights gained from WhatsApp interaction and compile to others. As a reaction I10 commented *"We wanted to join (PM Social) from the beginning for us to have a bigger interaction. We can answer, make some doubts. We even have our doubts because we do not know everything"* and I7 agreed: "*I think the WhatsApp's group did not have the analyst going along…There had to be someone to go over".* The centralization aspect of the organization put barriers for knowledge sharing and slows down the process.

In the same line, during the presentation of the EPM by I9, the aspect of centralization was found by researcher in following segment retrieved from interview: "*Even if someone wanted to make any kind of change in other projects, we here from the PMO, we limit this*" and *"Who will make this bridge now is the PMO"* (I9).

Bureaucracy was another aspect found in the PMESP characterization. I4, I5 and I15 assert that producing documents is PMESP culture. Strong evidence was given by I15 declaring: *"It has the physical and digital bound"* which was observed by the researcher in journal 20170929. I9 showed the same documents in digital and printed version.

The hierarchy of the military institution reflects on how to communicate in the institution. I5, I6, I9, I12 and I13 report that the flux of communication has to follow the same chain of command. This flux reduces the interaction amongs individuals, once they cannot exchange messages directly. Knowledge is transfered passively, consequently combination of ideia to create knowledge is impared.

Despite of the rigidity of the institution, the PMO demonstrates some flexibility in dealing with project teams, as stated in I13, *"The PMO went on the field to help the project manager in the construction of the project charter and the WBS (work breakdown structure). Then PMO started to have a performance closer to the manager. It was a very important of the PMO's attitude".*

The PMESP characterization was evidenced in this section to facilitate the understanding of the following data analysis. Figure 34: Codes and segments associated with the PMESP characteristic category, page 82 sums up the characterization.

From now, this section discuss and analyse the framework SM4PM instantiated by cathegory: communication, dissemintation, repository and control. In communication cathegory, it was analysed by two tools (WhatsApp, Lotus Note) and others forms of communication. Dissemination, repository and control were analysed with the SM tools PM Social, Sharepoint and EPM respectively.

4.2 COMMUNICATION

Communication category provides interpersonal connection for exchange of information and collaboration (Ikemoto, 2017). Its importance in project was reported, "*it is the critical point of anything, for any project: communication*" declared I18. Doing a lexical search, with the support of the segment analysis, it was possible to perceive interviewees associating this category with the words whose radicals were dissemination (8), repository (2) and collaboration (2), in this order of importance. Dissemination and collaboration are in line with the concept proposed from Ikemoto (2017), slightly modified by dissemination and repository. Ikemoto distinguishes dissemination from communication. According to Ikemoto (2017) Dissemination category is a publisher for PM documentation, a knowledge that is already explicit and organized. On the other hand, interviewees related the word 'dissemination' together with 'information' with the meaning of spreading information, endorsed by I18: *"In the medium of communication is the dissemination of information"*. Besides, once interviewees can recover the content of the conversation they considered it a repository of image (2) and conversation (1). Next, the evidences in the Communication category are best explained in the data analysis results, with the WhatsApp and Lotus Notes tools.

4.2.1 WhatsApp

The context analyzed demonstrated appreciation when "*someone is looking and is taking the action they should*" (I15) and feel to be included in the process because "*Then, I was added to the project. They were there: civil, captain, the whole world*" (I7) and in WhatsApp

conversation was said: "*the Captain talks little to me (in face-to-face meeting). Already in WhatsApp, no. He reported and spoke: I7 will do, I have already spoken with I7*" (I7).

Participants of the First Wave Test indicated trust in the process as I5 asserted. I4 pointed out the trust of WhatsApp tool as it "*does not monitor or explore your behavior as Facebook does*". Promoting trust among project team members was applied by I18 that got results and facility of knowledge sharing as reported previously in Park and Lee (2014). Even though, when announcing the instruction of First Wave Test, I1 needed to avoid objections about using WhatsApp, asking everyone to listen first. At that time, "*he looked to someone*" (Journal\171905\15:00), to the group leader.

Acceptance of WhatsApp tool was high, highlighting: information sharing by I6 and I11, fast by I19, diminishes activities time by I13 and I3, focus by I8. One evidence that PMESP accepts the remote communication was related by I12 declaring that "*in the military clothes there is a place to put the smartphone*".

Analysis about WhatsApp tool unveils tool features to four environments: people, technical, interaction and work. The features of people's environment are related to how people interact by means of this tool. I4 report that WhatsApp has "*spontaneous visualization*" and complete: "*WhatsApp expresses the behavior of that person at that moment…it is instant communication. Hardly at WhatsApp, someone that is nervous will not respond to. He answers. Then you can pick it up*" in essence with Chaves et al. (2016) that mentioned WhatsApp is an organic tool. This feature empowers the participant because he was "*losing a bit of insecurity for communicating through this tool*" (I1). It was reinforced with intimacy as "*it's on your phone, seems to be your own thing*" (I4). The act of looking at WhatsApp screen time to time was defined by I4 as a social behavior like "*brush the teeth*".

In technical environment, the features were related with device or technology of the tool. I15 cited in three segments that online tool, availability and affordability of use image guarantees the quality of the information and avoid losing the information record. I12 and I19 emphasized the online answering. It also showed to be asynchronous as said by I13: "*improved the quality of documentation of nonconformities, made it possible for people to do this, each in its own time*". At the same time, it is a virtual place to share information as described in Forcier et al. (2013) and Tsui and Fong (2012), commented by I1: "*interesting in WhatsApp is also that several people reported the same problem. He did not have to re-detail a problem he had already detected*".

Another aspect cited in the feature of technical environment was speed of information. 30 segments in this code mentioned this feature. It was resumed by the testimony of I14: "*interesting, today the fastest, most practical, most agile communication channel is WhatsApp really*" that was complemented by I2: "*communication in WhatsApp, it is more efficient*".

Asked about the usability, most of the interviewees affirm that it is easy of use (I1, I2, I3, I4, I5, I6, I12, I13, I15, I16, I18 and I19) pointing out communication, visualization, availability, possibility of attaching a photo, sharing knowledge, intuitiveness, accessibility and social behavior (habit to see constantly) is like "*changing clothes*" (I7). On the opposite, I4 registered the impression of WhatsApp is ease of use for other individuals but not for own use, as the smartphone screen is "*too small to type*".

Usefulness of WhatsApp was also a well evaluated. I1, I2, I4, I5, I7, I12, I13, I15, I18 and I19 that underlined that it provides solution by others and for everybody, saves time to find a solution and gives follow up online.

In the convenience category, most of the interviewees (I2, I5, I9, I12, I15, I18 and I19) recognized that having an application that can be used remotely brings convenience to use it in a better place and time, according to individual availability. But in the view of I5 it can bring dangers as "*being a military, if I have my cell phone stolen, open it on a page with my data, it will be exposing me*". Appendix J-1 depicted evidence of convenience.

Another environment on WhatsApp's feature is interaction. This environment is related with interaction among individuals. According to I1, with WhatsApp "*he (Software Factory's analyst) has already interacted directly with the user*", evidencing a virtual face-to-face relationship as described in Al Saifi et al. (2016). Simultaneously, "i*n WhatsApp everyone has a view of everything*" (I18), proved by the experience of I19 that declared: "*I threw the idea into the group, in fact, I did not refer to the Captain directly*", showing the aspect to communicate with one-to-many, identical to Panahi et al. (2012). Interaction in an organic tool is informal, as asserted by I1, I5, I6, I8 and I19. WhatsApp merges private and professional use in the same device, as confirmed I2: "*Because you can use WhatsApp for any purpose. Both for service and private*". Finally, interaction allows diverse views the reader.

The use of informal language to communicate one-to-many resulted in a significant break of the rule: the hierarchy communication. It was proved by I5: "*Since it was planned WhatsApp group, there was flexibility in the hierarchy. I could request the I6 to include the Software Factory's staff in the PM Social. Then I6, for security, gave science to his superior of*

what I6 did at my request. He no longer had that formality of me having to go and ask his boss. In this case, flexibility was increased".

Work environment is a feature of WhatsApp that is related to daily activities. I18 commented that WhatsApp enhanced his work. I5 added that it provided optimization. The most commented feature in work environment was possibility to give evidence reported by I1, I3, I5, I7 and I13. In work environment, researcher by observation noticed that co-workers did not neglect same room collaboration, they externalized their issues among themselves, adversely what was proposed by Evans (2012).

Until this point, the researcher investigated and presented results of social context in the use of WhatsApp tool in the Communication category and evaluation of the technical solution. Next, the researcher presents the role of WhatsApp in project management (PM) activities and knowledge management (KM) support.

- WhatsApp supporting PM activities

WhatsApp updates the project's information constantly "*because in WhatsApp, you're going to see the roll of information, come and see everything that's happening to everyone*", explained I18. I19 explained how he reported inconsistency in the PCO: "*And then I photographed the page and reported via WhatsApp's group that I was included*". This attitude was followed by I16 and I12.

Reporting immediate feedback in a collaborative communication tools is a benefit, an important activity for project manager, as commented by I15 and confirmed by I19. Complementing, I4 asserted that feedback also allow "*debugging of distorted information*". Feedback activity is an evidence of the team integration by WhatsApp. Another strong evidence came from I1, who said: "*What was interesting is that by having people in the Software Factory who are responsible for maintaining the system, correcting, fixing the inconsistencies, they are also part of this PCO group, and they interacted almost instantly with people who were posting some evidence of inconsistencies*". Position of I2, I3, I15, I18 and I19 are in line with I1.

WhatsApp conversations in the individuals' smartphone give them the power to have the propriety of the content. Individuals considered that what is put in this content is already registered. It was described by I7 as follow: "*I support the use of WhatsApp and Notes because I get this feedback fast and it's even registered*".

Figure 48 corresponds to a PM activities supported by WhatsApp. FG1and FG2 agreed with Figure 48 but I11advised that WhatsApp is not a institutional tool and decision making in project could not be done by it.

PM activities	
Update project information	Report facts
Give feedback	Debbuging information
Integration the project team	Follow-up project activities
Share issue and questions	Register image
Register conversation	Promote team interaction

Figure 48: PM activities – WhatsApp
Source: Author

- WhatsApp in KM support

The feasibility of KM support is intrinsic to WhatsApp's ability to present the characteristics found in the role of social media in HK Funnel, pointed out in the section 2.2.1 Social media for knowledge management, page 40.

According to I18: "*All the information needs to be digested and transformed. SM give you that. What you read, you interpret and you make your judgment*". The interviewee described two mechanisms: internalization and socialization. When I18 "*read*", the knowledge goes inside individuals mind (internalization). This knowledge made I18 to "*interpret*" and make his *"judgment*", the socialization mechanism. The treatment of the knowledge, under interviewee I18's viewpoint, is largely explored in SECI mechanism by Takeuchi and Nonaka (2008). Corroborating and resuming the concept of Socialization, I14 in FG2 said: "*Socialization is an idea maturation*".

In the First Wave Test, project manager requested the participants to narrate what happened during the test in WhatsApp or PM Social. I3, I5, I7, I12, I16 and I19 reported that they "*photographed the computer screen*", "*took the photo*", "*posted the photo*" and declared "*does not need explanation, I think he (analyst) will understand*", "*It was even a comment there among users, before putting the screen, not to be such a descriptive text and to be faster, especially for the programmer to identify (inconsistencies)*". Although the system error is shown in the image, leading to say that it is an explicit knowledge, narrative was substituted by an image which holds explicit knowledge (system error written) and by emotion of the participant's experience. Storytelling is based on tacit experience and understanding by photos (Herbenio et al., 2016) , in accordance with Terzieva (2014) whose storytelling is listed as a tacit knowledge (see Figure 4, page 32).

One more situation reported by interviewees was the increase of the WhatsApp content by the participant's interaction. I1 declared that "*someone reported an inconsistency and another person reported the same situation and added another inconsistency in the same situation*", increasing the knowledge, creating a new one, as outlined in Alavi and Leidner (2001).

Knowledge sharing was cited in 26 passages for the interviewees, demonstrating a strong connection with Communication category. I13 asserted that showing "*different views of the same problem*" and "*making it possible to follow the process as a whole*" are benefits of sharing knowledge. The output of the role of WhatsApp in the KM support is a list of KM process, depicted in Figure 49. In FG1 and FG2 no comments were, accepting the content.

KM support	
Socialization	Internalization
Externalization	Share tacit knowledge
Promote knowledge creation	Promote knowledge sharing
Repository of knowledge	

Figure 49: KM support – WhatsApp
Source: Author

Regardless of benefits of use of WhatsApp in PM activities and KM support issues surroud the use of the WhatsApp as a communicatio tool in PMESP. The tool is not considered institutional in PMESP, which means that none of structure is given to individuals. Consequently, there is no rule regulating its use, which can bring doubts to its purpose and its use. Besides, I12 externalized concerns whith the use of a tool that does not belongs to PMESP: "*How would the institution stand, surrendering to a person (owner of the tool) you (institution) do not know who the person is?[...] What if it (tool) stops? What is your (insitutition) exhaust valve?*".

4.2.2 Lotus Notes

Lotus Notes is an official communication tool in PMESP. It has traceability "*because Notes creates a trace"* by a "*a digital signature*" said I17. This is not a fast process but "*the reliability level is higher*", commented I14. Asked about the usefulness of Lotus Notes, I2 and

I7 reflected their activities without this tool. "*Without these tools (Lotus Notes and WhatsApp), I would not work, I do not think so. Unfeasible to make official letters, meetings. We would have no more time*". Both WhatsApp and Lotus Notes were considered convenient but Lotus Notes slightly less as "*the response would be more time consuming*", affirmed I19.

For being official, Lotus Notes has rules to be used. The communication flows the same chain of command, justifying "*hardly going to say this (emotion) to convey*" said I15. In doing so, I15 declared: "*it (communication) would be more cold because I was going to have to use more technical words to express that I lost all the information I just filled out. And I was very angry that time*". Flowing the chain of command in communication and with the limitation of the document attached leads Lotus Notes to serve from one to few. However, these characteristics helps Lotus Notes to have its roles in PM activities and KM support.

- Lotus Notes in PM activities and KM support

The researcher grouped both of the SM's roles because these can be explained at the same time. I1 used Lotus Notes for "*task designation*" so that the team member understood "*that this is a mission that he (team member) has to fulfill*". I1 is transferring knowledge to team member by sharing. Another usual PM activity that uses specifically Lotus Notes is "*schedule or cancel meetings*", affirmed I12.

The fact of present both PM and KM at the same time is in line with Oun et al. (2016), which affirms that there is a positive association between KM system and PM knowledge areas. Figure 50 displays the list of PM activities and KM support in the use of Lotus Notes. FG1 and FG2 agreed with Figure 50 with none observation.

PM activities	KM support
Task designation	Knowledge sharing
Schedule meeting	Storage/retrieve knowledge

Figure 50: PM activities and KM support - Lotus Notes
Source: Author

The researcher explored the use of different tool instead of WhatsApp and Lotus Notes in the Communication category to confirm if these tools were adjusted for this communication process. Sametime tool appeared as a substitution of WhatsApp but objections like to be not as available as WhatsApp, lack of the habit to check, and need a login to enter discourage the use. Telephone call and meeting in the coffee corner were remembered as an alternative, although these are not SM.

In the present section, the researcher explored the context and the use in the category Communication of the framework SM4PM instantiated in the PMESP. This knowledge sharing strategy combined codification and collaboration with formal and informal techniques, identical to Dixon et al. (2009). In the next section, the researcher presents the analysis result of the Dissemination category.

4.3 DISSEMINATION

According to Ikemoto (2017), to disseminate is to publishe the documentation in a explicit and organized way. I5 agreed with Ikemoto when said: "*dissemination is advertising information. Bring it to the public*". PMESP defined to use the PM Social blog as a tool for Dissemination category. PM Social is an institutional tool in PMESP and was defined by I11: "*It works through communities. These communities have forums, have the possibility to upload and download files, have possibilities to open topics for discussions*", supplementing with the fact that someone can work with "*open communities or restricted one*" and have "*access control*". Although this tool has all these possibilities, the instantiation considered only the use of the PM Social blog. Next subsection points out the analysis results.

4.3.1 PM Social blog

The fact of having access control showed the feature of traceability of the PM Social blog. I17 explained: "*I changed a text and it did an update. It generates another version. So, it has version control".* Access control helps to control dissemination (I17) which brings security, completed I2. Exploring the features of the PM Social blog, the researcher found three kinds of environments: technical, interaction and work environment. In technical environment, three interviewees, I1, I2 and I11 agreed with the ease of use of the PM Social blog. Conversely, I3, I4, I5, I6, I17 and I19 totally disagreed. Access control blocked I19 to use it. I17 and I3 affirmed that it is not intuitive. I5 and I6 asserted that they are not familiar with the tool. The fact that PM Social blog is an institutional tool, on the contrary it passes the perception that it is not easy to use, leads the conclusion that training in the use of PM Social blog is necessary. The vision of convenience was given by I11 in his testimony: "*First, because the person can even use from*

home. […] Even for those who are not very at ease in the area of technology, it is very intuitive". The interviewees I9, I13, I14, I15 and I17, supported I11.

Usefulness was perceived due to interviewees' testimony. I11 said: "As far as *a tool to share information, the PM Social is the most effective I have ever seen*". It is "*useful because there are informations that people are using*" (I10) and because of "*celerity*" (I3).

Affordances of PM Social blog were also highlighted by I3 that said: "*They can comment, they can replicate others, depending on the profile*", which make people part of the process as suggested by Kaplan and Haenlein (2010). In the feature speed of information, I1 declared: "*As soon as someone accesses the PM Social, he is already aware and could already take some action about what was reported*". This passage indicates PM Social blog is useful to connect individuals into collective knowledge as can be found in Mariano (2010).

Dissemination category supports the knowledge of organization as "*we can see all the information*" and "*mainly by the organization of the subjects*", mentioned by I6. The analysis of a segment of the I11 interview led the researcher to deduce that sharing the knowledge by dissemination in the interaction environment skip steps, an evidence that KM impacts on project performance, the same as that in Reich et al. (2014). The context in which PM Social blog is inserted was analyzed. Next, Dissemination category is explored and separated in two branches: supporting PM activities and KM support.

- PM Social blog supporting PM activities

The initiative of use the PM Social blog in PMO of PMESP is a rethinking practice, a category that belongs to a new PM concept given by Svejvig and Andersen (2015). First perception glimpsed from interviewees was the support of registration of the information exchanged during the project for "*future consultations and even for the very learning itself*" (I15), turning it in a lesson learned. As I15 said, in the future project team: "*Would take these difficulties into account or even explore the facilities we found there*". PM Social blog can be considered "*a bank of good practices, which is a lessons' bank*", affirmed I3.

Interacting in blog is a way to update information because users "*exchange information about a particular project*" (I11), sharing a new information or a report situation, as requested in the First Wave Test. I8 suggested to access PM Social to "*have access to legal documents and issues of the project for everybody to know*", the organizational asset that is crucial for project. Organize explicit knowledge (organization assets, system management report) and learn from tacit knowledge that comes from a storytelling from images, constitutes a reconceptualization of PM identical to Ahern et al. (2014). Figure 51 listed the PM activities

found with the use of PM Social. In FG2, it was found that not all participants knew about the alternative of the use of the PM Social blog. This could be another reason that PM Social blog had low use. FG1 and FG2 agreed with Figure 51 with no more observation.

PM activities	
Register the project information	Register lessons learned
Update project information	Access project asset
Interaction between team members	Report project information

Figure 51: List of PM activities - PM Social
Source: Author

- PM Social blog in KM support

For dissemination of knowledge, information needs to be externalized by individuals. PM Social blog was used as "*a way to report how each one who was involved with the project was going through, what were the difficulties that were being encountered, and even how it was solved*" said I15. It fosters discussion, in the human process of knowledge flow in which individuals read the comment, socialize with own knowledge in his mind, and externalize replicating the comment, as proposed in Takeuchi and Nonaka (2008).

Knowledge disseminated by PM Social blog can serve to "*who faced this type of problem*" (I15). This solution can be used by others project teams, PM Social blog being a bridge among teams, enlarging existing knowledge, as reported by Cheong and Tsui (2011) and in line with Lopez and Esteves (2013) that asserts that SM contributes to transferring knowledge in the organization. Knowledge can also be transferred to stakeholders, users and institutional community as declared I1, I3, I5, I6, I8, I10, I11, I14 and I15, consistent with Lopez and Esteves (2013). PM Social blog delivers sharing knowledge among team members for them to "*find an easy solution to develop the work that was being done*", explained I15. Related with this theme of using images to storytell the experience of the user, PM Social blog is in the same line as WhatsApp. Appendix J-2 displays the evidence of the KM support in the use of blog of the PM Social.

Figure 52 illustrates the output of this analysis, a list of KM support in the PM Social blog. In FG2, I1 argued that there was a knowledge application: "*They took the knowledge and applied it to what was wrong to fix it*". I7 who works in Software Factory agreed. With the agreement of the group, the support action apply knowledge was included.

KM support	
Externalization	*Provide bridging*
Provide knowledge transfer	*Provide knowledge sharing*
Provide a virtual shared space	*Share tacit knowledge*
Apply knowledge	

Figure 52: KM support - PM Social
Source: Author

Some issues arose from low perception of ease of use. The fact that one needs to login into PM Social blog is not convenient. For the interviewee perception, "*if he (user) should put a password, he sees it as work*" (I4), not a social interaction.

Two participants only used the PM Social blog in the First Wave Test, concluding that the PMESP institutional tool is not popular. Interviewees reported lack of familiarity and training as a difficult. With low interest in use of the PM Social blog, individuals do not have the habit to look for new knowledge by means of this SM. It provides visibility which is not well seen by some interviewees: "*I do not like to mix my social life with the Police. Institutional is institutional*", registered I5 which did not align with organization requirement of having individuals interacting in the same way they do privately as described by Schneckenberg (2009a). Besides, exposure put individuals in vulnerable position, which brings insecurity. Next subsection, the researcher presents the analysis result of the Repository category of the framework SM4PM instantiated in the PMESP.

4.4 REPOSITORY

Repository is a memory organization, a place in which knowledge is stored to be preserved and retrieved to be reused, conducting a sustainable process (Filieri & Alguezaui, 2014). The SM4PM was instantiated with the use of Sharepoint in the category Repository. Sharepoint is already integrated with EPM, the tool that helps project manager to control the project. EPM will be explained in the next subsection. The focus of the present subsection is Sharepoint.

4.4.1 Sharepoint

Researcher, under the view of interviewees, found feature in technical environment. For those users that have permission to access project documents, Sharepoint is convenient because it can be used in the localy and at a time more suitable for them, as cited by I9: "*If somebody wants to access it some other time, he can do it. […] I can access it from home*". Access control makes this tool not convenient to be used outside the workplace for those who have no authorization.

Sharepoint was mentioned to "*store project documents*" (I9) like "*a memorandum or by means of some electronic message, situation report, project charter, project plan*" (I13) and "*change requests"* (I8). Documents that can be stored, should be retrieved to transfer knowledge to others, in line with Ahern et al. (2014) that consider this document as a previous knowledge. The purpose of use of the Sharepoint in supporting KM activities and KM support is presented.

- Sharepoint supporting PM activities

Storing documents related to project in Sharepoint is a manner to record the project lifecycle. Retrieving them, the user can "*know if it has some way that was followed and we do not remember. It also serves as a query to remember, in view of the project that was executed*" commented I15 and complemented by I9: "*we tried to leave as detailed as possible. For future consultations and to know how each step was. Step by step, what we did during the project*". I13 affirmed that "*because of the suffering that the people participated in the project, they had the perception that there was a hit or an erro*r" which infer that a lesson learned should be recovered. Storing documents makes knowledge base increases, which is essential for future projects, as proposed in Todorović et al. (2015). Besides, it is an apprenticeship, a context of a landscape of learning that can be found in Cheong and Tsui (2011). Evidences of PM activities in Sharepoint is depicted in Appendix J-3.

PM activities detected in the use of Sharepoint in the Repository category are displayed in Figure 53. FG1 fully agreed with PM activities in the Figure 53. In FG2, I1, in accordance with I14, argued that a project history is constructed in the Sharepoint. I1 asserted: "*We have a history of everything that has been done. The progress's report will show what has been done and what you have to do in the project*". The group agreed with I1 and I14. The researcher added the construct project history as PM activities in Figure 53.

PM activities	
Store the project documents	Register lessons learned
Recover project life cycle	Recover lessons learned
Upload and download documents	Construct project history

Figure 53: PM activities - Sharepoint
Source: Author

- Sharepoint in KM support

The purpose of use of Sharepoint is to store project documents and lessons learned which are the knowledge of the project. Recovering these knowledges allows individuals to receive and to appropriate this knowledge, in a passive sharing and a transfer of knowledge. The output of the Sharepoint analysis in KM support is illustrated in Figure 54. FG1 and FG2 accepted without comments.

KM support	
Provide knowledge transfer	Store project knowledge
Recover project knowledge	

Figure 54: KM support - Sharepoint
Source: Author

The main issue cited by interviewees was the access control. It is not possible to a pro-active individual to make his own search if he does not have access authorization. Individual should "*looks for PMO. […]. There is no free access in repository today where I have best practices. This is a point I would say PMO has to move forward*", said I13 and added "*It's up to the perception of the person in PMO*". Following, the analysis result of the last category in the framework SM4PM instantiated, Control category, will be discussed.

4.5 CONTROL

Collecting project information, measure and action to keep the project agree to the plan is the process of project control (PMI, 2013). In PMESP, EPM has two packages: EPM client and EPM web. EPM client is installed in the personal computer. EPM web is in the web and can be accessed from anywhere. The framework SM4PM was instantiated with EPM set tool. It is an institutional tool chosen by PMESP that helps project manager to control the project.

4.5.1 EPM

Among those interviewees of the New Organizational Climate Survey Project, there were three PMO members, one project manager and seven persons that had contact with EPM in their professional life (see Figure 29: Interviewees profile, page 77). But, the use of EPM in the PMESP is restricted to PMO and project managers. For this reason, the perception of ease to use of the EPM was not well ranked.

Despite this, EPM was considered useful. I11, although perceived difficulty in use, claimed that the benefit of the EPM is to work with schedule. I9 highlighted the remote access and automatic budget estimative of management are useful for daily activities in projects. Usefulness in EPM has a narrow relationship with project activities. Next, the research presents the project activities that EPM supports.

- EPM supporting PM activities

EPM has been found to be convenient to use wherever and whenever the user needs. "*If somebody wants to access it at another time, he can do it*" (I9) because "*I can access in any computer from the military police*" (I9) or "*If I'm home*" (I1).

With EPM, project manager can "*set up project charter and assembling the work packages. So here we go, quite simply, launching the activities, the deadline, the beginning and the end, to see what the situation is, whether everything is going well or not*" affirmed I9. Additionally, I15 declared that with the EPM, project manager can also "*put milestones of periods that had been accomplished, the resources that were allocated, how much time we spent to do that indeed*". This is useful to control the project's resources.

In the view of I13, these both packages (EPM client and EPM web) were defined as follows: "*EPM client gives you a lot of options on project management optics. It is more agile in terms of project editing, timing, interactions, resource allocation, cost estimation. Managerial. Following critical path, it is much more robust, much more colorful than the web one that although we can edit it in the web environment, it has a few limitations. So, I would say that the two are complementary. I see them as complementary although they can work, in all tranquility, disconnected*", giving voice to the PM activities that can be realized by this tool. All these facilities made EPM to be considered "*a guide that should be followed*" (I15) or "*protocol*" (I13), showing the importance of this tool for PM.

Users of EPM asserted that the project can be updated as PMO collaborator "*update with things that just happened that were not planned in Project*" (I15). EPM also indicates if

someone has pending activity as explained I9: "*Every time I access the web, it gives me the information that I have some activities, some pending tasks attributed to me. Then I see what these activities are and it gives me the deadline and whether it is late or not. The project stakeholder, a member of the team, project manager, or even the sponsor will see what pending issues are related to him. When I assign a resource to an activity, this person receives an email. You have an activity that starts that day and that is what EPM does. It commands the time someone assigned the activity"*. Appendix J-4 shows the evidence by others source.

Another important activity of the project that EPM gives support is report. In the situation repot, it is written: "*what are happening, the next steps and corrective actions*" affirms I6. I1 complements: "*Then the people on the team or the people who have the executive access, at any time check the progress information of the project, both through Project Server (EPM), which is the software purposed for this control, or through the report which is saved in the repository. The situation report is now done monthly"*. Summarizing, Figure 55 lists the PM activities supported by EMP. FG1 and FG2 agreed with Figure 55.

PM activities	
Construct critical path	*Control activities*
Alocate human resource	*Update project information*
Planning	*Report project progress*
Cost control	*Time control*
Perform project protocol	

Figure 55: PM activities - EPM
Source: Author

- EPM in KM support

In PM activities, it was mentioned 'update project information' and 'report project progress'. This knowledge interests the stakeholders of the projects. In doing the transfer of these knowledge to stakeholders, the EPM is performing a bridging process, the share internal knowledge, which was conceptualized previously in this study by Lopez and Esteves (2013). Evidence of KM support in the use of EPM is illustrated in Appendix J-5.

The output of the Control category analysis is a KM support list that EPM can provide. Figure 56 depicts this output list. In FG2, I1 reinforced that not everybody has authorized access in EPM. FG1 and FG2 totally agreed with Figure 56.

KM support	
Combination	Bridging
Provide knowledge transfer	Provide knowledge sharing

Figure 56: KM support – EPM
Source: Author

EPM has reasonable acceptance by PMO collaborator. "*Today I understand that it is a special tool. The EPM, we will have to use it in all projects, it is essential*" asserted I9. Yet, access control prevents spreading the best practices of project.

Each category of SM4PM artefact was evaluated with the intention to explore the interaction between users and artefact (context knowledge) and analyze its efficacy (category tool validation). In the next subsection, the analyses result under the perception of the integration of the SM in the SM4PM framework is presented.

4.6 SM4PM INSTANTIATED – INTEGRATION AND PROJECT LIFECYCLE

According to I3, "*the purpose of having one more tool is to facilitate the circulation of information and especially the capture of information*" because "*if we capture the information we are seeking, this will become improvement or become a lesson learned*". For this purpose, "*necessarily the tools have to be integrated*".

The perception of the integration in the SM4PM instantiated framework showed blurry up but not in all cases. Some testimonies assert that tools in the framework are integrated and some do not agree with this position. In the following paragraphs theses contradictions are described.

The perception of the integrated use of EPM, Sharepoint and Lotus Notes is clear as cited in subsections 4.4 REPOSITORY, page 105 and 4.5.CONTROL page 110. In some case, perception of integration is clear for the interviewee, as commented I18: "*I see integration very easily*". Another perception came from the complementary use of the same tool in diverse platforms, as asserted I15 in which interviewee affirms that there is "*integration, because one (tool) complements the other. EPM does not allow more than one person to edit. In theory, one will have to wait to do the editing he wants. Once this is happening, the other tool (EPM client) will complement. The probability of me not passing the information I need is going to decrease a lot, because I have another tool that complements and I can already interact and provide the*

information on the other channel". I18, I1 and I6 corroborated with I15 position. Adversely, the totally lack of knowledge about Sharepoint is an evidence of the perfect integration of the tool, as perceived in the speech of I9: "*I do not know if it is in Sharepoint, this information I do not have*".

Another group of interviewees (I1, I6 and I14) justified that the ease of exchange of the SM tool during the process of First Wave Test gave the perception that the framework was integrated. I1 also affirmed that WhatsApp Web integrates with personal computer, concluding that it can be integrated with other tools.

Conversely, some testimonies asserted that SM4PM framework does not have integrated tool. For the view of I13, integration should be done by a unique tool: "*I should have a project management's tool that it would do everything integrated. This would be an ideal world. This is an opportunity for a tool, an integrating tool. […] It must have human's intervention to provide this integration. There is not a tool that does all this"*. Corroborating, I11 said: "*I do not understand the integration. I do not know any integration of Sharepoint repository with PM Social, WhatsApp and with Lotus Notes. Perhaps Sharepoint and EPM*".

Despite of these counterpoint, the acceptance of the framework was high. I9 commented that he "*would not replace these tools by another*". I8 agreed with I9: "*From this framework, I would not stop using any tool, I would use all*". I6 highlighted: "*It was a benefit the insertion of social media".* I3 gave the opinion that "*it was an orientation that worked out. I think it was cool*". I4 reinforced the relevance of the use of a framework: "*I've always worked with framework. In my mind has a PDCA framework. Someone has already studied it (the framework). It is what I have known, and I have seen that it really brings results, especially how to do it. It has no doubts that it is a framework that should be internalized; mainly by the managers*".

Perception of usefulness was evidenced by I15 as SM4PM framework has specific tools for specific activities. Already, the interviewees I6, I1 and I15 also argued that remote access helps on updating the project information, which is useful. In this case, convenience increased the intention of the use, in line with Yoon and Kim (2007).

I1 declared in an interview segment that SM4PM tools is a place of interaction to be in touch with knowledge, praise and others information's instantly, confirming that it is a virtual shared space. The perceived benefits were improvement of the performance (I1) and facilitation of communication (I18).

On the topic of quantity of the tools that should be used, there was not a convergence. I13 and I6 argued that, with more options, the users could choose the one that is the easiest to use or the most familiar. Counterpointing, I11 claimed that if it is more centralized, more people would join it, declaring: "*who would like to get into many tools to reach an information? Who thinks this is nice? […] We must try as much as possible to focus the information on one tool*". I11 outsourced the concern of using many tools: "*This forces you to search for information in all of them. Without integration, the individual must use a different login for each tool*". I3 gave another view affirming that the issue is not the quantity of the tools to be used but to have a dissemination strategy where "*knowledge gets the way it should arrive: whole and integral*". The proposed process should be "*defined, written, disseminated, known to everyone*" (I11). I6 complemented "*integration depends on agreement with the project team*".

After analyzing the data from interviews, the researcher conducted the FG with those findings affirming that it was not clear if the integration was perceived by the users. It was previous planned in the research stage evaluation (Figure 27). In both FG, it was necessary to spend a long time in discussion about integration. Figure 57 depicted the duration of each FG and the time spent to discuss the theme Integration. 20% to 25% of the FG was spent to discuss the specific theme Integration of the SM4PM instantiated framework, showing the uncertainty of the interviewees perceptions.

ID	Duration Total (hour)	Duration Integration Discussion	%
FG1	**01:09:17**	**00:17:40**	**25,5%**
FG2	**01:17:47**	**00:16:00**	**20,5%**

Figure 57: Focus group duration
Source: Author

The first perceptions of the interviewees were that tools in the artefact were not integrated because they consider only physical integration. I2 asserts that "*in communication category, the tools do not connect*". From this perception, I13 said: "*Necessary human intervention to make the knowledge flow from one to another but it works [...] you need to have a recruit back to capture all this information*". With this reminder, I5 reported: "*I tabulated the information, put it in the PM Social, and there was a contact with the Software Factory's analysts. They did not want to join the WhatsApp group, they asked to join the PM Social. It was done. The information was made available*", evidencing that I5 had the mission to do it. I11 put an issue in this finding: "*It is integration by process because it was defined that I5 would*

get all WhatsApp content and put in the PM Social. I am in doubt, because it seems at first, that it is integration by person". I3 affirmed: "By p*rocess because of the definition of responsibility*". All participants agreed.

In FG2, I1 asserted that there was "*integration by agreement with the project team*" because "*we said that WhatsApp was to be used and who did not desire to join WhatsApp, could use the PM Social*", emphasizing an agreement among project team. The same perception of I2 in the FG1, I18 in FG2 had the perception of the lack of integration as tools were not physically integrated, as declared by I18 in this commentary: "*Now, the problem was people who only used WhatsApp or only used the PM Social. If he just put it in WhatsApp and I just put it in the PM Social, I do not know what he put there*". "*It was compartmentalized*", confirmed I14. Conversely, I10 gave a testimony: "*I5 puts the reports (in PM Social), the information of what was happening, trying to improve, to solve these problems. These problems he took from WhatsApp*". I18 exchanged his opinion: "*Then there was (an integration). It was a precarious integration. It had a mediator who was carrying the message*". I1 confirmed the I10 testimony: "*It depended on me talking to E5, we would make available to the Software Factory's staff for them to have access to reports of inconsistencies and nonconformities, so E5 cataloged all inconsistencies of the system, available in the dissemination part of the PM Social knowledge*". I18 concluded: "*The integration happened? Yes. But what about the quality of this interaction? Quality of speed, accuracy of information. […] if I pass and then you pass, it is no longer my information. It is yours"*. Participants of FG2 agreed. FG2 concluded that there was a partial integration. Instructions of what tool could be used to execute the activities of the First Wave Test were agreed upon previously but they were not formalized, leading to the conclusion that it is necessary to write and to design a process that explains the use of the framework. Besides, it was necessary for one person to collect data from WhatsApp and post it in the PM Social, inferring that it was necessary to involve people in the process.

Finally, in both FG, it was presented evidence that in the SM4PM instantiated framework, lessons learned are registered during the whole of project lifecycle by situation report and minutes of meeting. In FG1 all participants agreed and no more documents were included. In FG2, I1 requested to include schedule and change request in the list. All participants of FG2 agreed and it was included. The list of the documents that register lessons learned is displayed in Figure 58.

Document for register lessons learned in project lifecycle	
Situation report	Minute of meeting
Schedule	Change request

Figure 58: Documents that register lessons learned in project lifecycle
Source: Author

The process of registering a lesson learned received some commentaries from FGs. I1 in the FG2 reported: "*It (lesson learned) will be as an integration of the situation report and change request. I am requesiting for an extension of time, based on the information that the Software Factory sent to me*". In the passage reported, I1 suggests that it is a lesson learned to read together the documents meeting minutes, situation report, change request and timeline.

In FG2, I11 alerted: "*We have not established in the Software Factory, process for lessons learned. Most of the time they are spread in emails, in the heads of people who already go through those problems but we do not have a process*", demonstrating that PMO does not have a process to eficiently collect lessons learned and register them. I3 described the current *modus operandis*: "*Try to track all the paths again or read all the documentation*". I2 remembered: "*The turnover happens*". I11 justified: "*So, you have to establish a process, moments of capturing lessons learned. Let's capture and explore*", showing that is is a necessity.

When analyzed, data from all categories show relationships between PM and KM. Activities in PM use processes of KM, in accordance with Ahern et al (2014) which re-conceptualized project as a process of knowledge. KM support is the base for PM activities. As a practical example, in the PM activities debugging information or share issue and questions, individuals socialize the ideas in their minds with existing knowledge. Putting ideas in the SM is an act of externalization. This is an environment of a KM process of knowledge creation. This relation happens in the whole project lifecycle. In this view, project has a role of a knowledge process.

Another remarkable finding is related to the KM process, based on Alavi and Leidner (2001). In each SM4PM category, there are evidences that all the processes of KM (knowledge creation, knowledge transfer, knowledge store/retrieve and knowledge application) happens inside of each category, providing support that KM processes are independent of SM category. These evidences are shown in Figure 59.

Category /SM	KM process	PM activities	KM support
Communication WhatsApp	Knowledge creation	Debbuging information, promote team interaction, share issue and questions, give feedback, integration the project team, follow-up project activities	Socialization, externalization, promote knowledge creation
	Knowledge transfer	Report facts, give feedback, share issue and questions, follow-up project activities	Promote knowledge sharing, share tacit knowledge
	Knowledge store/retrieve	Register conversation, register image	Repository of knowledge
	Knowledge application	-	-
Communication Lotus Notes	Knowledge creation	-	-
	Knowledge transfer	Task designation, schedule meeting	Knowledge sharing
	Knowledge store/retrieve	-	Storage/retrieve knowledge
	Knowledge application	-	-
Dissemination PM Social (Blog)	Knowledge creation	Interaction between team members	Externalization, provide a virtual shared space
	Knowledge transfer	Register the project information, update project information, register lessons learned, access project asset, report project information	Provide knowledge transfer, provide a virtual shared space, provide bridging, provide knowledge sharing, share tacit knowleged
	Knowledge store/retrieve	Register the project information, register lessons learned, access project asset	Provide a virtual shared space
	Knowledge application	-	Provide a virtual shared space, apply knowledge
Repository Sharepoint	Knowledge creation	-	-
	Knowledge transfer	Recover project life cycle, recover lessons learned, construct project history	Provide knowledge transfer
	Knowledge store/retrieve	Store the project documents, recover project life cycle, upload and download documents, register lessons learned, recover lessons learned, construct project history	Recover project knowledge, store project knowledge
	Knowledge application	-	-
Control EPM	Knowledge creation	Construct critical path, perform project protocol	Combination
	Knowledge transfer	Alocate human resource, planning, cost control, perform project protocol, control activities, update project information, report project progress, time control	Provide knowledge transfer, bridging, provide knowledge sharing
	Knowledge store/retrieve	Sharepoint	Sharepoint
	Knowledge application	Planning, cost control, time control, control activities	Combination

Figure 59: Relation among PM activities and KM process supported by SM
Source: Author

In agreement with Oun et al. (p.28), PM has a strong association with KM. The merge of PM and KM activities resulted in the construction of Gasik's PKM (p.29) in the 'executing knowledge management' and 'knowledge summarization' phases, which the SM4PM instantiation is based on (p.30). What highlights the 'executing knowledge management' phase are PM activities within the KM process, which indicates that there is mobilization of knowledge and its development. However, the difference compared with Gasik's PMK is that 'knowledge summarization' phase will occur throughout the project lifecycle, a contradiction to chronological phases of Gasik's PKM.

4.7 ARTEFACT VALIDATION AND DESIGN CHANGES

The present subsection has the objective to present results of the perception of ease to use, usefulness and convenience based on the result of FG and TAM methodology (Yoon & Kim, 2007) to validate the SM4PM instantiated framework. Results will serve as a basis to propose improvement to the artefact.

In Figure 60, the current study presents the metrics used to assess the three dimensions (ease to use, usefulness and convenience) that validate the SM4PM instantiated artefact. Ease of use is the perception of using the artefact without effort and usefulness is the measure of the belief that the use of the artefact would enhance performance (Ng, Shroff, & Lim, 2013). Convenience is the degree to which an individual can use the artefact whenever and wherever he needs (Yoon & Kim, 2007). Measure were took using the qualitative result of the questions purposed.

Methodology	Dimension	Metric
TAM (Yoon & Kim, 2007)	**Ease of use**: refers to the degree to which a person believes that he or she could use the particular system without effort (Ng, Shroff & Lim, 2013)	Qualitative perception: Do you have necessity to use another tool? Do you want to exchange any tool?
	Usefulness: is the degree to which a person believes that using a particular system would enhance his or her performance whilst (Ng, Shroff & Lim, 2013)	Qualitative perception: In what ways do these tools interfere with your project activities?
	Convenience: The degree of perception held by someone that he/she can use particular system to accomplish their job at a time, place and process that is more convenient for them (yoon & Kim, 2017).	Qualitative perception: How do you give continuity to your work, when you are: In another department or another group company Outside the business environment

Figure 60: TAM metrics
Source: Author

During the interview, the researcher explored the perception in its three dimensions by each category and for the whole framework. This study received considerable contribution in Communication category. Ease of use, usefulness and convenience were strongly perceived in this category by WhatsApp. Lotus Notes received little commentary, possibly because WhatsApp is the novelty in the process and it demands more commentary. In Dissemination category PM Social did not get a good overall feedback. Although it was perceived useful and convenient, most of interviewees found it difficult to use. This criticism is justified by lack of training and lack of strategy for Dissemination that were found in the subsections 4.3.1 PM Social blog, page 105, and 4.6 SM4PM instantiated – integration and project lifecycle, page 113. The result of the low perception of the dimension ease of use lead a low engagement in the use of PM Social as described in Yoon and Kim (2007). Repository category received the fewest contributions in this study because it is physically integrated with EPM and its uses is transparent (cannot be perceived as being used). Control category was well perceived in convenience as this tool can be used in any place, at any time. The tabulation of the results is displayed in Figure 61.

	Communication				Dissemination		Repository		Control		SM4PM instantiated	
	WhatsApp		Lotus Notes		PM Social		Sharepoint		EPM		Integration	
	Y	N	Y	N	Y	N	Y	N	Y	N	Y	N
EOU	12	1	0	0	3	6	0	0	0	1	0	0
U	10	0	2	0	6	0	0	0	3	0	3	0
C	6	1	2	1	6	0	1	1	4	0	2	0

Figure 61: Tabulation of TAM results
Source: Author
Abbreviation: Y: yes; N: no; EOU: ease of use; U: usefulness; C: convenience
Note: number is the quantity of interviewees

Despite of all contributions and results per category, these were not reflected in the SM4PM instantiated integration. What was perceived by the researcher observations is that interviewees could not think of the framework as a whole. These results caused the perception of ease of use and convenience to blur up, as illustrated in Figure 62.

	Dimension	Interview	FG1	FG2
TAM	Ease of use	NC	NC	NC
	Usefulness	Y	Y	Y
	Convenience	NC	NC	NC

Figure 62: TAM result
Source: Author
Abbreviation: Y: yes; NC: not confirmed

After the First Wave Test, results of the SOM4PM instantiated artefact validation and stakeholder's assessment indicate that the artefact should be refined. The maturation of the artefact is planned in the Design Science Research (DSR) approach and Technical Action Research (TAR) methodology.

The current study proposes as a first step of the improvement, to apply a macro-knowledge lifecycle proposed in Gasik (2011), meaning that the process should be designed for formal application with the intention to clarify the framework and engage the usability.

In the refined artefact, it was proposed to indicate how the social media (SM) is integrated. As a solution, WhatsApp is being indicated to be integrated by a process that explains how and in which situations is to be used. PM Social is integrated with a link to PMO website, in line with what was proposed in Ikemoto (2017) which affirms that tool integration can be done by links connections.

In Ikemoto (2017), it is emphasized that the integration of SM ensures traceability of the data. Traceability is achieved with registration, which is in line with the stakeholder's objective: to register the inconsistencies of the New Organizational Climate Survey Test (First Wave Test). The summary of the improvement applied in the artefact is listed in Figure 63.

Integration	Design change	Reason
WhatsApp	Formalize a process which clarifies 5W (what, who, when, where, which)	Enhance perception of integration and usefulness
	Formalize who and when the content should be register in the repository	• Establish the integration by process • Enhance perception of integration and usefulness
PM Social (blog)	Create a community by project	• Establish virtual shared space • Increase knowledge database • Enhance perception of usefulness
	Create a post as an abstract of the project	• Share knowledge for whom has not access of the project • Enhance perception of usefulness
	Create a link for PMO website	• Integrates PM Social and responsible of EPM • Enhance perception of ease of use, usefulness and convenience

Figure 63: Design changes in SM4PM instantiated artefact
Source: Author

Applying the micro knowledge lifecycle of Gasik (2011), it was possible to enhance two TAM dimensions: ease of use and usefulness. Results of the stakeholders' assessment indicate that unfamiliarity with PM Social made users avoid it. Figure 64 indicates that there is not a design change in the SM4PM instantiated framework, but the researcher suggests trainning users.

Social media	Action suggested	Reason
PM Social (PM)	Training the users to use the PM Social blog	Engage the use Enhance perception of ease of use and usefulness

Figure 64: Suggestions based on micro knowledge lifecycle
Source: Author

Based on the assessment of the stakeholders and TAM validation of the artefact, design changes and sugestions were made to refine the SM4PM instantiated artefact. In the next section, the researcher presents the refined artefact.

4.8 THE FRAMEWORK SM4PM INSTANTIATED REFINED

Previous subsection described reasons and propositions that suggest the refinement of SM4PM. These changes are represented in the SM4PM design. The center of the framework, Integration, is now represented by a three-dimension cycle, making an analogy of layers of integration. Low layer represents physical integration. EPM and PM Social belong to this layer. EPM has a physical integration with Sharepoint and Lotus Notes tools. Yet, PM Social has a physical integration with Lotus Notes. But both EPM and PM Social do not have this deep interaction between them. One of the design's changes integrates EPM and PM Social by connecting Dissemination and Control category with a link in the PM Social blog, addressing an e-mail to the PMO's responsible or to a PMO's web page. This link is represented in the SM4PM framework with a chain that joins both EPM and PM Social.

In the central circle, Integration, an icon with the shape of a human head with gears inside was added, representing that in the high level of integration, it can be done by process and people. The same shape and icon of central circle Integration was applied to WhatsApp tool, in the Communication category. These changes represent that WhatsApp is integrated by process and people, as described in the subsection 4.7 Artefact Validation and Design Changes, page 119. Figure 65 illustrates the refinement in the SM4PM instantiated framework.

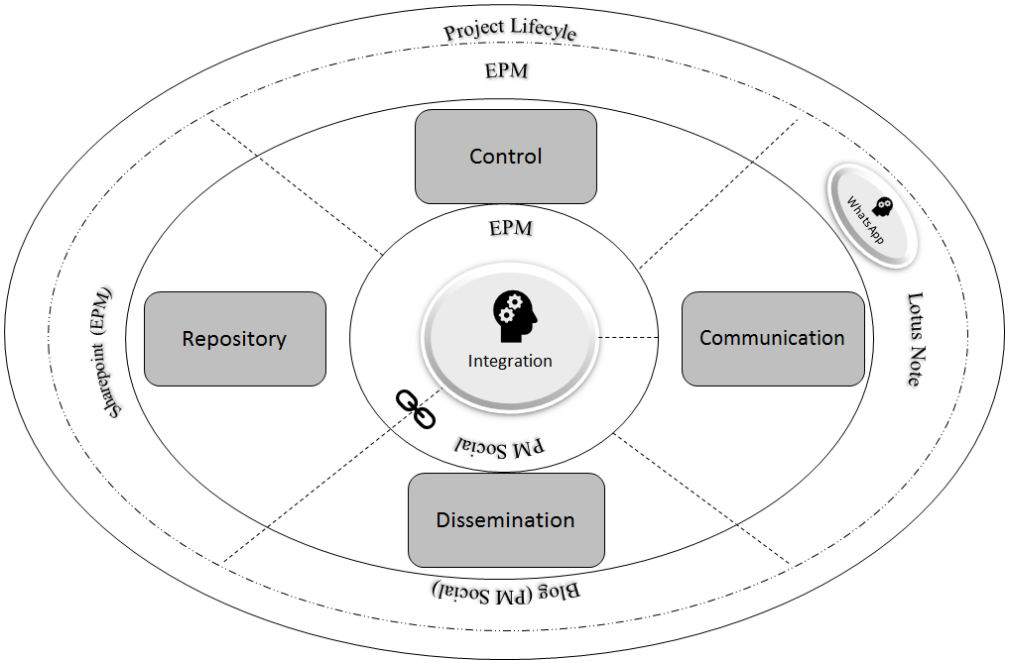


Figure 65: SM4PM instantiated framework refined
Source: Author

The refined framework was presented to a two-confirmatory focus group (CFG) to validate the refinement. CFG1 was formed by four practitioners and CFG2 by four practitioners. The total duration of time of CFG was one hour and forty-eight minutes. Researcher followed the confirmatory focus group protocol that is in the Appendix C. Resume of the CGF1 and CFG2 composition is depicted in Figure 66.

	CFG1	**CFG2**
Members	I5, I6, I9, I13	I4, I7, I15, I18
CFG duration	00:39:49	01:08:44

Figure 66: Composition of the confirmatory focus group
Source: Author

The researcher began the CFG with the findings of the FG as a refresh of the subject. Over these findings, the refinement was proposed. CFG1 validates the findings of FG highlighting that "*convenience should be thought not only about regulation but also cost of material and other financial impacts*", said I5, supported by I13. Next, the proposition of the SM4PM refinement was presented and was validated by CFG1. I13 exposed the participant's impression: "*a simple way to integrate, by link"* and complemented with new ideas: "*we can*

point out other types of communication tool as a gateway to PM Social where the information of projects is being disseminated". I9 agreed with the proposition of training individuals in PM Social as "*should be a bit more explored*". Asked if the Figure 65 represents the SM4PM instantiated with the refinements, CFG1 confirmed and validated. After, the researcher requested for the CFG to speak about their understanding of the project lifecycle in the SM4PM instantiated refined framework. After some reflection, CFG1 confirmed with no doubt that the whole flux of the SM4PM happens during the whole project lifecycle. About the theoretical validation of the SM4PM refined, considering ease of use, usefulness and convenience, I13 "*liked*", supported by I5 and I6. Convenience had some commentary about the regulation in the use of WhatsApp and restriction of the use of EPM. Despite of this, CFG1 agreed that SM4PM is convenient.

The same dynamics were applied to the CFG2. I4, I7, I15 and I18 agreed with the FG findings and agreed with the refinement in the WhatsApp tool. In the refinement related with PM Social, I4 commented: "*it was a way to increase the potential of the tool*". About the action in the micro knowledge lifecycle, I4 warned: "*How to train?*". Engaging individuals requires a plan with previous communication that can sensitize and will make them understand the role of the PM Social and then, it is necessary to plan the way how the training should be conducted, asserted I4. Thinking of the policemen who is in the street, I7 commented that they will not have the interest in learning how to use the PM Social. They will use the most popular SM because they "*want to be part of this group*" (I7).

Asked about the understanding the project lifecycle in the SM4PM, some discussion surfaced because the group wanted to compare with PDCA (plan, do, check and act) cycle. After some discussion under the theme, the group entered consensus that "*categories will fit into every stage of the project lifecycle*", affirmed I15. Likewise, the group recognizes that knowledge processes happen during the whole project lifecycle.

Crucial discussion appeared when researcher gave the chance of the group to enhance the SM4PM instantiated refined design. I15 suggested exchanging Repository category with Control category because visually the proximity of Control category and PM Social should make more sense of the link. On the other side, I18 proposed exchanging the circle Category with circle Integrator. In the new suggestion, the understanding of the integrator that integrates SM categories is clearer to the reader. For CFG2, categories represent the knowledge areas, as depicted in Figure 67.

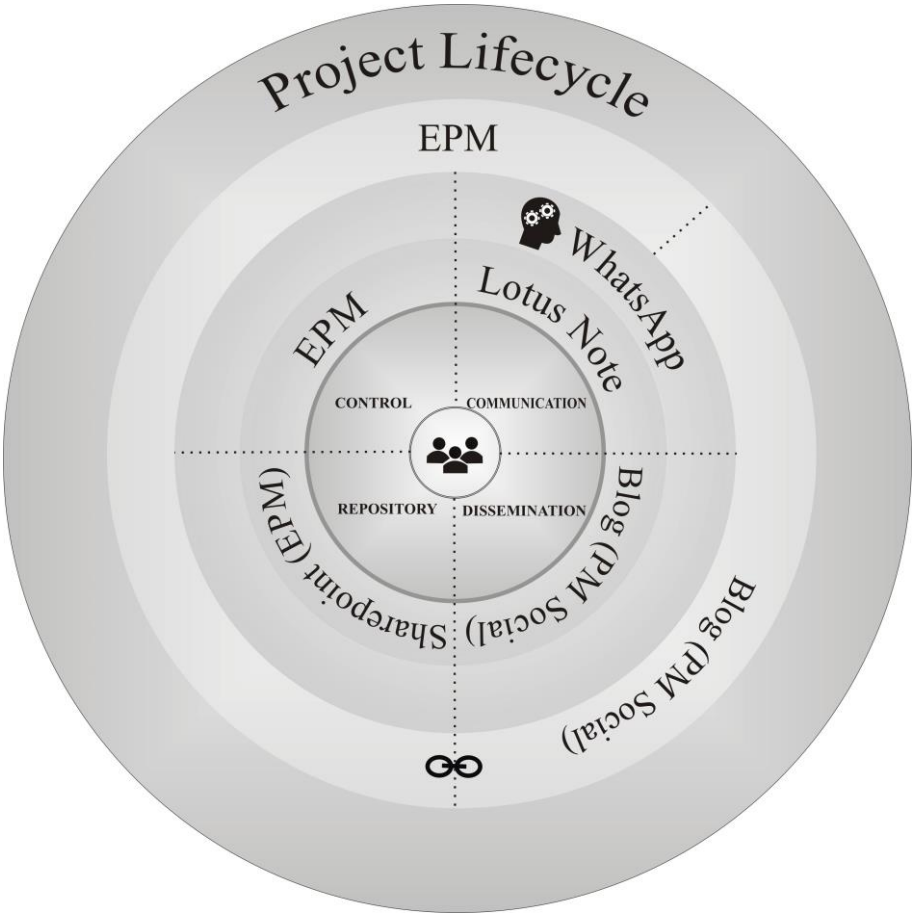


Figure 67: SM4PM instantiated refined and redesigned
Source: Author

The final refined framework, human ideas (ideological environment) is permeated by knowledge area, the categories, that uses SM tools in an integrated way (technological environment), inside project lifecycle. SM4PM intantiated refined framework is in line with the KH Funnel proposed in the subsection 2.2 Social media, p. 38.

The results obtained suggest several contributions in theoretical field, confirming and giving more knowledge in the extant theory and reveal new theory for academy. Practical contribution benefits the whole graduation in PMESP and can be extended to another public security organizations and organizations in general. The contributions are explained in the next section.

5 THEORETICAL AND PRACTICAL CONTRIBUTIONS

The present study was engaged to reveal the relevance of the integrated use of social media in project manager supporting knowledge management. In that purpose, it was crucial to apply prescriptive framework in a classical use (project management), empirically in an existing problem (collect and register lessons learned) to find a new role of this framework: manage knowledge.

The findings brought different types of theoretical contributions, those for confirming current theory, other adding new factors that redirect existent views. Theory contribution based on the practical utility in diverse scenery. Theoretical and practical contribution is presented in the follow subsections.

5.1 THEORETICAL CONTRIBUTIONS

The researcher has been able to confirm existing theory. The base of the framework is technological constructed by integrated social media that achieve knowledge process, based in ideas, in line with Maier and Schmidt (2015). The ideas come from individuals that input the knowledge in the SM, where by physical or process integration it is recorded in the repository, analogous to Stein & Zwass (1995). The usefulness of the confirmation of the exiting theory is to bring new and additional evidences that it will conduct to new paths for continued study of that theory, according to Corley and Gioia (2011).

Besides, the current study associates aspects of where the role of SM in KM has matched the Holistic Knowledge (HK) Funnel, in line with subsection 2.2.1 Social media for knowledge management, page 40. The theory in which HK Funnel was constructed is exiting theory but the approach to view KM in holistic view can provide insights to a macrolevel theory in KM.

New factors found in the current study make it possible to extent the knowledge frontiers. Relation between PM and KM was already studied by Gasik (2011). New knowledge comes from the evidence that all process of KM runs inside each category of SM4PM instantiated framework. The utility of the findings is a new understanding of which knowledge process run in each PM's steps, allowing insights of proposing micro frameworks, in line with Corley and Gioia (2011).

The stakeholders' aim in the unit of analysis of this study was to register inconsistencies in the First Wave Test. The use of both Communication category tool (WhatsApp) and

Dissemination category tool (PM Social) in another function (register), emphasize the multiple use of social media in the same project, giving rise to new application of each tool, as asserted Whetten (1989). This new result implies collecting tacit knowledge during the project lifecycle. By the view of science, it would be opening a road to study transferring tacit knowledge by technological instrument as made in Yi-Frazier et al. (2015). In addition, it may be reasonable to suppose that in the SM4PM instantiated framework, explicit and tacit knowledge circulated, implying that project is a process of knowledge, in the same line with Ahern et al. (2014).

Although this study did not focus on human behavior, it appears in theory background and data analysis. Social media is driven by human faculty of exchange and collaboration, a nature extension (Fernando, 2010). The use of WhatsApp was compared with a human behavior. It seems likely that WhatsApp is an extension of mind or smartphone is an extension of the body. There is a clear possibility for science to embrace the study of this proposition which is revelatory, according with Corley and Gioia (2011).

Invaluable finding emerged during the study of strong association of PM and KM in Gasik's (2011) PKM. Overall, it is accepted that SM4PM instantiated framework resulted in the PKM's steps 'executing knowledge management' and 'knowledge summarization'. However, 'knowledge summarization' runs inside 'executing knowledge management', significantly different to the chronological Gasik's (2011) PKM. This counterpoint is a useful idea to rethink PKM flux.

Data analyses result of the current study evidenced that SM4PM, initially designed to support project management, can also manage knowledge. It supports the idea that SM4PM framework can be applied in diverse management areas, implying that it can solve a class of problems, in line with Wieringa (2014). These problems include collecting lessons learned naturally during the project lifecycle, manage the knowledge in project management, organization's communication and understand relation among processes and its integration, as a list of examples.

5.2 PRACTICAL CONTRIBUTION

The DSR provides an experience that join theoretical foundation to develop an artefact and apply it in a real word. This gives the opportunity to enrich the existing theories whose practical application solves a class of problems. The role of the researcher is to apply theory to propose practical utility which was achieved by the instantiation of the SM4PM framework.

SM4PM is an organized and visual protocol that regulates and explains how SM are integrated, and for what purpose they should be used. The artefact SM4PM can be considered as an organizational asset, helping PMESP's PMO to spread the methodology of PM and KM. SM4PM as organization asset is in line with the strategy of the General Command of the PMESP, and can be used by Majors that are responsible for organizing the diverse sections in an public security organization.

Technological support came from the use of SM in the current study. The SM brought an infrastructure and an environment of updating, improvement and reinforcement in the support of PM and KM, justifying the use of the same SM for both objectives, implying less investments in technology but achieving efficiency. The integrated use of SM, added to its ease of use, usefulness and convenience, bring benefits to the policeman that usually are in the street and can update, be updated and report their difficulties by the SM4PM. Captains in the function of project managers that support their stakeholders and team members using SM4PM, and finally Colonels that getting advanced knowledge about the situation, can make the decisions quickly.

The adoption of SM by the project team led to the engagement of collective knowledge, as stated by Cabitza and Simone (2012) and Maier & Schmidt (2015), reducing the responsibility of the project manager in the theme of the equalization of individual knowledge.

Unlike Park and Lee (2014) who suggest grouping teams with similar experiences, in the First Wave Test, the project enriched different users' visions, suggesting that the interaction in the project with a diversity of stakeholders brings benefits for the project.

The generalization of the use of the SM4PM framework (justified in 5.1) suggests its application in diverse types of project and scenery in a public security organization. Both simple and complex projects need to use the four categories of SM4PM. Distinctions are made by powerful of the SM tool, quantity of SM to be used and how SM would be integrated. These distinctions were already explored in Ikemoto (2017). Outstanding is the use of SM4PM in diverse management area. Managing is control, but efficacy is achieved by means of communication and dissemination (Ignacio, 2016), all with the guarantee of being stored and retrieved. Besides, PM and KM can be used in people management (stakeholders, customer, human resource), assets management (financial, equipment), process management among others.

For the purpose to tie up loose ends, the current study will be summarized. First, it was proposed a prescriptive use of integrated social media in project management by a SM4PM

framework to help project teams doing their activities well (theory to practice). With the data analyses results from First Wave Test, based on the reason the users act, SM4PM instantiated framework was refined, bringing theory from practice. Reconciling both, applying theory to practice and recovering theory from practice, implies the enhancing of scientific knowledge.

6 CONCLUSION

This research showed the instantiation and the evaluation of the SM4PM in a New Organizational Survey Project in PMESP. It demonstrated the effects of the SM4PM instantiated in the context and artefact validation. These results allow to answer the research question: **How does the integrated use of SM support KM in activities related to PM in a project of a public security organization?** The originality of the solution lies in the fact that the results confirm that social media supports both PM and KM.

It was evidenced when the researcher crossed PM activities with KM process presented in Figure 59. SM made possible to track the KM processes and support. Each category of SM4PM supported the whole KM processes. Althought the KM process is the same in all caategory, the same KM process is related with different PM activities, however, the role of the KM process does not change. For each set of PM activities, there were KM support associated.

Integration was done with mixed solution. Technical solution with the use of SM (EPM and PM Social), practical soluiton with a link and people. The assessment of the context resulted in the refinement of the artefact and SM4PM artefact was validated by TAM model. This finding is an evidence that SM4PM can have its use generalized because the framework manage knowledge inside project processes. Therefore, the SM4PM framework offers a solution to a class of problems: manage the important knowledge during the whole project lifecycle which has the ability to upload documents, images, and whose content can be easily stored, recovered and disseminted.

The main limitations of the experimental result were the small project team and the data collection done only in one phase of the project. The limited number that composes the project team could bring bias to the study. However, the high number of experienced users in PM minimizes this limitation. The findings of the current study are promising and should be explored in the assessment during the whole project lifecycle which requires clarification.

Several other questions remain to be addressed. Attention should be paid to about human relationship with SM as an extension of human faculty and social behavior. Further investigation is needed to verify the proposition that SM is an extension of human mind and smartphone is an extension of human body. In the same line, this present study found an evidence of transferring tacit knowledge by SM narrating the user’s experience by an image. More experiments will be needed to verify how this phenomenon occurs and its impact in the PM and KM. Other research opportunities should be explored to confirm the depth of the

integration of the SM. Theoretically, there was a validation of the integration of SM but it suggests a longitudinal study since there was no previous comparison.

Besides that, the findings showed that all process of KM runs in each SM4PM category encouraging more studies to verify to what extent each knowledge process run. After all, the current study presented evidence of a solution for a specific problem in a public security organization. Continued doctoral research on integrated use of SM supporting KM in activities related to PM by a DSR approach appears fully justified. SM4PM solution brought specific knowledge that once being generalized can be an answer of a class of problems that affects other organizations.

REFERENCES

Addas, S., & Pinsonneault, A. (2014). IT capabilities and NPD performance: examining the mediating role of team knowledge processes. *Knowledge Management Research & Practice*, *14*(1), 1–20. https://doi.org/10.1057/kmrp.2014.16

Ahern, T., Leavy, B., & Byrne, P. J. (2014). Knowledge formation and learning in the management of projects: A problem solving perspective. *International Journal of Project Management*, *32*(8), 1423–1431. https://doi.org/10.1016/j.ijproman.2014.02.004

Aken, J. E. van. (2004). Management research based on the paradigm of the design sciences: the quest for field-tested and grounded technological rules. *Journal of management studies*, *41*(2), 219–246.

Al Saifi, S. A., Dillon, S., & McQueen, R. (2016). The relationship between face to face social networks and knowledge sharing: an exploratory study of manufacturing firms. *Journal of Knowledge Management*, *20*(2), 308–326. https://doi.org/10.1108/JKM-07-2015-0251

Alavi, M., & Leidner, D. E. (2001). Review: Knowledge management and knowledge management systems: conpectual foundations and research issues. *MIS Quarterly*, *25*(1), 107–136.

Alberghini, E., Cricelli, L., & Grimaldi, M. (2014). A methodology to manage and monitor social media inside a company: a case study. *Journal of Knowledge Management*, *18*(2), 255–277. https://doi.org/10.1108/JKM-10-2013-0392

Argote, L., McEvily, B., & Reagans, R. (2003). Managing knowledge in organizations: An integrative framework and review of emerging themes. *Management science*, *49*(4), 571–582. https://doi.org/10.1287/mnsc.49.4.571.14424

Bardin, L. (2011). *Análise de conteúdo* (3º ed). São Paulo: Edições 70.

Baskerville, R. L. (1999). Investigating information systems with action research. *Communications of the AIS*, *2*(3es), 4.

Baxter, G. J. (2014). Implementing Web 2.0 tools in organisations. *The Learning Organization*, *21*(1), 2–5.

Bebensee, T., Helms, R., & Spruit, M. (2011). Exploring Web 2.0 applications as a mean of bolstering up knowledge management. *The Electronic Journal of Knowledge Management*, *9*(1), 1–9.

Bell, L., Van Waveren, C. C., & Steyn, H. (2016). Knowledge-sharing within the project-based organisation: a knowledge-pull framework. *South African Journal of Industrial Engineering*, *27*(4), 18–33. https://doi.org/10.7166/27-4-1580

Bharati, P., Zhang, W., & Chaudhury, A. (2015). Better knowledge with social media? Exploring the roles of social capital and organizational knowledge management. *Journal of Knowledge Management*, *19*(3), 456–475. https://doi.org/10.1108/JKM-11-2014-0467

Blomquist, T., Hällgren, M., Nilsson, A., & Söderholm, A. (2010). Project-as-practice: In search of project management research that matters. *Project Management Journal*, *41*(1), 5–16.

Boell, S. K., & Cecez-Kecmanovic, D. (2014). A Hermeneutic Approach for Conducting Literature Reviews and Literature Searches. *Communications of the Association for Information Systems*, *34*(1), 12.

Bolisani, E., & Scarso, E. (2016). Factors affecting the use of wiki to manage knowledge in a small company. *Journal of Knowledge Management*, *20*(3), 423–443. https://doi.org/10.1108/JKM-05-2015-0205

Braglia, M., & Frosolini, M. (2014). An integrated approach to implement project management information systems within the extended enterprise. *International*

Journal of Project Management, *32*(1), 18–29. https://doi.org/10.1016/j.ijproman.2012.12.003

Bredillet, C., Tywoniak, S., & Dwivedula, R. (2015). What is a good project manager? An Aristotelian perspective. *International Journal of Project Management*, *33*(2), 254–266.

Breunig, K. J. (2016). Limitless learning: assessing social media use for global workplace learning. *The Learning Organization*, *23*(4), 249–270. https://doi.org/10.1108/TLO-07-2014-0041

Cabitza, F., & Simone, C. (2012). Investigating the role of a Web-based tool to promote collective knowledge in medical communities. *Knowledge Management Research & Practice*, *10*(4), 392–404. https://doi.org/10.1057/kmrp.2012.31

Câmara, R., Chaves, M. S., Soares, R., & Tessi, M. (2015). WikiRiskMan: um framework para gestão de riscos em projetos. In *Twenty-first Americas Conference on Information Systems*. Puerto Rico.

Carrillo, P., Ruikar, K., & Fuller, P. (2013). When will we learn? Improving lessons learned practice in construction. *International Journal of Project Management*, *31*(4), 567–578. https://doi.org/10.1016/j.ijproman.2012.10.005

Cerchione, R., Esposito, E., & Spadaro, M. R. (2016). A literature review on knowledge management in SMEs. *Knowledge Management Research & Practice*, *14*(2), 169–177. https://doi.org/10.1057/kmrp.2015.12

Chaves, M. S., Araújo, C. C. S. de, Teixeira, L. R., Rosa, D. V., Glória, I., Jr., & Nogueira, C. D. (2016). A new approach to managing Lessons Learned in PMBoK process groups: the Ballistic 2.0 Model. *International Journal of Information Systems and Project management*, *4*(1), 27–45. https://doi.org/10.12821/ijispm040102

Chaves, M. S., & Pedron, C. (2015). Web 2.0 Technologies in Project Management: A Proposal of a Benefits Dependency Network. Apresentado em Americas Conference on Information Systems, Puerto Rico.

Chaves, M. S., Tessi, M., Winter, R. A., & Damasceno Jr., J. (2015). Tecnologias da Informação da Web 2.0 em empresas e na gestão de projetos: Análise e uma agenda de pesquisa. *Iberoamerican Journal of Project Management*, *6*(1), 23–46.

Cheong, R. K., & Tsui, E. (2011). From Skills and Competencies to Outcome-based Collaborative Work: Tracking a Decade's Development of Personal Knowledge Management (PKM) Models. *Knowledge and Process Management*, *18*(3), 175–193. https://doi.org/10.1002/kpm.380

Chua, A. Y., & Banerjee, S. (2013). Customer knowledge management via social media: the case of Starbucks. *Journal of Knowledge Management*, *17*(2), 237–249. https://doi.org/10.1108/13673271311315196

Connelly, C. E., Ford, D. P., Turel, O., Gallupe, B., & Zweig, D. (2014). 'I'm busy (and competitive)!'Antecedents of knowledge sharing under pressure. *Knowledge Management Research & Practice*, *12*(1), 74–85.

Cooper, R. G., Edgett, S. J., & Kleinschmidt, E. J. (1999). New product portfolio management: practices and performance. *Journal of product innovation management*, *16*(4), 333–351.

Corley, & Gioia, D. A. (2011). Building theory about theory building: what constitutes a theoretical contribution? *Academy of management review*, *36*(1), 12–32.

Costello, J. T., & McNaughton, R. B. (2016). Can Dynamic Capabilities be Developed Using Workplace E-learning Processes? *Knowledge and Process Management*, *23*(1), 73–87. https://doi.org/10.1002/kpm.1500

Decreto N. 7.290, Pub. L. No. Decreto 7290 (1975). Recuperado de http://www.al.sp.gov.br/repositorio/legislacao/decreto/1975/decreto-7290-15.12.1975.html

Del Giudice, M., & Della Peruta, M. R. (2016). The impact of IT-based Knowledge Management Systems on internal venturing and innovation: a Structural Equation Modeling approach to corporate performance. *Journal of Knowledge Management, 20*(3). Recuperado de http://www.emeraldinsight.com/doi/abs/10.1108/JKM-07-2015-0257

Dey, I. (2003). *Qualitative data analysis: A user friendly guide for social scientists*. London: Routledge.

Dick, B. (2007). What Can Grounded Theorists and Action Researchers Learn from Each Other? In *The SAGE Handbook of Grounded Theory* (p. 623). London: Sage Publictions.

Dixon, B. E., McGowan, J. J., & Cravens, G. D. (2009). Knowledge sharing using codification and collaboration technologies to improve health care: lessons from the public sector. *Knowledge Management Research & Practice, 7*(3), 249–259. https://doi.org/10.1057/kmrp.2009.15

Dokkun, E. van, & Ravesteijn, P. (2016). Managing Project Communication: Using Social Media for Communication in Projects. In S. Gilbert, *Strategic Integration of Social Media into Project Management Practice* (p. 366). Hershey PA, USA: IGI Global.

Dresch, A., Lacerda, D. P., & Antunes, J. A. V. (2015). *Design science research: método de pesquisa para vanço da ciência e tecnologia*. Porto Alegre: Bookman.

Duffield, S. M., & Whitty, S. J. (2016). Application of the Systemic Lessons Learned Knowledge model for Organisational Learning through Projects. *International Journal*

of Project Management, *34*(7), 1280–1293. https://doi.org/10.1016/j.ijproman.2016.07.001

Evans, N. (2012). Destroying collaboration and knowledge sharing in the workplace: a reverse brainstorming approach. *Knowledge Management Research & Practice*, *10*(2), 175–187. https://doi.org/10.1057/kmrp.2011.43

Evans, R. D., Gao, J. X., Mahdikhah, S., Messaadia, M., & Baudry, D. (2016). Crowdsourcing User-Contributed Solutions to Aerospace Product Development Issues through Micro-Blogging. *The Electronic Journal of Knowledge Management*, *14*(2), 126–136.

Fernando, I. (2010). Community creation by means of a social media paradigm. *The learning organization*, *17*(6), 500–514. https://doi.org/10.1108/09696471011082367

Filieri, R., & Alguezaui, S. (2014). Structural social capital and innovation. Is knowledge transfer the missing link? *Journal of Knowledge Management*, *18*(4), 728–757.

Filieri, R., & Alguezaui, S. (2015). Retraction:"Knowledge Sourcing and Knowledge Reuse in the Virtual Product Prototyping: An Exploratory Study in a Large Automotive Supplier of R&D" by. *Knowledge and Process Management*, *22*(4), 318.

Flick, U. (2010). *An Introduction to qualitative research* (4º ed). Great Britian: Ashford Colour Press Ltd.

Forcier, E., Rathi, D., & Given, L. M. (2013). Knowledge management and social media: A case study of two public libraries in Canada. *Journal of Information & Knowledge Management*, *12*(04), 10. https://doi.org/10.1142/S0219649213500391

Garcia-Perez, A., & Ayres, R. (2010). Wikifailure: the Limitations of Technology for Knowledge Sharing. *Electronic Journal of Knowledge Management*, *8*(1), 43–52.

Gasik, S. (2011). A model of project knowledge management. *Project Management Journal*, *42*(3), 23–44.

Gholami, B., & Murugesan, S. (2011). Global IT Project Management Using Web 2.0. *International Journal of Information Technology Project Management (IJITPM)*, *2*(3), 30–52.

Goes, P. B. (2014). Design Science Research in Top Information Systems Journals. *MIS Quartely*, *38*(1), iii–viii.

Gregor, S., & Hevner, A. R. (2013). Positioning and Presenting Design Science Research for Maximum Impact. *MIS Quarterly*, *37*(2), 337–355.

Guldberg, K. R., Mackness, J., Makriyannis, E., & Tait, C. (2013). Knowledge management and value creation in a third sector organisation. *Knowledge and Process Management*, *20*(3), 113–122. https://doi.org/10.1002/kpm.1410

Guo, T., Schwartz, D. G., Burstein, F., & Linger, H. (2009). Codifying collaborative knowledge: using Wikipedia as a basis for automated ontology learning. *Knowledge Management Research & Practice*, *7*(3), 206–217. https://doi.org/10.1057/kmrp.2009.14

Handzic, M., & Lagumdzija, A. (2010). Global faculty learning community: a case study. *Knowledge Management Research & Practice*, *8*(1), 89–98. https://doi.org/10.1057/kmrp.2009.35

Hartzel, K. S., Mahanes, C. J., Maurer, G. J., Sheldon, J., Trunick, C., & Wilson, S. J. (2011). Corporate posts and tweets: brand control in web 2.0. *Journal of Information & Knowledge Management*, *10*(01), 51–58. https://doi.org/10.1142/S0219649211002821

Hasan, H. (2008). Back to the future for KM: the case for sensible organisation. *Knowledge Management Research & Practice*, *6*(1), 26–30.

Herbenio, C. S., Moreira, L. O., Coutinho, E. F., Paillard, G. A., Lima, E. T., & Sousa, F. R. (2016). StoryMotion: A collaborative recommendation tool for storytelling through

photos. In *Telematics and Information Systems (EATIS), 2016 8th Euro American Conference on* (p. 1–8). IEEE.

Hong, J., Lee, O.-K. D., & Suh, W. (2016). Creating knowledge within a team: a socio-technical interaction perspective. *Knowledge Management Research & Practice*, *15*(1), 23–33. https://doi.org/10.1057/kmrp.2015.27

Hubert, C. (2012). The new edge in knowledge: how knowledge management is changing the way we do business. Apresentado em Offshore Technology Conference, Texas, USA.

Ignacio, C. E. B. (2016). A comunicação interna e o gerenciamento de projetos na Polícia Militar do Estado de São Paulo: Conceitos, perspectivas e desafios. In *V SINGEP* (p. 1–14). São Paulo.

Ikemoto, M. N. (2017). *SOME4PM: a prescriptive framework for guiding integrated use of social media in project management*. Universidade Nove de Julho, São Paulo.

IPMA. (2017). Standards | Project Management Certification,Standards,Competence Development,IPMA. Recuperado 27 de março de 2017, de http://www.ipma.world/resources/standards

Jackson, P., & Klobas, J. (2013). Deciding to use an enterprise wiki: the role of social institutions and scripts. *Knowledge Management Research & Practice*, *11*(4), 323–333. https://doi.org/10.1057/kmrp.2012.20

Janes, S. H., Patrick, K., & Dotsika, F. (2014). Implementing a social intranet in a professional services environment through Web 2.0 technologies. *The Learning Organization*, *21*(1), 26–47. https://doi.org/10.1108/TLO-11-2012-0068

Jesson, J. K., Matheson, L., & Lacey, F. M. (2011). *Doing your literature review : traditional and systematic techniques*. London: Sage.

Kaplan, A. M., & Haenlein, M. (2010). Users of the world, unite! The challenges and opportunities of Social Media. *Business horizons*, *53*(1), 59–68. https://doi.org/10.1016/j.bushor.2009.09.003

Kidd, J. (2014). The 'law of requisite variety'may assist climate change negotiations: a review of the Kyoto and Durban meetings. *Knowledge Management Research & Practice*, *12*(1), 62–73. https://doi.org/10.1057/kmrp.2012.56;

Kim, H.-L., Breslin, J., Kim, H.-G., & Choi, J.-H. (2010). Social semantic cloud of tags: semantic model for folksonomies. *Knowledge Management Research & Practice*, *8*(3), 193–202. https://doi.org/10.1057/kmrp.2010.10

Kosonen, M., & Ellonen, H.-K. (2010). From ivory towers to online bazaars? The internet, social media and competing discourses in the newspaper industry. *Knowledge Management Research & Practice*, *8*(2), 135–145. https://doi.org/10.1057/kmrp.2009.37

Lancini, A. (2015). Evaluating Interorganizational Knowledge Management: The Concept of IKM Orientation. *Electronic Journal of Knowledge Management*, *13*(2).

Lech, P. (2014). Managing knowledge in IT projects: a framework for enterprise system implementation. *Journal of Knowledge Management*, *18*(3), 551–573.

Lei 16.347, Pub. L. No. 16.347, 126 Diário oficial 1 (2016). Recuperado de https://www.al.sp.gov.br/norma/?id=180453

Levy, M. (2009). WEB 2.0 implications on knowledge management. *Journal of knowledge management*, *13*(1), 120–134. https://doi.org/10.1108/13673270910931215

Levy, M. (2013). Stairways to heaven: implementing social media in organizations. *Journal of Knowledge Management*, *17*(5), 741–754. https://doi.org/10.1108/JKM-02-2013-0051

Liu, M., & Rao, P. (2015). A comparative perspective of knowledge management via social media: India and China. *The Learning Organization*, *22*(2), 93–114. https://doi.org/10.1108/TLO-03-2014-0010

Lloria, M. B. (2008). A review of the main approaches to knowledge management. *Knowledge Management Research & Practice*, *6*(1), 77–89.

Lomas, C., Burke, M., & Page, C. L. (2008). Collaboration Tools. *Educause Learning Initiative*, 1–11.

Lopez, V. W. B., & Esteves, J. (2013). Acquiring external knowledge to avoid wheel re-invention. *Journal of Knowledge Management*, *17*(1), 87–105. https://doi.org/10.1108/13673271311300787

Maier, R., & Schmidt, A. (2015). Explaining organizational knowledge creation with a knowledge maturing model. *Knowledge Management Research & Practice*, *13*(4), 361–381. https://doi.org/10.1057/kmrp.2013.56

Margaryan, A., Boursinou, E., Lukic, D., & de Zwart, H. (2015). Narrating Your Work: an approach to supporting knowledge sharing in virtual teams. *Knowledge Management Research & Practice*, *13*(4), 391–400. https://doi.org/10.1057/kmrp.2013.58

Mariano, S. (2010). An analysis of the impact of blogging on knowledge processes. *Journal of Information & Knowledge Management*, *9*(04), 329–339. https://doi.org/10.1142/S0219649210002711

Mazzon, J. A. (1981). *Análise do Programa de Alimentação do Trabalhador sob o conceito de marketing social* (Tese de doutorado). Faculdade de Economia, Administração e Contabilidade da Universidade de São Paulo, São Paulo.

Ng, E. M. W., Shroff, R. H., & Lim, C. P. (2013). Applying a Modified Technology Acceptance Model to Qualitatively Analyse the Factors Affecting E-Portfolio

Implementation for Student Teachers' in Field Experience Placements. *Issues in Informing Science and Information Technology*, *10*, 355–365.

Olajide, A. A. (2015). Social Media Platform as a Knowledge Management Tool: Nigerian Librarians Experience. *Journal of Information & Knowledge Management*, *14*(03), 9. https://doi.org/10.1142/S0219649215500185

Oun, T. A., Blackburn, T. D., Olson, B. A., & Blessner, P. (2016). An Enterprise-Wide Knowledge Management Approach to Project Management. *Engineering Management Journal*, *28*(3), 179–192. https://doi.org/10.1080/10429247.2016.1203715

Panahi, S., Watson, J., & Partridge, H. (2012). Social media and tacit knowledge sharing: developing a conceptual model. *World academy of science, engineering and technology*, 1095–1102.

Pandey, S. C., & Dutta, A. (2013). Role of knowledge infrastructure capabilities in knowledge management. *Journal of knowledge management*, *17*(3), 435–453.

Park, J.-G., & Lee, J. (2014). Knowledge sharing in information systems development projects: Explicating the role of dependence and trust. *International Journal of Project Management*, *32*(1), 153–165. https://doi.org/10.1016/j.ijproman.2013.02.004

Paulin, D., & Suneson, K. (2012). Knowledge Transfer, Knowledge Sharing and Knowledge Barriers-Three Blurry Terms in KM. *Electronic Journal of Knowledge Management*, *10*(1), 81–91.

Peffers, K., Tuunanen, T., Rothenberger, M. A., & Chatterjee, S. (2007). A design science research methodology for information systems research. *Journal of management information systems*, *24*(3), 45–77.

Perrott, B. (2015). Including Consumers in the Organisational Knowledge Network. *Knowledge and Process Management*, *22*(4), 288–296.

Petticrew, M., & Roberts, H. (2006). *Systematic Reviews in the Social Sciences*. Malden: Blackwell Publishing.

PMI. (2013). *Um guia do conhecimento em gerenciamento de projetos (guia PMBOK)*. Pennsylvania: Project Management Institute (PMI).

PMI. (2017a). About PMI Standards. Recuperado 27 de março de 2017, de https://www.pmi.org/pmbok-guide-standards/about

PMI. (2017b). Talent Triangle | Project management Institute. Recuperado 7 de setembro de 2017, de https://www.pmi.org/learning/training-development/talent-triangle

Ragab, M. A., & Arisha, A. (2015). The MinK framework: towards measuring individual knowledge. *Knowledge Management Research & Practice*, *13*(2), 178–186.

Rathi, D., Given, L. M., & Forcier, E. (2014). Interorganisational partnerships and knowledge sharing: the perspective of non-profit organisations (NPOs). *Journal of Knowledge Management*, *18*(5), 867–885. https://doi.org/10.1108/JKM-06-2014-0256

Reich, B. H., Gemino, A., & Sauer, C. (2014). How knowledge management impacts performance in projects: An empirical study. *International Journal of Project Management*, *32*(4), 590–602. https://doi.org/10.1016/j.ijproman.2013.09.004

Ritchie, J., & Lewis, J. (2003). *Qualitative Research Practice: A Guide for Social Science Students and Researchers*. London: SAGE.

Rosa, D. V., Chaves, M. S., Oliveira, M., & Pedron, C. (2016). Target: a collaborative model based on social media to support the management of lessons learned in projects. *International Journal of Managing Projects in Business*, *9*(3), 654–681. http://dx.doi.org/10.1108/IJMPB-12-2015-0120

Schneckenberg, D. (2009a). Web 2.0 and the empowerment of the knowledge worker. *Journal of knowledge management*, *13*(6), 509–520. https://doi.org/10.1108/13673270910997150

Schneckenberg, D. (2009b). Web 2.0 and the shift in corporate governance from control to democracy. *Knowledge Management Research & Practice*, *7*(3), 234–248. https://doi.org/10.1057/kmrp.2009.17

Serenko, A., & Bontis, N. (2013). Global ranking of knowledge management and intellectual capital academic journals: 2013 update. *Journal of Knowledge Management*, *17*(2), 307–326.

Serenko, A., Bontis, N., & Hull, E. (2015). An application of the knowledge management maturity model: the case of credit unions. *Knowledge Management Research & Practice*, 1–15. https://doi.org/10.1057/kmrp.2014.37

Shang, S. S., Li, E. Y., Wu, Y.-L., & Hou, O. C. (2011). Understanding Web 2.0 service models: A knowledge-creating perspective. *Information & Management*, *48*(4), 178–184. https://doi.org/10.1016/j.im.2011.01.005

Shiri, A., & Rathi, D. (2013). Twitter content categorisation: A public library perspective. *Journal of Information & Knowledge Management*, *12*(04). https://doi.org/10.1142/S0219649213500354

Souza, M. T. de. (2016). *Avaliação de um modelo colaborativo suportado por tecnologias da web 2.0 para apoiar a gestão de lições aprendidas em projetos de segurança patrimonial usando uma abordagem de design science*. Universidade Nove de Julho, São Paulo.

Stein, E. W., & Zwass, V. (1995). Actualizing organizational memory with information systems. *Information systems research*, *6*(2), 85–117.

Svejvig, P., & Andersen, P. (2015). Rethinking project management: a structured literature review with a critical look at the brave new world. *International Journal of Project Management*, *33*, 278–290.

Takeuchi, H., & Nonaka, I. (2008). *Gestão do Conhecimento*. Porto Alegre: Bookman.

Telles, R. (2001). A efetividade da matriz de amarração de Mazzon nas pesquisas em Administração. *Revista de Administração, 36*(2), 64–72.

Terzieva, M. (2014). Project Knowledge Management: how organizations learn from experience. *Procedia Technology*, *16*, 1086–1095.

Todorović, M. L., Petrović, D. Č., Mihić, M. M., Obradović, V. L., & Bushuyev, S. D. (2015). Project success analysis framework: A knowledge-based approach in project management. *International Journal of Project Management*, *33*(4), 772–783. https://doi.org/10.1016/j.ijproman.2014.10.009

Topping, N. D. J. (2016). Knowledge Sharing and Business Expertise Factor Relationships. *Electronic Journal of Knowledge Management*, *14*(2). Recuperado de http://www.ejkm.com/issue/download.html?idArticle=774

Tremblay, M. C., Hevner, A. R., & Berndt, D. J. (2010). Focus groups for artifact refinement and evaluation in design research. *CAIS*, *26*, 599–618.

Tsui, E., & Fong, P. S. (2012). Requirements elicitation and planning of a knowledge portal: case study of a property management division in a housing organization. *Knowledge and process management*, *19*(1), 39–51. https://doi.org/10.1002/kpm.1382

Tuomi, I. (1999). Data is more than knowledge: Implications of the reversed knowledge hierarchy for knowledge management and organizational memory. In *Systems Sciences, 1999. HICSS-32. Proceedings of the 32nd Annual Hawaii International Conference on* (p. 12–pp). IEEE. Recuperado de http://ieeexplore.ieee.org/abstract/document/772795/

Verheyden, M., & Goeman, K. (2013). Does (company) size matter? Differences in social media usage for business purposes. *Journal of Applied Quantitative Methods*, *8*(4), 3–16.

Von Krogh, G. (2012). How does social software change knowledge management? Toward a strategic research agenda. *The Journal of Strategic Information Systems*, *21*(2), 154–164. https://doi.org/10.1016/j.jsis.2012.04.003

Weber, R., Aha, D. W., & Becerra-Fernandez, I. (2001). Intelligent lessons learned systems. *Expert Systems with Applications*, *20*(1), 17–34. https://doi.org/10.1016/S0957-4174(00)00046-4

Weber, S. (2010). Design Science Research: Paradigm or Approach? In *Americas Conference on Information Systems*. Lima, Peru.

Whetten, D. A. (1989). What Constitutes a Theoretical Contribution? *Academy of management review*, *14*, 490–495.

Wieringa, R. J. (2014). *Design Science Methodology for Information Systems and Software Engineering*. London: Springer-Verlag Berlin Heidelberg.

Wiewiora, A., & Murphy, G. (2015). Unpacking 'lessons learned': investigating failures and considering alternative solutions. *Knowledge Management Research & Practice*, *13*(1), 17–30. https://doi.org/10.1057/kmrp.2013.26

Wiig, K. M. (1997). Knowledge management: where did it come from and where will it go? *Expert systems with applications*, *13*(1), 1–14. https://doi.org/10.1016/S0957-4174(97)00018-3

Yi-Frazier, J. P., Cochrane, K., Mitrovich, C., Pascual, M., Buscaino, E., Eaton, L., … Malik, F. (2015). Using Instagram as a Modified Application of Photovoice for Storytelling and Sharing in Adolescents With Type 1 Diabetes. *Qualitative Health Research*, *25*(10), 1372–1382. https://doi.org/10.1177/1049732315583282

Yin, R. K. (2016). *Pesquisa Qualitativa do Início ao Fim*. Porto Alegre: Penso.

Yoon, C., & Kim, S. (2007). Convenience and TAM in a ubiquitous computing environment: The case of wireless LAN. *Electronic Commerce Research and Applications*, *6*(1), 102–112. https://doi.org/10.1016/j.elerap.2006.06.009

Zhao, R., & Chen, B. (2013). Study on enterprise knowledge sharing in ESN perspective: a Chinese case study. *Journal of Knowledge Management, 17*(3), 416–434. https://doi.org/10.1108/JKM-12-2012-0375

APPENDIX A INTERVIEWS PROTOCOL

Dimensão	Avaliação		Questões
Dados do entrevistado	Individual	1	Sexo: ( ) Masculino ( ) Feminino
		2	Idade:
		3	Quantos anos de experiência você possui em projetos?
		4	Há quanto tempo você trabalha nesta organização?
	Educação	5	Qual o seu nível educacional? ( ) Doutor em _____ ( ) Mestre em _____ ( ) MBA or Pós graduação em _____ ( ) Graduação em _____ ( ) Tecnico em _____
		6	Você tem certificação em Gestão de Projetos? ( ) Não ( ) Sim. Qual? _____
	Profissional	7	Qual a sua função?
		8	Qual o seu papel neste projeto?

Dimensão		Questões
Comunicação	PC.1	Conte-me sua experiência em usar o WhatsApp para comunicação no projeto.
	PC.2	Compare a comunicação com esta ferramenta (WhatsApp) e o Sametime.
	PC.3	Muitas vezes não percebemos que aprendemos ou melhoramos o nosso conhecimento em projetos. Pode nos reportar um conhecimento aprendido ou melhorado e que foi aplicado neste projeto?
Disseminação	PC.4	Conte-me sua experiência em usar o Blog do PM Social no projeto.
Repositório	PC.5	O Novo Projeto de Clima Organizacional teve dentro dos requisitos o uso de TI com mobilidade e acessibilidade, e uma linha base de tempo de 9 meses. Na sua percepção, que fatores contribuíram para que um projeto complexo fosse planejado para uma entrega rápida? Qual a sua estratégia quando você precisa de uma informação para realizar uma atividade no projeto?
Controle	PC.6	Qual o legado que o Novo Projeto de Clima Organizacional trouxe para a gestão de projetos?
	PC.7	Como foi construído este conhecimento?
	PC.8	Na sua percepção, a partir das informações deste projeto, como você prevê a construção deste conhecimento para o próximo projeto?

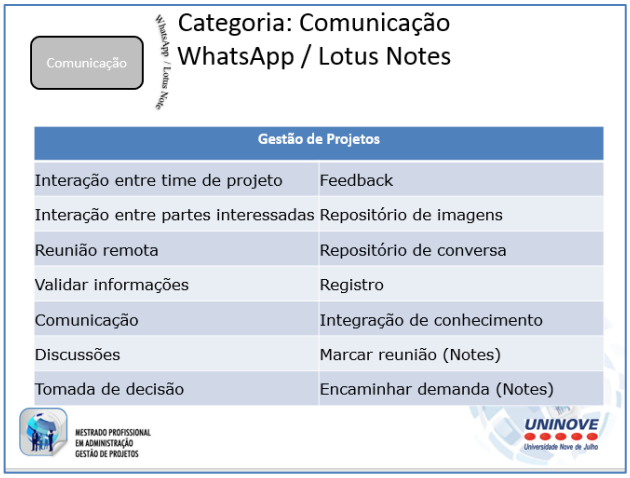
Dimensão	Questões	
Pré-set	PA.1	Quais ferramentas digitais você está utilizando no Projeto da Nova Pesquisa de Clima Organizacional?
	PA.2	Com que propósito você tem utilizado cada uma destas ferramentas? (Desenhar um quadro junto com o entrevistado Ferramenta x Propósito).
Facilidade de uso	PA.3	Considerando somente o Projeto da Nova Pesquisa de Clima Organizacional, para cada propósito listado por você, houve necessidade de uso de outro meio?
	PA.4	Qual a proporção?
	PA.5	Qual o motivo?
	PA.6	Atividades distintas exige utilização de ferramentas distintas. Qual a sua percepção quando precisa fazer esta alternância?
Utilidade	PA.7	Em que aspecto estas ferramentas interferem nas suas atividades no projeto?
Conveniência	PA.8	Você recebeu uma informação e precisa interagir com o seu projeto imediatamente. Como você dá continuidade ao seu trabalho, quando você está: Em outro departamento ou em outra empresa do grupo Fora do ambiente empresarial

Dimensão	Questões	
Encerramento	PE.1	Qual a sua opinião (pessoal) em relação ao uso de ferramentas web 2.0 nas atividades de gestão de projetos?
	PE.2	Até que ponto, na sua opinião, a integração destas ferramentas no dia a dia de um projeto realmente funciona?

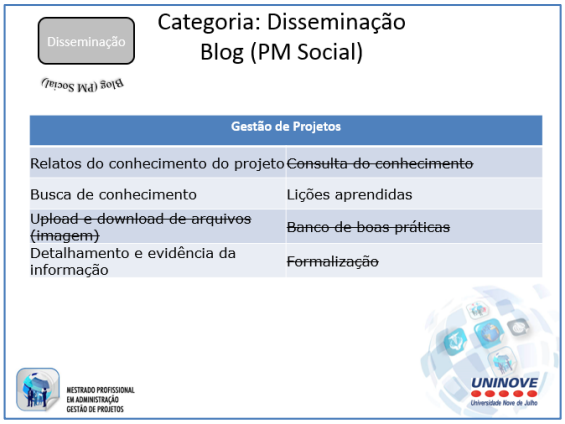
APPENDIX B FOCUS GROUP PROTOCOL

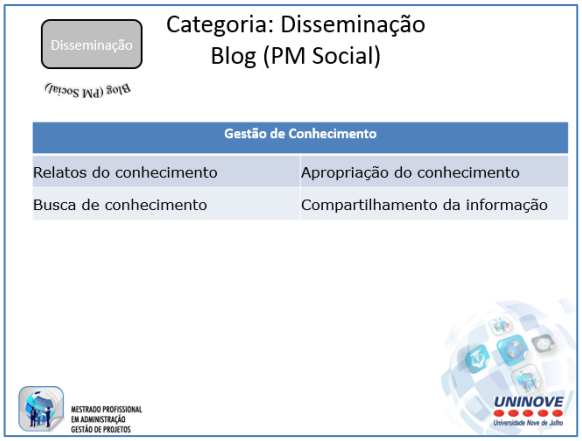
<table>
<tr><th>Dimensão</th><th colspan="2">Questões</th></tr>
<tr><td>Contextualização</td><td></td><td>

Apresentação do objetivo da pesquisa
Entendimento do artefato instanciado
Explicação da dinâmica do grupo focal e seus objetivos
Dinâmica do grupo focal: apresentar tabela de resultados individuais de Gestão de Projetos e Gestão do Conhecimento

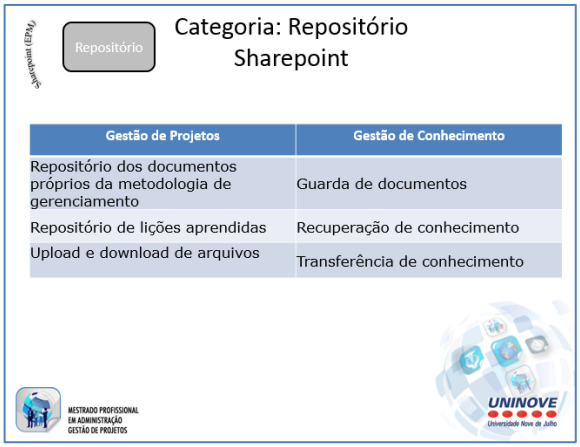
</td></tr>
<tr><td rowspan="2">Comunicação</td><td>PFG.1</td><td>Você concorda que as atividades de projetos apresentadas neste slide ocorreram durante a Primeira Onda de Teste?
 
</td></tr>
<tr><td>PFG.2</td><td>Você concorda que as atividades de gestão do conhecimento apresentadas neste slide ocorreram durante a Primeira Onda de Teste?
 
</td></tr>
</table>

<table>
<tr><td rowspan="2">Disseminação</td><td>PFG.3</td><td>Você concorda que as atividades de projetos apresentadas neste slide ocorreram durante a Primeira Onda de Teste?

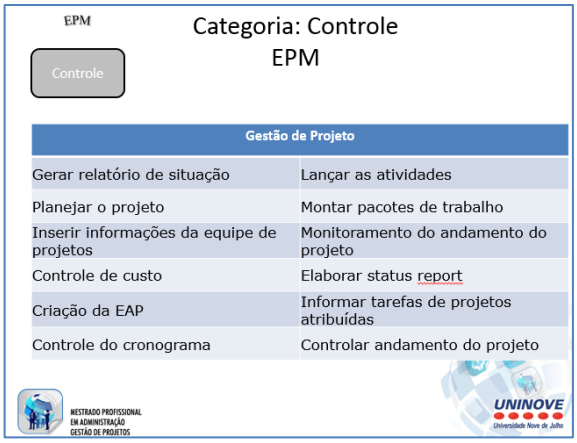
 
</td></tr>
<tr><td>PFG.4</td><td>Você concorda que as atividades de gestão do conhecimento apresentadas neste slide ocorreram durante a Primeira Onda de Teste?

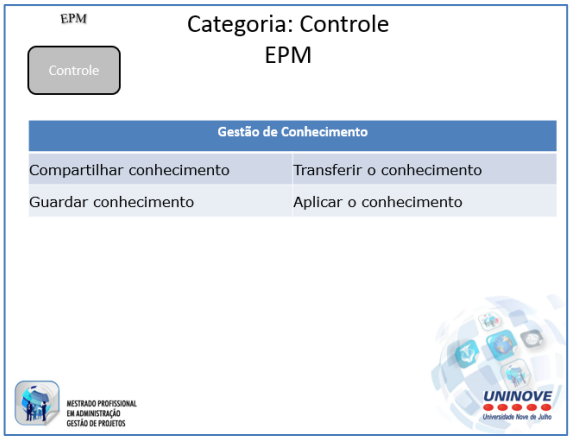
 
</td></tr>
<tr><td>Repositorio</td><td>PFG.5</td><td>Você concorda que as atividades de projetos apresentadas neste slide ocorreram durante a Primeira Onda de Teste?

Você concorda que as atividades de gestão do conhecimento apresentadas neste slide ocorreram durante a Primeira Onda de Teste?

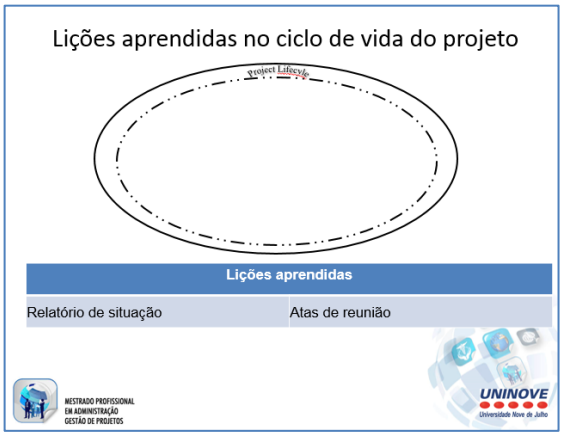
 
</td></tr>
</table>

<table>
<tr><td rowspan="2">Controle</td><td>PFG.6</td><td>Você concorda que as atividades de projetos apresentadas neste slide ocorreram durante a Primeira Onda de Teste?

 
</td></tr>
<tr><td>PFG.7</td><td>Você concorda que as atividades de gestão do conhecimento apresentadas neste slide ocorreram durante a Primeira Onda de Teste?

 
</td></tr>
<tr><td>Ciclo de vida do projeto</td><td>PFG.8</td><td>Vocês concordam com as ferramentas utilizadas para registro de lições aprendidas estão apresentadas neste slide?

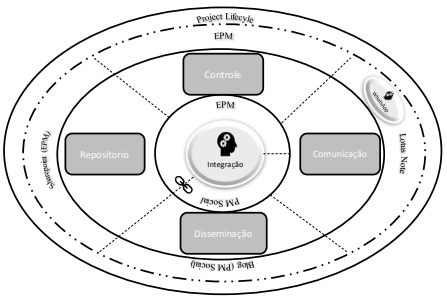
Vocês concordam que os registros foram feitos durante todo o ciclo de vida do projeto?

 
</td></tr>
</table>

Integração		Há uma incerteza com relação a percepção da integração entre mídias sociais. O slide apresenta os segmentos das entrevistas que levaram a esta incerteza. Qual a sua percepção? 

Dimensão	Questões	
Facilidade de uso **Utilidade** **Conveniência**		Devido às incertezas observadas na dimensão integração, não foi possível validar o artefato no grupo focal.

APPENDIX C CONFIRMATORY FOCUS GROUP PROTOCOL

<table>
<tr><th>Dimensão</th><th colspan="4">Questões</th></tr>
<tr><td>Contextualização</td><td></td><td colspan="3">De acordo com o Grupo Focal:
• Houve uma percepção de integração frágil das mídias sociais por:
Processo: acordo com a equipe
Pessoas: definição de responsabilidade de um membro da equipe para inserir o conteúdo do WhatsApp no PM Social
• Não há como integrar fisicamente o WhatsApp
• Confirmada a utilidade do modelo
• Não confirmada a facilidade de uso
• Não confirmada a conveniência</td></tr>
<tr><td>Refinamento do modelo</td><td></td><td colspan="3">
<table>
<tr><th>Integração</th><th>Proposição de mudança</th><th>Razão</th></tr>
<tr><td>WhatsApp</td><td>Formalizar um processo que esclareça o uso (quem, o que, quando, onde, com que propósito)</td><td>Melhorar a percepção de integração e utilidade</td></tr>
<tr><td></td><td>Formalizar quem, onde e quando o conteúdo deve ser registrado no repositório</td><td>• Estabelecer integração por processo
• Melhorar a percepção de integração e utilidade</td></tr>
<tr><td>PM Social (blog)</td><td>Criar comunidade por projeto</td><td>• Estabelecer um espaço virtual compartilhado
• Aumentar a base de conhecimento
• Melhorar a percepção de utilidade</td></tr>
<tr><td></td><td>Criar um post com Resumo do projeto</td><td>• Compartilhar conhecimento para quem não tem acesso ao projeto
• Melhorar a percepção de utilidade</td></tr>
<tr><td></td><td>Criar um link para a página web do PMO</td><td>• Integrar PM Social e responsável do EPM
• Melhorar percepção de facilidade de uso, utilidade e conveniência</td></tr>
</table>
<table>
<tr><th>Midia Social</th><th>Ações sugeridas</th><th>Razão</th></tr>
<tr><td>PM Social (blog)</td><td>Treinar usuários no uso do blog do PM Social</td><td>Engajamento no uso
Melhorar percepção de facilidade de uso, utilidade</td></tr>
</table>


</td></tr>
</table>

Validação	PCFG.1	Você concorda com as percepções do pesquisador com relação a percepção do grupo (contextualização)?
	PCFG.2	Você concorda com a sugestão de refinamento do modelo feito para o WhatsApp?
	PCFG.3	Você concorda com a sugestão de refinamento do modelo feito para o PM Social?
	PCFG.4	Você concorda com as ações sugeridas para o PM Social?
	PCFG.5	Você entende que o desenho representa o modelo refinado?
	PCFG.6	Qual o seu entendimento do ciclo de vida do projeto neste modelo?
	PCFG.7	Qual a sua percepção teórica com relação a facilidade de uso do modelo?
	PCFG.8	Qual a sua percepção teórica com relação a utilidade do modelo?
	PCFG.9	Qual a sua percepção teórica com relação a conveniência de uso do modelo?
Encerramento	PCFG.10	Você tem alguma sugestão para complementar o modelo?

APPENDIX D DIRECT OBSERVATION PROTOCOL

Practitioner observed: _____	**Date:** _____	**Local:** _____
Observation regarding the use of the artefact:		
Observation regarding the process:		
General observation:		

APPENDIX E DOCUMENT OBSERVATION PROTOCOL

Type of document: _____	**Date:** _____	**Local:** _____
Document related with the use of the artefact:		
Document regarding the process:		
General observation:		

APPENDIX F OFÍCIO Nº PM6-165/31/17

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Hora: 17:26 - Sd Rn
Protocolista:

SECRETARIA DE ESTADO DOS NEGÓCIOS DA SEGURANÇA PÚBLICA

POLÍCIA MILITAR DO ESTADO DE SÃO PAULO

São Paulo, 19 de abril de 2017.

OFÍCIO Nº PM6-165/31/17

Da Chefe da 6.ª Seção do Estado-Maior da Polícia Militar

A Senhora Prof.ª Dr.ª Cristina Dai Prá Martens

Diretora do Programa de Mestrado em Administração - Gestão de Projetos da Universidade Nove de Julho.

Assunto: *Utility: Use, adoption and integration of web 2.0 tools in information technology project.*

Referência: Missiva, de 2 de fevereiro de 2017.

É com satisfação que levo ao conhecimento de Vossa Senhoria que foi autorizada a realização do trabalho de pesquisa, intitulado *Utility: Use, adoption and integration of web 2.0 tools in information technology project*, numa parceria entre a Universidade Nove de Julho (UNINOVE) e esta Instituição Policial-Militar, mediante a lavratura de termo de confidencialidade.

Esta parceria reafirma a importância da academia para a sociedade, da academia para o Estado, à medida que objetiva auxiliar a Polícia Militar por meio de seu Escritório de Gerenciamento de Projetos no registro e na disseminação de lições apreendidas, podendo contribuir na melhor prestação de serviços de segurança pública à sociedade paulista.

Indico o Cap PM Carlos Eduardo Banhos Ignacio para prosseguimento dos trabalhos, por meio do telefone (11) 3327-7460 ou (11) 3327-7461, correio eletrônico eduardobanhos@policiamilitar.sp.gov.br .

Por fim, ao final dos trabalhos, consultamos quanto a possibilidade de envio de cópia da dissertação visando disponibilizá-la para consulta.

Atenciosamente,

DANIELE CRISTINA OLIVEIRA DE FREITAS
Tenente Coronel PM Chefe

APPENDIX G TERM OF NO-DISCLOSURE AND COMMITMENT FOR MAINTAINANCE OF SECURITY

SECRETARIA DE ESTADO DOS NEGÓCIOS DA SEGURANÇA PÚBLICA
POLÍCIA MILITAR DO ESTADO DE SÃO PAULO
6.ª SEÇÃO DO ESTADO-MAIOR
TERMO DE COMPROMISSO DE MANUTENÇÃO DE SIGILO (TCMS)

www.policiamilitar.sp.gov.br
6compm@policiamilitar.sp.gov.br

Eu, Rosana Yasue Narazaki, brasileira, CPF 748.132.347-04, identidade 05807344-6 (27/08/1980, SSP RJ), filiação: Yasuo Narazaki (pai) e Sakae Narazaki (mãe), endereço: Rua Tagipuru, 127 apto 123 – CEP 01156-000 - SP, declaro ter ciência inequívoca da legislação sobre o tratamento de informação classificada cuja divulgação possa causar risco ou dano à segurança da sociedade ou do Estado, e me comprometo a guardar o sigilo necessário, nos termos da Lei nº 12.527, de 18 de novembro de 2011, e a:

a) tratar as informações classificadas em qualquer grau de sigilo ou os materiais de acesso restrito que me forem fornecidos pela Policia Militar do Estado de São Paulo e preservar o seu sigilo, de acordo com a legislação vigente;

b) preservar o conteúdo das informações classificadas em qualquer grau de sigilo, ou dos materiais de acesso restrito, sem divulgá-lo a terceiros;

c) não praticar quaisquer atos que possam afetar o sigilo ou a integridade das informações classificadas em qualquer grau de sigilo, ou dos materiais de acesso restrito; e

d) não copiar ou reproduzir, por qualquer meio ou modo: (i) informações classificadas em qualquer grau de sigilo; (ii) informações relativas aos materiais de acesso restrito do (da) [órgão ou entidade], salvo autorização da autoridade competente.

Declaro que tive acesso a material, e por estar de acordo com o presente Termo, o assino na presença das testemunhas abaixo identificadas.

São Paulo, 20 de abril de 2017.

Nome: ROSANA YASUE NARAZAKI
RG: 05804544-6

TESTEMUNHAS

Nome: Carlos Eduardo Banhos Ignacio
RG: 24.853.328-9

Nome:
RG:

"Nós, Policiais Militares, sob a proteção de Deus, estamos comprometidos com a defesa da Vida, da Integridade Física e da Dignidade da Pessoa Humana".

APPENDIX H TERMO DE CONSENTIMENTO ESCLARECIDO

Meu nome é Rosana Yasue Narazaki e estou desenvolvendo minha dissertação de mestrado no Programa de Mestrado Profissional Em Administração e Gestão de Projetos da Universidade Nove de Julho (UNINOVE), sob orientação da Profª. Drª. Cristiane Drebes Pedron (UNINOVE) e do Prof. Marcirio Silveira Chaves (PUCRS). O título da minha dissertação é: "APLICAÇÃO DE UM FRAMEWORK PARA GUIAR O USO INTEGRADO DE MÍDIAS SOCIAIS NO SUPORTE À GESTÃO DO CONHECIMENTO EM GERENCIAMENTO DE PROJETOS". Tenho como objetivo geral avaliar a Gestão do Conhecimento no Gerenciamento de Projetos por meio de um framework que guia o uso integrado de mídias sociais que suportam as atividades relacionadas a Gestão de Projetos, sob o paradigma da Design Science Research.

Sua participação envolve uma entrevista que tem dois objetivos específicos: (i) caracterização e distinção entre o conhecimento produzido em Design Science Research e nas ciências natural e social; (ii) avaliação de um modelo instanciado que propõe o uso integrado de mídias sociais, suportando a Gestão de Conhecimento nas atividades da Gestão de Projetos, no contexto da Polícia Militar do Estado de São Paulo. Caso você permita, este Grupo Focal será gravado e terá a duração aproximada de sessenta minutos.

Saliento que a sua participação nesse estudo é voluntária, e que você tem absoluta liberdade de declinar deste convite ou de desistir de continuar em qualquer momento.

Sua contribuição para a pesquisa será de extrema valia e você poderá ter acesso aos resultados finais, caso seja de seu interesse.

Caso queira esclarecer quaisquer dúvidas relativas à pesquisa, fique à vontade para entrar em contato pelo telefone (11) 98779-7189 ou e-mail (rosana.narazaki@gmail.com) .

Atenciosamente,

_____ _____

Rosana Yasue Narazaki Local e data

Consinto em participar deste estudo e declaro ter recebido uma cópia deste termo de consentimento.

_____ _____

Nome e assinatura do participante Local e data

APPENDIX I SYSTEMATIC LITERATURE REVIEW – METHOD

Large bodies of knowledge are being produced in KM and SM. Issues are being answered and new areas of uncertainty are also appearing. Collecting this existing knowledge in a systematic way enables us to classify concepts and findings to understand the constructs and areas that are or are not being studied. Using a systematic literature review (SLR), this article explores knowledge registered in scientific repositories to understand the link between SM and KM. Data quality is essential to give confidence in the findings and this is achieved by the rigor of the method. This SLR has been organized following phases proposed by Cerchione et al., (2016): sampling, classification, and content analysis.

This SLR was conducted based on the most important journals in KM, as mentioned by Serenko and Bontis (2013) in their KM/IC (intellectual capital) global ranking study. The authors determined the journal's score using a methodology combining a survey from 379 experts and journal citation. The result of this combination gave the score that provided a final ranking list of 25 journals with tiers from A+ to C. Three IC journals were discarded as they were not the subject of this study, leaving 22 journals. Two journals were also discarded because they do not have a search robot and a manual search was not possible. From the remaining 20 KM ranked journals, C tier was not considered as the researchers decided to use more qualified journals, thus leaving the 15 journals. The aforementioned scores allocated by Serenko and Bontis (2013) reflect the perception of quality by experts and academy. To choose journals that are more relevant as sources of our research, we considered journals with a score of 1.000 or greater, which led us to use the top six journals as shown in Figure 1.

Rank	**Tier**	**Title**	**Year launched**	**Score**
1	A+	Journal of Knowledge Management	1997	4.274
2	A	The Learning Organization	1994	2.118
3	A	Knowledge Management Research & Practice	2003	2.089
4	A	Knowledge and Process Management: The Journal of Corporate Transformation	1997	1.759
5	B	Journal of Information and Knowledge Management	2002	1.395
6	B	Electronic Journal of Knowledge Management	2003	1.000

Figure 1: List of KM journals ranked.
Source: Serenko and Bontis (2013)

Articles were prospected using their own search robot and appropriate string, two of them with the keywords “social media” OR “web 2.0” in the abstract AND “knowledge management” as a keyword. For another three journals whose robots were not sophisticated, the string “social media” OR “web 2.0” AND “knowledge management” was used. Although the robot for the last journal was not sophisticated, the journal site allowed a manual search. As a result, we found 95 articles, considering publications in the last ten years. The number was considered high enough by the researchers to carry out the study. The remaining journals become a database for future analysis. Figure 2 presents the research design.

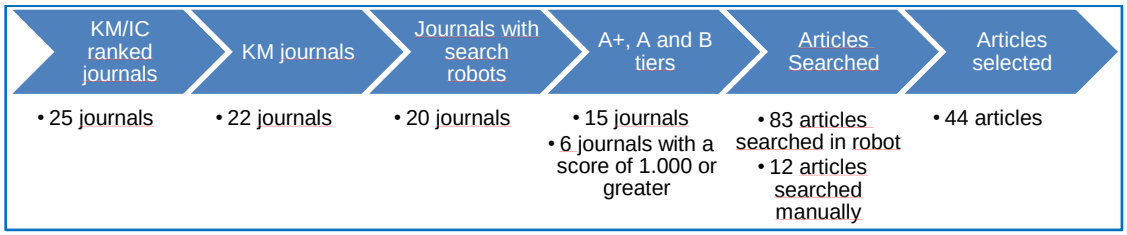


Figure 2: Research design.
Source: authors

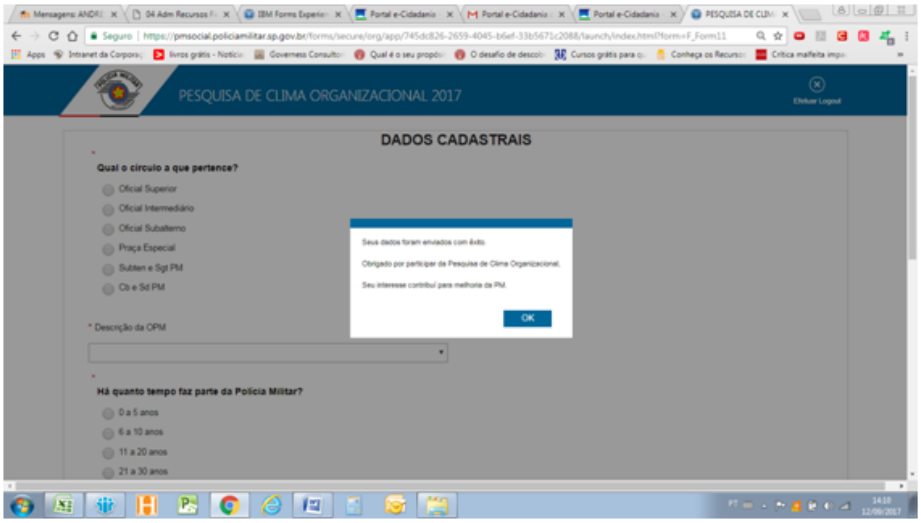
From the 95 articles resulting from the search phase, 51 were rejected for the following reasons: were not available (3), cited but not on the radar (2), in two journals (1), infrequently quoted (20), editorial (1), book review (1), keyword only in the article author’s CV (3), out of context (17), and keyword only in the references (3). The remaining 44 articles were dissected on a spreadsheet, mapped and classified, based on Boell and Cecez-Kecmanovic (2014). We also did an in-depth content analysis (Yin, 2016; Jesson, Matheson, & Lacey, 2011) decomposing and re-composing the data with the view to creating data arrangements to disclose new patterns of approach, tool groups, construct and concept. For this purpose, the entire articles were read and the spreadsheet was revisited to guarantee the findings.

APPENDIX J EVIDENCES

Most of printscreens were taken by smartphone and researcher collected them from WhatsApp or PM Social. For this reason the images have low definition.

Document	Code	Segment
170920_003	Convenience	"*Now WhatsApp, Lotus Notes, I can even use at home. Then I can get in touch with a manager or a member of my project team*".
Evidence		
WhatsApp\Pesquisa Clima-PCO-Teste [23:04, 9/12/2017] +55 11 xxxx-xxxx: I could not fill in. Locked in the second screen. Like I17. [00:25, 9/13/2017] +55 11 xxxx-xxxx: Good evening sir. I was able to fill the PCO on my cell phone. Some considerations. - when I clicked save draft, the option to include the email appeared [...] it was inserted [...] when I returned the survey was blank and did not appear what I had already filled out. [05:52, 9/13/2017] E1: Thanks for the return, I19 and I15. [06:11, 9/13/2017] +55 11 xxxx-xxxx: 👍 "		

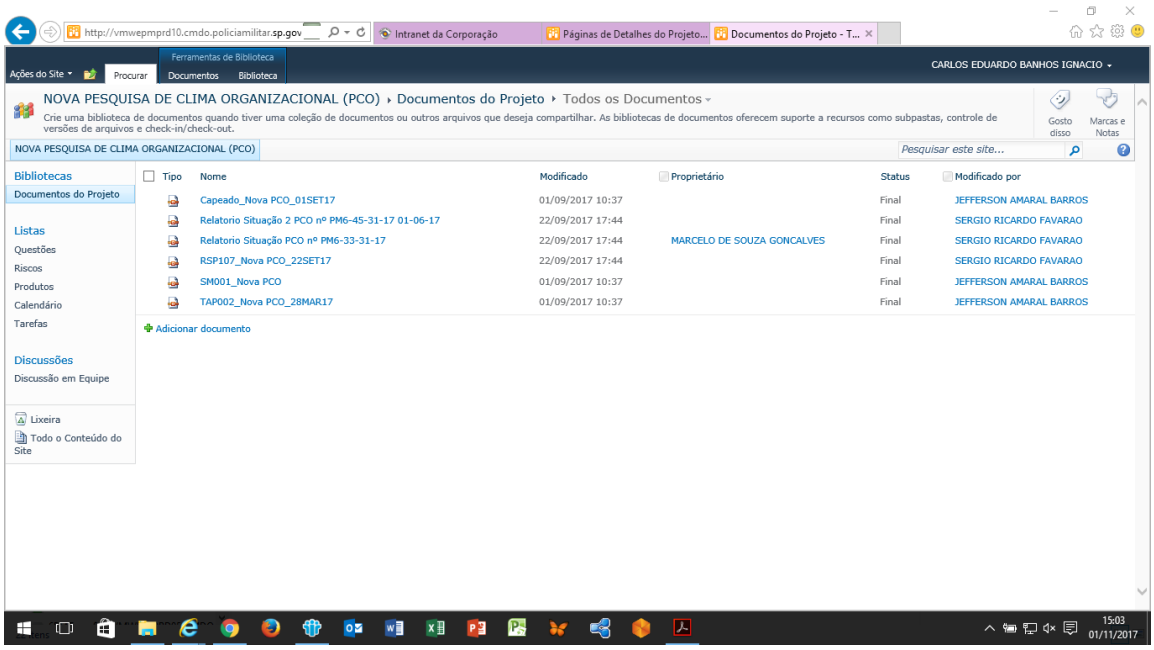
Appendix J-1: Evidence of convenience – WhatsApp

Document	Code	Segment
170918_003	Knowledge sharing	"*In this project of the PCO, I deposited my impressions. I had already read an earlier post. I made mention of it*".
Evidence		
https://pmsocial.policiamilitar.sp.gov.br/forums/html/topic?id=75b776dc-e24c-4af3-a4e5-84986d865500 in 08/10/2017 12. Na mensagem abaixo, exibida quando cliquei em "enviar" pela segunda vez, sugiro substituição da palavra "contribuí" por "contribui":  13. No teste que fiz, ocorreu a mesma sobreposição de caracteres que o Sgt Jorge detectou;		

Appendix J-2: Evidence of KM support - PM Social

Document	Code	Segment
170913_002	Storage project document	"*I use EPM Web because I can use it as a repository, like some information, for example, situation report or the same physical project, I insert this PDFs in this project*".

http://vmwepmrd10.cmdo.policiamilitar.sp.gov.br **in 01/11/2017**



Document	Code	Segment
170920_009	Lesson learned	"*I can find the suffering in the situation reports, yes. But mostly on meeting minutes*".

Evidence

Project status report

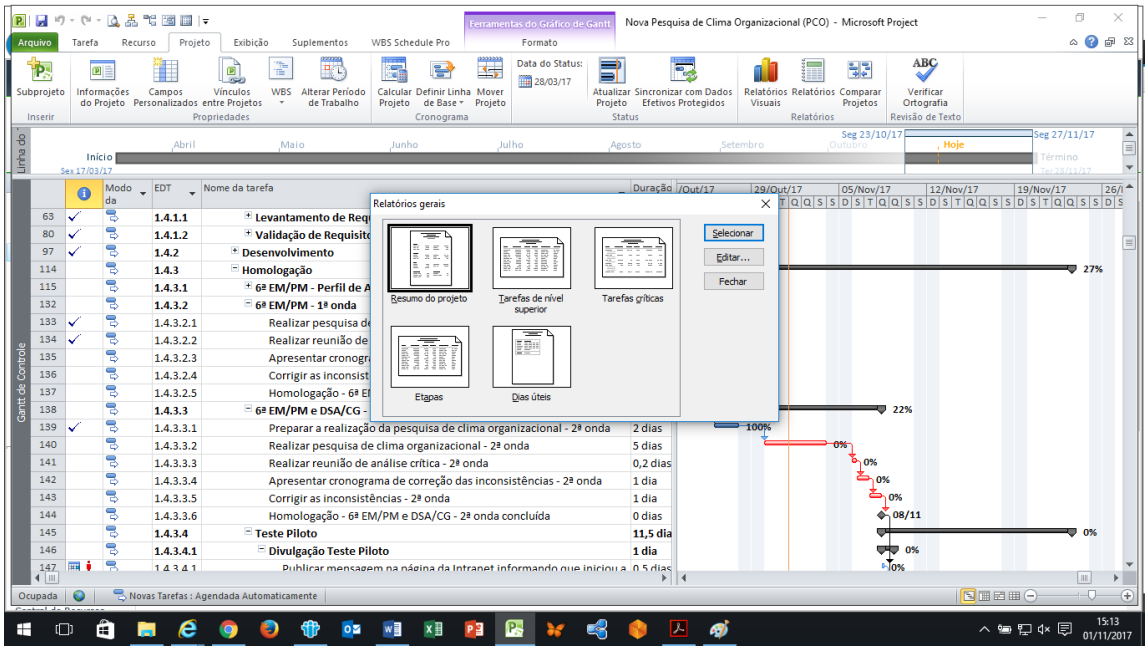
Identificação do Projeto	Projeto nº PM6-2/31/17 – Nova Pesquisa de Clima Organizacional				Status	64%
Tempo	**Início (TAP)**	28/mar/17	**Término (TAP)**	30/set/17	**1ª Prorrogação**	14/nov/17
Custo	**Custo Planejado (R$)**	30.486,32	**Custo Acumulado (R$)**	48.413,79	**Custo Total (R$)**	
Equipe do Projeto	**Patrocinador**	Ten Cel PM Daniele Cristina Oliveira de Freitas		**Gerente**	Cap PM Marcelo de Souza Gonçalves	
Objetivo do Projeto	Reestruturar o processo de Pesquisa Clima Organizacional (PCO) na PMESP, desenvolvendo novo questionário e sistema informatizado multiplataforma.					
Produto	Redesenho (TO BE) e instruções de trabalho (TO BE) do processo de Pesquisa Clima Organizacional (PCO) aprovados; sistema informatizado da PCO multiplataforma homologado; PCO aplicada em caráter piloto; norma institucional sobre pesquisa de clima organizacional aprovada					
Situação do Projeto	1) Fase Gerenciamento do Projeto 69%, sendo Planejamento - 100%, Monitoramento e Controle - 97%; Fase Mapeamento dos Processos (*To Be*) - 89%, sendo Mapeamento do processo - 90%, Instrução de Trabalho - 98%; Fase Norma PCO 93%; Fase Sistema Informatizado Multiplataforma 39%, sendo Estrutura Inicial 98%, desenvolvimento 100%, homologação 18% e Implantação 0%. 2) Homologação do sistema PCO, mas por inconsistência na permissão de acesso por meio do link não prosperou; transmitida a inconsistência pela 6ª EM/PM ao CPD mas sem solução até a presente data. 3) Enviada Mensagem nº PM6-363/31/17, de 21JUL17, ao CPD solicitando indicar os procedimentos para acessar a PCO por meio do link, bem como reiterada a necessidade de validação do cronograma do projeto no que se refere, principalmente, ao desenvolvimento e produção do software. 4) Formulada Solicitação de Mudança de prazo haja vista a realização de testes no sistema da nova PCO desenvolvida pelo CPD e, consequentemente, as inconsistências apontadas pelos usuários e a necessidade de ajustes no referido sistema pela equipe do CPD.					
Próximos passos	1) Homologar o sistema informatizado multiplataforma, por meio do link enviado, após correção na permissão de acesso e realização dos testes; 2) validar o cronograma do projeto no que se refere, principalmente, ao desenvolvimento e produção do software.					

Appendix J-3: Evidences of PM activities – Sharepoint

Document	Code	Segment
170920_009	Critical path	"*EPM client, it gives you much more options on project management optics… The generation of managerial reports, to follow the project, critical path, it is much more robust, much grander than the web environment*".

Evidence

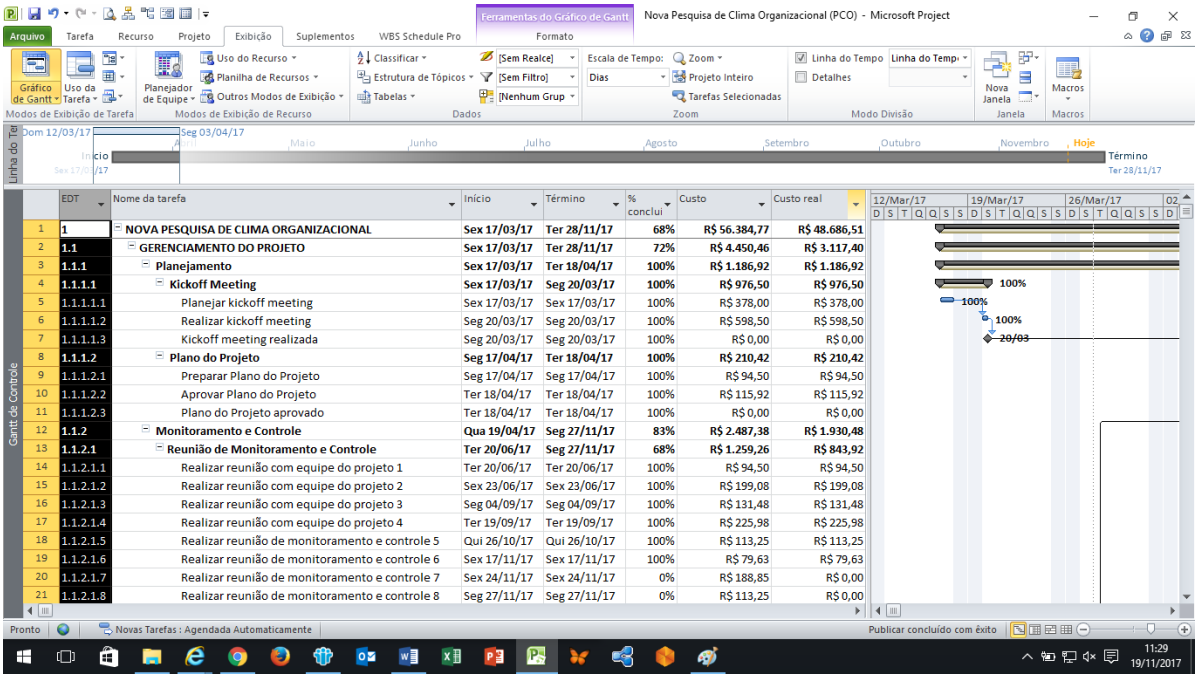
EPM client printscreen in 01/11/2017



Document	Code	Segment
170920_009	Alocate resource	"*EPM client, it gives you much more options on project management optics. It is more agile in terms of editing the project, as well as in the timeline, interactions, resource allocation, cost estimation*".

Evidence

EPM cliente printscreen in 19/11/2017



Document	Code	Segment
170920_009	Update project information	"*EPM client, it gives you much more options on project management optics… we can edit it in the web environment…I see them as complementary although they can work, in all tranquility, disconected*".

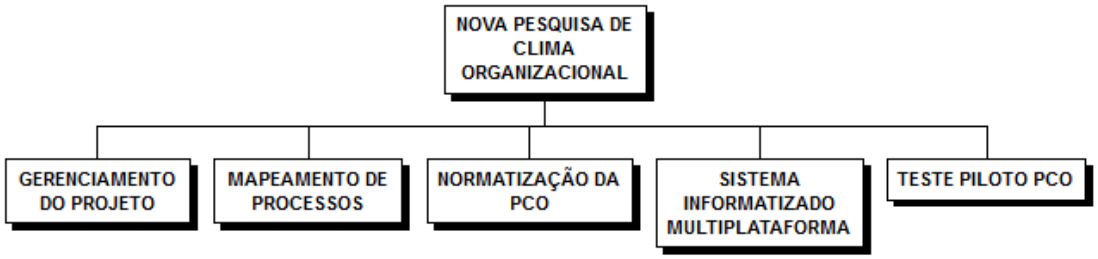
Journal 20171928, 16:00

Passing by the team member work-table, researcher noticed that both, EPM serve and EPM client were open, one in each monitor. Team menber uses both for his convenience, confirming that both, EPM client and EPM server are complementary.

Document	Code	Segment
170913_002	Planning	"*[...]then we end up using EPM to do the WBS (work breakdown structure) assembling the work packages. So here we go, quite simply, launching the activities, the deadline to see how the situation is, whether everything is going well or not*".

Evidence

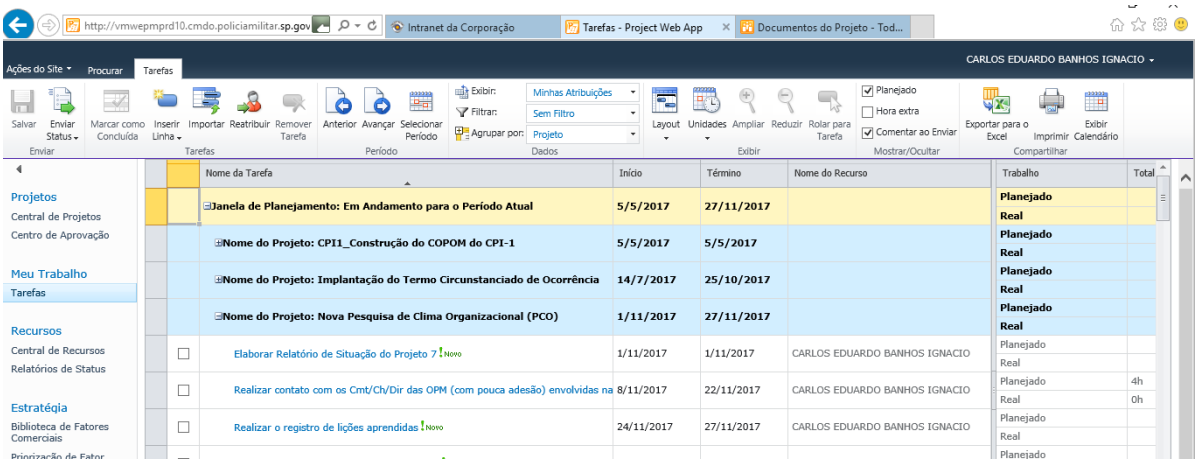
WBS (work breakdown structure)



Document	Code	Segment
170913_002	Activity control	"*...every time I access the web, it gives me the information that I have some activities, some pending tasks...Then I will see what these activities are and it give me the deadline, whether it is late or not*".

Evidence

EPM printscreen in 19/11/2017



Document	Code	Segment
170913_002	Progress	"*We are doing our monthly reporting status. Gathering the information for the sub-commander. There are the contacts, there is the situation, there we point out how the project is, in relation to the previous month of what we are reporting*".

Evidence

Extract from the situation report

1.1. Atividades desenvolvidas

1.1.1. **Planejamento:**

1.1.1.1. homologação do sistema PCO: realizados pré-testes pela 6ª EM/PM com perfil de administrador do sistema; apontadas as inconsistências e repassadas ao CPD em reunião realizada em 04SET17; enviados, pelo CPD, *login* e senha aos usuários; realizados testes pelos usuários entre os dias 11 e 15SET17; informadas, pelos usuários, as inconsistências do sistema e repassadas ao CPD em reunião em 19SET17.

2. NECESSIDADE DE AÇÕES CORRETIVAS

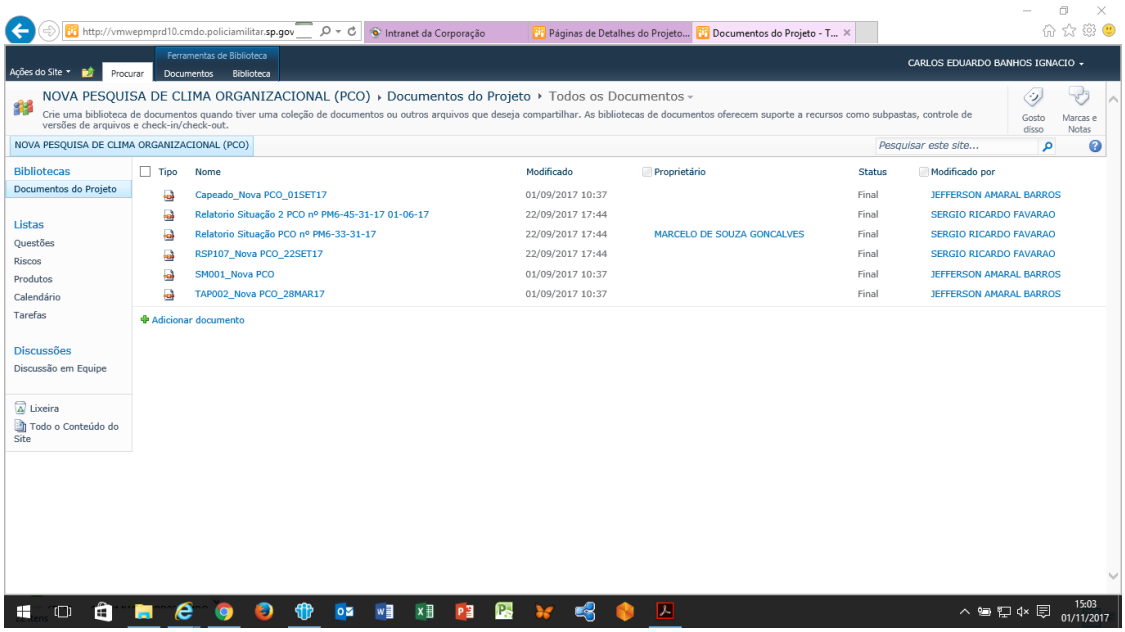
2.1. inconsistências repassadas ao CPD que apresentará um cronograma para sanar os problemas no sistema.

3. PRÓXIMOS PASSOS

3.1. sanar as inconsistências do sistema apresentadas quando da realização do primeiro teste (CPD);

"Nós, Policiais Militares, sob a proteção de Deus, estamos comprometidos com a defesa da Vida, da Integridade Física e da Dignidade da Pessoa Humana."

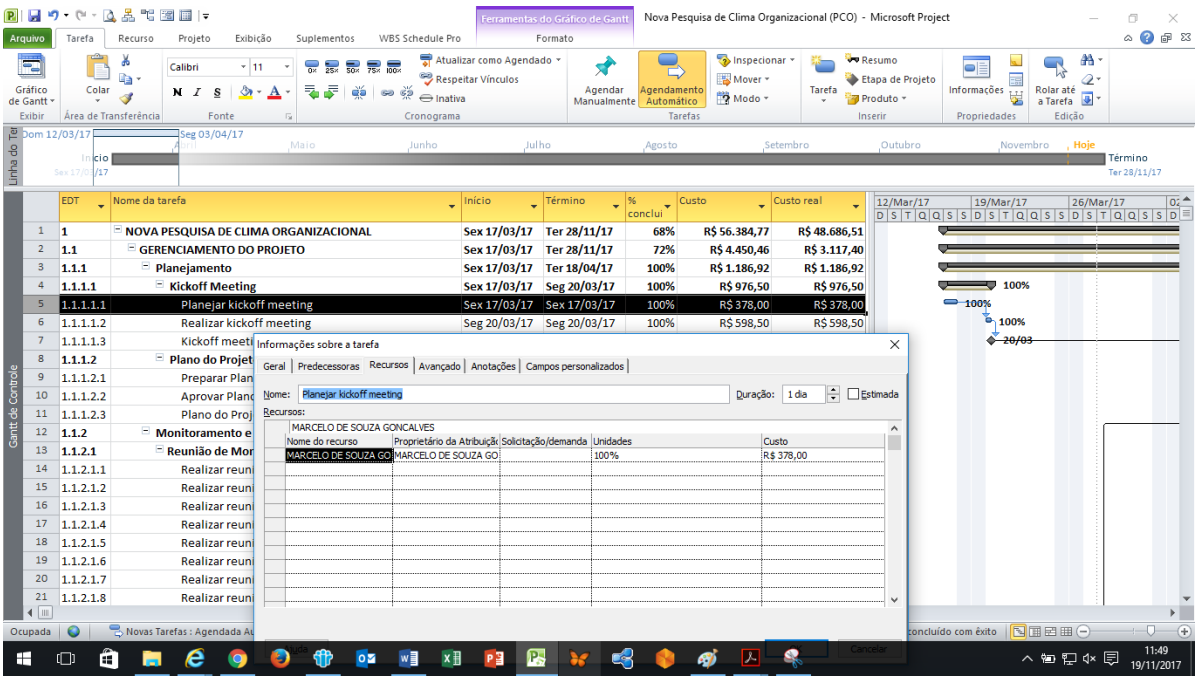
EPM printscreen in 19/11/2017



Document	Code	Segment
170913_002	Cost control	"*So we only enter the duration of the activity. Then, EPM calculate…If we pick up an activity that's just for validation, I can do it in half a day or two. And there EPM will give me the calculation of how much was spent to develop this activity*".

Evidence

EPM cost control printscreen in 19/11/2017

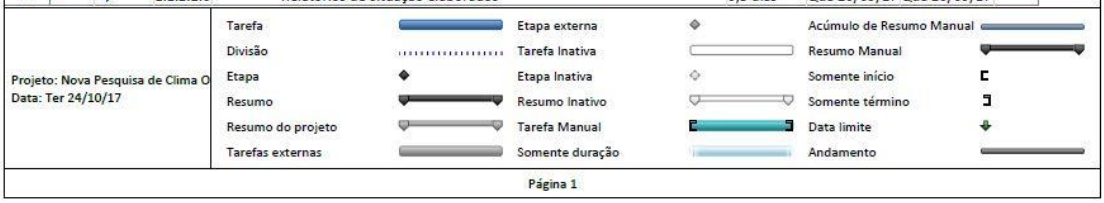


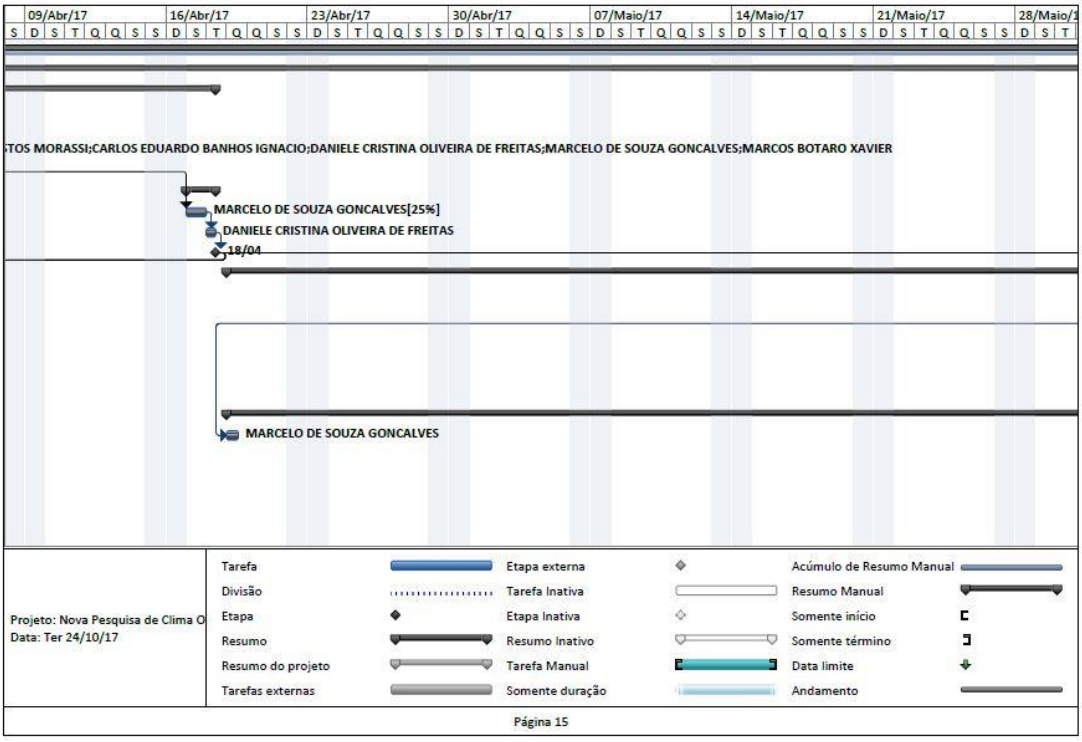
Document	Code	Segment
170919_004	Time control	"*With EMP, I control the timeline and project status report…It subsidizes the status report for the general command*".

Evidence

Schedule Project: New Organizational Climate Survey in 08/11/2017

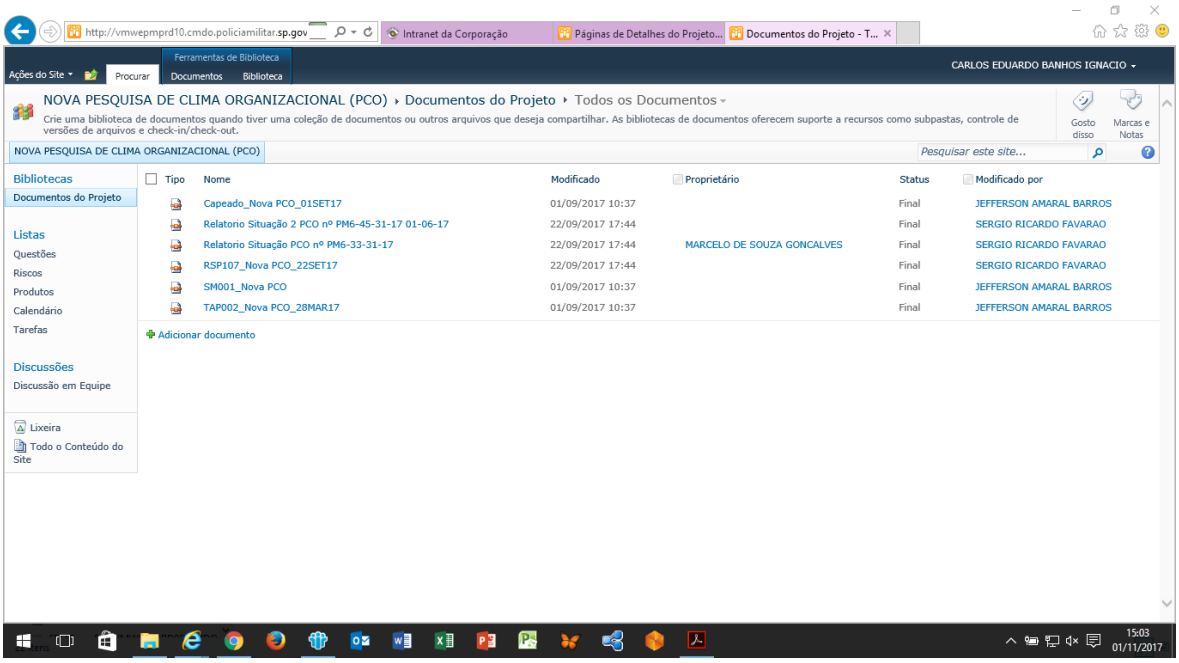
Id	Modo da Tarefa	EDT	Nome da tarefa	Duração	Início	Término	Predec
1		1	NOVA PESQUISA DE CLIMA ORGANIZACIONAL	183,25 dias	Sex 17/03/17	Qua 29/11/17	
2		1.1	GERENCIAMENTO DO PROJETO	183,25 dias	Sex 17/03/17	Qua 29/11/17	
3		1.1.1	Planejamento	22,25 dias	Sex 17/03/17	Ter 18/04/17	
4		1.1.1.1	Kickoff Meeting	1,25 dias	Sex 17/03/17	Seg 20/03/17	
5		1.1.1.1.1	Planejar kickoff meeting	1 dia	Sex 17/03/17	Sex 17/03/17	
6		1.1.1.1.2	Realizar kickoff meeting	0,25 dias	Seg 20/03/17	Seg 20/03/17	5
7		1.1.1.1.3	Kickoff meeting realizada	0 dias	Seg 20/03/17	Seg 20/03/17	6
8		1.1.1.2	Plano do Projeto	1,25 dias	Seg 17/04/17	Ter 18/04/17	
9		1.1.1.2.1	Preparar Plano do Projeto	1 dia	Seg 17/04/17	Seg 17/04/17	7
10		1.1.1.2.2	Aprovar Plano do Projeto	0,25 dias	Ter 18/04/17	Ter 18/04/17	9
11		1.1.1.2.3	Plano do Projeto aprovado	0 dias	Ter 18/04/17	Ter 18/04/17	10
12		1.1.2	Monitoramento e Controle	116 dias	Qua 19/04/17	Qui 28/09/17	
13		1.1.2.1	Monitoramento do projeto	72 dias	Ter 20/06/17	Qui 28/09/17	
14		1.1.2.1.1	Realizar reunião com equipe do projeto 1	0,25 dias	Ter 20/06/17	Ter 20/06/17	11
15		1.1.2.1.2	Realizar reunião com equipe do projeto 2	0,25 dias	Sex 23/06/17	Sex 23/06/17	14
16		1.1.2.1.3	Realizar reunião com equipe do projeto 3	0,25 dias	Seg 04/09/17	Seg 04/09/17	15
17		1.1.2.1.4	Realizar reunião com equipe do projeto 4	0,25 dias	Ter 19/09/17	Ter 19/09/17	16
18		1.1.2.1.5	Reuniões realizadas	0 dias	Qui 28/09/17	Qui 28/09/17	
19		1.1.2.2	Relatório de Situação do Projeto	111,5 dias	Qua 19/04/17	Qui 21/09/17	
20		1.1.2.2.1	Elaborar Relatório de Situação do Projeto 1	0,5 dias	Qua 19/04/17	Qua 19/04/17	14
21		1.1.2.2.2	Elaborar Relatório de Situação do Projeto 3	0,5 dias	Qui 01/06/17	Qui 01/06/17	
22		1.1.2.2.3	Elaborar Relatório de Situação do Projeto 3	0,5 dias	Seg 19/06/17	Seg 19/06/17	21
23		1.1.2.2.4	Elaborar Relatório de Situação do Projeto 4	0,5 dias	Sex 21/07/17	Sex 21/07/17	22
24		1.1.2.2.5	Elaborar Relatório de Situação do Projeto 5	0,5 dias	Qui 21/09/17	Qui 21/09/17	23
25		1.1.2.2.6	Relatórios de Situação elaborados	0,5 dias	Qua 20/09/17	Qua 20/09/17	





Appendix J-4: Evidence in PM activities - EPM

Document	Code	Segment
170913_002	Bridging	"*Based on this information, the percentage, the schedule of the project itself, we inform the sub-commander about the projects that he authorizes the opening or not of the project*"
Evidence		
Boletim geral 281400MAR17 In Appendix J-6		
Document	**Code**	**Segment**
170913_002	Knowledge transfer	"*When we receive the opening term, we separate who our contacts will be and with the information they pass on to us, who will update the project, we will be doing our monthly status report*".
Evidence		
EPM repository printscreen in 01/11/2017		



Appendix J-5: Evidence in KM support – EPM

Appendix J-6: Boletim Geral 281400MAR17

SÃO PAULO – SP

281400MAR17

ESCRITÓRIO DE GERENCIAMENTO DE PROJETOS DA POLÍCIA MILITAR (EGP/PM)

PROJETO: NOVA PESQUISA DE CLIMA ORGANIZACIONAL

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TERMO DE ABERTURA DO PROJETO Nº PM6 - 2/31/17

1. JUSTIFICATIVA DO PROJETO

1.1. INTRODUÇÃO

A Pesquisa de Clima Organizacional (PCO) é uma forma de comunicação entre a liderança e a força de trabalho, adotada por muitas organizações, no sentido de avaliar a satisfação profissional de toda força de trabalho. Permite levantar os pontos fortes e fracos do ambiente na organização segundo a ótica de seus integrantes, indicando ao comando, em seus vários níveis, o que é possível melhorar na Instituição para buscar maior satisfação dos policiais militares de uma maneira geral.

No âmbito da Instituição Policial-Militar, a PCO foi estabelecida no ano de 2011, pela Diretriz n.º PM6-001/40/11, alterada pela Ordem Complementar n.º PM6-001/40/12, bem como, pela Nota de Instrução n.º PM6-2/40/12.

A pesquisa foi aplicada no período de 2012 a 2015, contando com a participação de muitos policiais militares. Em 2012 foram 10.258 policiais participantes, no ano de 2013 foram 8.402, em 2014 foram 7.347 e em 2015 foram 10. 929.

A participação voluntária dos policiais na pesquisa propiciou o mapeamento dos problemas e necessidades, porém, com base na filosofia de melhoria contínua dos processos faz-se necessária a atualização do questionário, do sistema informatizado e dos planos de ação visando a melhoria do ambiente organizacional.

1.2. BENEFÍCIOS

1.2.1. BENEFÍCIOS PARA O CIDADÃO

- Melhoria da qualidade dos serviços prestados pela PMESP;

1.2.2. BENEFÍCIOS PARA O GOVERNO

- Atendimento das diretrizes estratégicas do Governo que preconizam a melhoria da gestão pública;

1.2.3. BENEFÍCIOS PARA A PMESP

- Melhoria da qualidade dos serviços prestados pela PMESP;
- Melhoria do clima organizacional;
- Valorização do policial militar;
- Aprimoramento do planejamento administrativo da PMESP;

1.3. ALINHAMENTO ESTRATÉGICO

1.3.1. Objetivos Estratégicos do Governo do Estado de São Paulo[1]

O projeto está alinhado aos objetivos estratégicos do Plano Plurianual 2016 - 2019:

- Objetivo estratégico 11: gestão pública inovadora, eficiente e comprometida com o planejamento e a execução dos programas e serviços públicos de qualidade, que descreve a importância de promover ações que elevem a qualidade dos serviços públicos, em especial garantindo a transparência e a eficiência nos processos e no uso dos recursos humanos, materiais, tecnológicos e financeiros.

1.3.2. Diretrizes da Polícia Militar

O projeto está alinhado às Diretrizes do Comando Geral que estabelecem:

- Diretriz 3 - Valorização do policial militar;
- Diretriz 5 - Gestão voltada à eficácia administrativa e operacional.

[1] Lei n.º 16.083, de 28 de dezembro de 2015, que instituiu o Plano Plurianual para o quadriênio 2016 a 2019.

2. OBJETIVO DO PROJETO

N.º	OBJETIVO	INDICADORES	META		
			1º Trim 2017	2º Trim 2017	3º Trim 2017
1	Reestruturar o processo de Pesquisa Clima Organizacional (PCO) na PMESP, desenvolvendo novo questionário e sistema informatizado multiplataforma	Taxa de andamento do projeto	20%	50%	30%

3. ESCOPO

3.1. ESCOPO DO PROJETO

O trabalho que deve ser realizado para entregar um produto, serviço ou resultado com as características e funções especificadas:

- Mapeamento do processo de pesquisa clima organizacional (*TO BE*);
- Desenvolvimento de sistema informatizado da PCO;
- Realização da PCO, em caráter piloto, para fins de homologação do sistema informatizado;
- Atualização da normatização sobre pesquisa de clima organizacional.

3.2. ESCOPO DO PRODUTO

As características e funções que descrevem um produto, serviço ou resultado são:

- Redesenho (*TO BE*) do processo de pesquisa clima organizacional e as Instruções de Trabalho (*TO BE*), com base na metodologia *Business Process Management (BPM)*;
- Sistema informatizado da PCO deve ter as seguintes funcionalidades básicas:
  - capacidade de edição do questionário de pesquisa;
  - coletar a pesquisa de clima organizacional;

- gerar relatórios gerenciais de resultados gerais e estratificados por OPM, por posto e graduação, por sexo, por tempo de serviço, por área de atuação (operacional e administrativo) etc.;
- acessibilidade pela Internet e Intranet;
- disponibilidade de versões do sistema para acesso em *desktop* e *mobile*;
- garantia de anonimato dos participantes da pesquisa;
- capacidade de geração de planos de ação.

- Atualização da normatização sobre pesquisa de clima organizacional no âmbito da Polícia Militar, incluindo novo questionário de pesquisa, nos termos das I-25-PM;
- Realização da PCO, em caráter piloto, para fins de homologação do sistema informatizado.

3.2.1. Entregas

As entregas são:

- Redesenho (*TO BE*) e Instruções de Trabalho (*TO BE*) do processo de pesquisa clima organizacional aprovados;
- Sistema informatizado da PCO multiplataforma homologado;
- PCO aplicada em caráter piloto;
- Norma institucional sobre pesquisa de clima organizacional aprovada.

4. PREMISSAS

As premissas do projeto são:

- Haverá o apoio e suporte do Comando Geral, dos Órgãos de Direção Geral e Setorial e dos Órgãos de Execução para sua execução e conclusão;
- Haverá a alocação de recursos financeiros e humanos.

5. RISCOS INICIAIS

Os riscos iniciais são:

- Falta apoio institucional para implementação da nova PCO;
- Falta ou insuficiência de recursos orçamentários e humanos;
- Falta ou baixa sinergia entre as OPM envolvidas;
- Recursos orçamentários (custeio) inexistentes ou insuficientes para manutenção dos equipamentos e dos sistemas informatizados.

6. CRITÉRIOS PARA APROVAÇÃO

6.1. COMPETÊNCIA PARA APROVAÇÃO

- Mapeamento dos processos de pesquisa de clima organizacional: Ch 6ª EM/PM;
- Homologação do sistema informatizado da PCO multiplataforma: Ch 6ª EM/PM;
- Norma institucional sobre pesquisa de clima organizacional: Cmt G;
- Encerramento do projeto: Subcmt PM.

7. PARTES INTERESSADAS NO PROJETO

7.1. PARTES INTERESSADAS INTERNAS

São partes interessadas com capacidade de determinar requisitos do projeto.

- Cmt G;
- Subcmt PM;
- Subch EM/PM;
- EM/PM;
- DTel;
- CPD;
- 6ª EM/PM;
- EGP/PM;
- EPE/PM;
- Comandantes / Chefes / Diretores;
- Policiais militares da ativa.

8. DESIGNAÇÃO DA PATROCINADORA, DO GERENTE E DA EQUIPE DO PROJETO

8.1. PATROCINADORA DO PROJETO

- Ten Cel PM 910273-6 Daniele Cristina Oliveira de Freitas, da 6ª EM/PM;

8.2. GERENTE DO PROJETO

- Cap PM 940647-6 Marcelo de Souza Gonçalves (titular);
- Cap PM 104543-1 André Fernando da Silva Nogueira (eventual), ambos da 6.ª EM/PM.

8.3. EQUIPE DO PROJETO

- Maj PM 891253-0 Ricardo Souza Barreto,
- Cap PM 940740-5 Marcos Botaro Xavier;
- 1° Ten PM 127682-4 Eder Gonçalves Beserra, todos do CPD;
- Cap PM 940667-A Beatriz de Assis Bastos Morassi;
- 1° Sgt PM 953285-4 Wilson Jorge dos Santos Alves;
- Cb PM 967268-A Valeska Koch Moreira, todos da 6.ª EM/PM;

São Paulo, 28 de março de 2017.

MAURO CEZAR DOS SANTOS RICCIARELLI
Cel PM Subcomandante