Applying Questionnaire to Assess the Lessons Learned Process in Software Project Management: a Case Study at GAIA

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Abstract — In order to obtain benefits from the Lessons Learned Process in Software Project Management it is necessary to assess the process periodically. To avoid failures, assessments can be conducted based on questionnaires duly appropriate for each organisation or segment of the software project under development. Studies of Lessons Learned and Software Project Management have increased the assessments techniques and have guided the construction of assessment criteria in organisations. In this paper, we present a questionnaire template with different alternatives that offer different scores and axes of efficiency to enhance the assessment. We intend to demonstrate that this questionnaire template establishes parameters for accurate measurements of the assessment of the Lessons Learned Process.

Keywords – Lessons Learned, Software Project Management, Assessment Questionnaire.

I. INTRODUCTION

Through research on the organisation itself and with the participation of the people involved in software development projects, it is possible to maintain an information database called Lessons Learned [1]. The content of this database is the result of activities performed within an organisation. Throughout the project, the experiences are accumulated in an organised way to form the Lessons Learned of the project team.

Structuring Lessons Learned Processes in an organisation is not always fast and there should be a constant discussion of the subject for all people involved. The benefits of Lessons Learned should be pursued by those involved in the development of a software project [2], in the life cycle of the software development process. This paper aims to identify the main points that can be improved for this organisation, either through classification of information, its source or characteristic, or by its complexity.

Aiming at the success of the project, the application of Lessons Learned in the organisation is one of the techniques that contribute to this goal [3]. The goals must be constantly pursued in spite of the diversity of resources involved, the complexities and restrictions required during the project. Therefore, in order to facilitate the decision during the project, the Lessons Learned is fundamental to promote assertiveness in these decisions.

The maintenance of Lessons Learned contributes positively to the successful delivery with the expected quality [3], even with the numerous innovative techniques in project management [4]. In this paper, the advantages offered by the Lessons Learned Process are proposed through the development of six axes of efficiency. The development of these axes intends to determine the level of efficiency of the maintenance of Lessons Learned Process that is being practised in the organisation.

By using the Lessons Learned Process in Software Project Management, organisations intend to guarantee effective collaboration in building the best software development techniques. Therefore, assessments should be conducted to measure the efficiency of this process. With that in mind, in this paper, we designed an assessment questionnaire to measure the efficiency of Lessons Learned for the main axes of the management process.

The present article is organised as follows: in Section 2, there is a literature review of the main bases of this project – Lessons Learned, Project Management and related work. In Section 3, we present the assessment based on the questionnaires at GAIA – Software Factory, as a case study. In Section 4, the process evaluation of Lessons Learned in Project Management. The results are presented in Section 5, and finally, the conclusion and future work are presented in Section 6.

II. LITERATURE REVIEW

We conducted [2] several studies for the literature review focusing on two areas: Project Management and Lessons Learned. The survey was developed from several documents with relevant and current issues in these areas. The study of related work also helped to consolidate the assessment proposed in this article.

A. Lessons Learned

The Lessons Learned Process includes organised activities for the recorded experiences of the people involved in a particular project and has great value as knowledge. Both positive and negative experiences are considered equally important in Lessons Learned, e.g., a variation of the technique of software testing can be positively considered; but if this variation results in failure, it can be considered as negative.

In [5], a Lesson Learned is considered as so when it has an impact on daily operations. Basically, adverse experiences are observed and used to improve the organisation or a particular member of staff. In all cases, the result should be, among others, a significant reduction of effort, an improvement in design, and an optimisation of computer resources.

Among the several applications of Lessons Learned, with beneficial impacts to the organisation, some can be cited according to [3]:

- Time saved in solving problems, since the solutions of common problems are centralised in one location for easy access by members.
- Reduction or elimination of costs from avoiding the same work to be done again when correcting discovered defects.
- Encouragement of the use of best practices within the organisation, which increases the likelihood of success of the projects.

Narratives that explicit knowledge or understanding gained through experience – both positive and negative – can still be characterised as a lesson learned. The lesson relates what was expected to happen, the facts and deviations that happened, the analysis of the causes of these deviations and what might be learned during the process [6].

The record of the lessons learned is an excellent way to avoid the same mistakes previously made and to replicate the successes achieved in the past to future projects. According to [7], five points are listed for a successful implementation of the process of documentation of the lessons learned:

1) Training of members of the organisation – it is necessary to change the paradigm that the collection and recording of lessons learned is a waste of time, and to bring to knowledge the benefits that information sharing has in an organisation. For this process to work, it is very important that the manager is able to generate motivation and involvement of all. According to [8], to make full use of the practices of knowledge management in a company, one of the key factors is the involvement of both stakeholders and workforce – which involves a change of habits.

2) Collection and recording of experiences – this task is considered to be costly and demands great effort from the staff. This task should be performed using practices and oriented towards an easy method of items relevant for the organisation; also, it is important that these items are organised following a set pattern.

3) Analysis of successes and failures – it is not enough that the lessons learned are simply recorded and catalogued; they also must be understood and analysed. After the identification of the activities that resulted in good results or failures, these records must be part of the knowledge basis. In that way, the Lessons Learned Process becomes an opportunity for analysing facts and for adopting measures for a continuous improvement.

4) Dissemination of knowledge – Simply archiving these lessons is not enough; they should also be disclosed throughout the organisation. This disclosure must take into account the direction and prioritisation of such information in accordance with the interests of each group.

5) Updated records – It is very important to understand that the register of the Lessons Learned should be cyclical, i.e., it must be constantly updated.

B. Project Management

Software development has been one of the major technological advances of our days, in the information age. All products built based on projects have shown positive results and measurable improvements in the future [4]. For that, project management is an activity largely applied to software development, which has improved significantly with less effort.

The most widely accepted definition for the term "project" is presented by the Project Management Body of Knowledge (PMBOK), and characterised as "a temporary endeavour undertaken to create a product, service or result only". In the same line, [9] defines it as "a unique venture to produce a set of results according to constraints of time, cost and quality clearly defined".

The great amount of software projects in progress, the number of people involved in these tasks and the tight delivery deadlines increases the complexity of these projects [10]. Therefore, there is a growing practice of Project Management (PM) for new software projects, whether new products or changes in systems already developed. According to [11], PM is used by organisations to manage the innovations in their processes. Thus, encouraging the creation and dissemination of organisational management techniques in these organisations is fundamental to improve products and processes services.

According to [12], there is the PM-specific branch of the organisation's activity, because it includes various techniques in different business areas, such as: general administration, military organisation and engineering, among others. The activities involved in PM are multidisciplinary and require a lot of expertise and the participants' commitment to its implementation. The growth of project management refers to topics such as roles and responsibilities, organisational structures, delegation of authority, decision-making and especially corporate profitability [13].

Thus, the project management "is the application of knowledge, skills, tools and techniques to project activities to meet project requirements". Once the characteristics of the delivery products (and services) [4] [9] are defined, the activities must meet these objectives in an explicit – and not implicit – way. Throughout their development, the projects are organised according to their life cycle and divided in two classes: the projects that involve the activities of PM and the products that include the activities of product development [12].

During the development of a product, the tasks may vary according to the branch of industry (software, pharmaceutical, manufacturing, etc.), while the PM is independent from the segment. They can be classified into groups (called stages), such as initiation, definition, planning, execution, controlling, and closing. Each stage brings together activities with similar purposes, but with their own features and goals.

C. Related Work Process and Lessons Learned

The Process Management of the Lessons Learned is increasing, especially in the area of Information Technology,

aiming at consolidating this process in software projects. For example, [14] proposes an architectural model for managing Lessons Learned in the testing phase. Although there are studies reporting the importance of this process, none of them includes the assessment questionnaire.

In the work of [15], the authors developed a guide containing major errors in the Lessons Learned. This subject was widely discussed by National Aeronautics and Space Administration (NASA) especially after the incident with the space shuttle Columbia. These authors' proposal is to consider the following key steps: the collection of lessons learned, their management and application in future projects.

According to [16], Lessons Learned Process is used to develop and maintain an organisational memory for a technology centre that develops high risk systems. In this centre, through interviews, decomposition and reintegration of tacit knowledge with explicit information, including the information gathering and dissemination, they managed to establish a process and obtained good results after its implementation.

In software engineering, the process of knowledge dissemination is based on Lessons Learned [17] in order to maintain a community of interest. This work describes the operation of the engineering centre software based on Commercial Off-The-Shelf (COTS) and how the Lessons Learned is used. It also includes a detailed description of a repository Lessons Learned and a planning evolution for it.

As previously mentioned, the use of Lessons Learned Process has clear aims in project management, which in turn requires the assessment of this process so that improvements can take place. Several studies focus on Lessons Learned Process, highlighting its necessity and advantages. However, the formal and effective assessment of this process is not always correctly explained.

In this paper, a formal assessment with the aim of improving Lessons Learned Process is proposed through a questionnaire applied to all involved in the project. Based on the results of this questionnaire, the organisation can decide how to employ its resources for each level of need indicated by the axes of efficiency.

III. ASSESSMENT OF LESSONS LEARNED PROCESS BASED ON A QUESTIONNAIRE

There are several methods of gathering information to meet an internal process in the organisation. In [18], one of them includes the collaboration of the team members that participated in this survey, so the accuracy of the information given is associated to the participants' commitment. Following this principle, a questionnaire was developed to be applied to all members of the software development team.

An assessment was conducted, as a case study, at GAIA Software Factory of the Department of Computing, State University of Londrina. This organisation was chosen because it develops software of various scopes for the university itself and, specially, because it is formed by undergraduate and postgraduate students that – after their graduation – leave the Factory, leading to knowledge loss. Other important factors were listed in this case study:

- An environment focused on software development;

- The team works with procedures, attributes and templates that can be reused;
- An organisation focused on a continuous improvement of its processes;
- The development software process includes integration at several software engineering area and governance in Information Technology (IT);
- Specialists in knowledge management;
- Experienced staff in project management.

In the work of [19], a method was used for multiple-item development of a questionnaire. The main objective of this method was the measurement of a universe through issues that represent reality. Alternatives distributed between strong, weak and staggered tend to result in accuracy. Thus, the questionnaire represents a powerful tool for the measurement of a situation.

In order to obtain a broad and complete picture, the questionnaire was built with objective questions, containing qualitative and quantitative alternatives. Beyond the issues that were considered in the axes of efficiency that lead to good practices for each process involved in the use of Lessons Learned Process. The axes of efficiency show trends for each of the items considered [20].

As illustrated in Figure 1, these axes represent the main features to use effectively the resources from Lessons Learned in a Software Development organisation. Through these axes of efficiency it is possible to focus on a specific feature, facilitating the management of Lessons Learned Process.

Figure 1.   Axes of efficiency in Lessons Learned Process (adapted from [20])

Each question was elaborated with the objective of indicating the need of improvement. Also, it was considered getting a diagnosis for the applicability of the process related to the efficiency of Lessons Learned Process, according to the axes of efficiency. Each alternative indicates the level of this applicability, which can be achieved by the weight associated to each axis of efficiency, due to the impact that this response will provide to the axis.

The weight of the efficiency as a function of the sum is generally a multiplication, with values ranging from 0 to 3, in which 0 represents 'no influence', 1 'low influence', 2 'medium influence' and 3 'high influence'. To this levels of influence is added either the signs (+) or (–) determining, respectively, a positive or negative influence. The alternatives suggest that the participant will be framed according to their degree of participation in the Lessons

Learned Process. As an example, Figure 2 shows the possible alternatives for the two issues.

In Figure 2, the answer to each question consists in an alternative, which will be chosen by those involved in the development project. In the questionnaire, the participant answers the questions without knowing neither the correspondent weights nor the axes of efficiency. However, for each answer, it will be computed in a general sum and the representativeness of a participant's answer will be given by their answer multiplied by its respective weight.

Questions / Axes of Efficiency	Alternatives for the answers and their weights for each Axis of Efficiency	Organisational Culture aimed at L.L.	Explanation of L.L.	Dissemination of L.L.	Easy to use L.L.	Configuration Management of L.L.	Policy of the Access Control L.L.
Is there a documented procedure for the dissemination of L.L.?	**Strong,** there is a documented procedure for dissemination of L.L. and it is periodically assessed for its improvement	2	2	3	2	1	2
	Yes, there is a documented procedure, but there is no review for improvement	1	1	2	1	1	1
	Partly, the documented procedure was described, but not for those involved in the project	1	1	1	1	1	1
	No, there is no documented procedure for dissemination of L.L.	1	1	-2	1	1	1
	Weak, there is no documented procedure and there are no plans to define this procedure	-2	-1	-3	-2	1	-1
Is the history of changes of L.L. maintained? Are the versions managed?	**Strong,** there is a control version for L.L. storage with record of modifications	2	2	1	2	3	2
	Yes, the record is kept, but the versions are not managed	1	2	1	1	2	1
	Partly, records are eventually stored	1	1	1	1	1	1
	No, no record changes are kept	1	1	1	1	-2	1
	Weak, the organisation does not plan to implement change control of a L.L.	-2	-2	1	-1	-3	-1

Figure 2.   Issues, alternatives, effiency and weights (Produced by the authors)

For example, the question "Is there a documented procedure for the dissemination of L.L. (Lesson Learned)?" has five alternatives and each one represents gradually the position of the organisation. It is possible that the weights were assigned to each alternative along an axis of efficiency. In spite of the fact that the weights of each answer have a simple score calculation, this format leads to results more accurately dependent on the granularity of each alternative.

Different weights were attributed for the axis "Dissemination of Lessons Learned": '3' to the alternative "Strong, there is a documented procedure for dissemination of L.L. and it is periodically assessed for its improvement", which indicates a high positive impact to this issue. And so on, up to the weight '–3' for the option "Weak, there is no documented procedure and there are no plans to define this procedure", indicating that there is a high negative impact.

IV.   ASSESSMENT OF LESSONS LEARNED PROCESS IN PM

Based on the proposal and on the issues raised and described in Figure 2, we conducted a case study about the advantages that its use can provide to the application of the Lessons Learned Process as part of software development project management. Then, we explain three main advantages of the questionnaire with axes of efficiency in the assessment of the Lessons Learned Process ([1], [3], [14], [21]). These themes were established according to the studies conducted in the organisational environment of systems development, in which there is collaboration for project management.

The benefits of each axis of efficiency lie on the results that each of them will provide for the development of systems and especially for the process of software

development with Lessons Learned Process. For a positive result in project management it is necessary that the analysis [22] for each axis be part of the process. Thus, each axis of efficiency will demonstrate the contribution to the whole process.

A.   Explanation of Lessons Learned

Knowledge is valid for people when the development of a task can be controlled by them, and adapted to specific needs, i.e., when it becomes a Lesson Learned. That, in turn, may or may not be spelled out for future use or shared with others [23]. Sharing a Lesson Learned with a software project development team becomes an advantage that can result in minimisation of effort or improvement of the final product.

The possibility of having an organisational integration of knowledge management and, as a consequence, gaining a competitive advantage in the market [21], represents the importance of explaining Lessons Learned. When described, a Lesson Learned becomes reference for use, association or improvement of a given process or task within the organisation.

In order to complete the cycle of information, according to [23], knowledge must transit between tacit and explicit, in phases of socialisation, externalisation, combination and internalisation. On the other hand, [24] states that before the storage of information, knowledge must be made explicit, classified and integrated, so it can contribute to improvements and add new information. Thus, the axis of Explanation of the Lessons Learned is considered essential to a formal process; without which it would be impossible to continue the treatment and use of acquired knowledge.

B.   Ease of search

The models and materials surveyed do not offer an explicit description of the minimum criteria that would facilitate the recovery of the Lessons Learned stored. Capability Maturity Model Integration (CMMI) reports that the recovery of a Lesson Learned should have criteria to facilitate this process; however, it does not show how this procedure should be done.

The tool used to storage the Lessons Learned facilitates the search and access, encouraging the practice of the process as a whole [20]. Besides that, the design is optimised in time, considering that several people access several times the knowledge repository. If for each survey the time can be optimised, then the time of the task can also be reduced.

The easy access to a Lesson Learned is a major factor that drives the effective use of this process. Since a Lesson Learned is explicit, it should be made available in a simple way for the consultation process. Some keywords are fundamental to enable this search by those involved in the project. Still, according to [24], this question must have the correct rating to have the assertiveness and adequate categorisation also highlighted by [27]. With the combination of these practices, naturally, one can predict that the good explanation and ease of use will boost the dissemination of Lessons Learned.

C. Configuration Management

One of the most important activities in software development is the responsibility of the project manager to control revisions and versions. In this process, all changes are controlled in an organised and predictable way [26], which can be envisaged for specific versions for each project phase. The great advantage in the use of configuration management is the control of the record of Lessons Learned, for a more efficient decision-making. Comparing a Lesson Learned at the exact moment in which its use is being analysed [16] ensures the manager an effective decision for its application or not.

This article aims to contribute to the studies analysed with an approach in an appropriate format and customisable for the assessment of Lessons Learned Process at a software development organisation. The axis of efficiency Configuration Management will complement the stability to use the Lessons Learned Process, along with the other axes. The collaboration of this axis is directly related to the axes of Policy of the Access Control and the Dissemination of Knowledge. Through proper configuration of each item a Lesson Learned will enable the correct version of the item according to the responsibility of the project member giving, therefore, greater security and reliability of the information to the project manager.

V. RESULTS

The organisation's choice to conduct the questionnaire was crucial because the GAIA has development model components that are organised and trained to act in this segment. In GAIA, there are three groups: specialists, non-specialists, and project manager. In this way, it becomes feasible to conduct the questionnaire, and because all are involved, daily, in the development software process.

Following the process, proposed by [21], as a methodology for collecting results, research was targeted at the three groups of the software development team in order to obtain the recognition of the assessment questionnaire proposed by this article. The team involved and engaged belongs to the project GAIA – a Software Factory, a research and extension project of the Department of Computing, State University of Londrina (UEL). People were classified into three groups: project manager, specialists, and non-specialists. In the first group, there were those who know and perform project management; in the second, experts of Knowledge Management; and in the third group, the other participants of the software development team.

The statements were designed in accordance with the suggestions of the participants of the software development team, based on guidelines found in the literature ([21], [25]). The statements, presented in Table I, are essential to the targeting of objectives of knowledge management and assessment of Lessons Learned Process. In order to prepare Table I with the statements, we initially prepared questions about GAIA's Lessons Learned and we conducted it to the three assessment groups. The questionnaire was designed considering the axes of efficiency, treated in Section 3, for a more effective assessment.

TABLE I.   LIST OF THE ASSESSORS' CLAIMS

No.	Statements
01	Lessons Learned Process is initiated by explicit knowledge, supporting the possibility for use and improvements.
02	With the management of Lessons Learned participants will have greater confidence to use and work with the repository.
03	Lessons Learned explained and managed becomes part of the organisation and is not restrict to the expert who wrote it anymore.
04	Participants will have the greatest stimulus in the use of Lessons Learned when it is easy to use.
05	Saving versions of changes in Lessons Learned will enable checking the evolution of its use.
06	Lessons Learned is not available without access control, which will maintain its integrity in a controlled way.
07	It is possible to measure the efficiency of use from the reach of a Lesson Learned to the ones involved in the project.
08	The questionnaire will direct the evolution of the quality of the process of Lessons Learned.
09	Through the questionnaire containing the axes of efficiency, the margin of safety in the assessment of the Lessons Learned Proces will be increased.
10	The weights allocated to each of the answers indicate greater importance in the application of Lessons Learned.

a. Produced by the authors.

In Table I, we present the advantages of completing the assessment of the Lessons Learned framework with the axes of efficiency. The efficiency of the proposed process is depicted in Table II, which shows a positive assessment, with scores close to the maximum. The great advantage – presented in this paper – of the assessment methodology using the questionnaire is specifically the objectivity to validate each point represented by the axes, the contribution to the effectiveness and efficiency in project management in a software development organisation.

The applicability of the questionnaire for assessing the Lessons Learned Process was presented and submitted in the organisation model of software development GAIA, among the three groups. Based on the model presented in Figure 2, the questionnaire aimed to assess whether it is possible to have positive results for assessment of Lessons Learned Process in a software development organisation.

Each group – specialist, non-specialist and project manager – analysed the problems with their weights, responding according to the applicability in the development environment GAIA. Data were collected after each participant gave a score between 1 and 5, in which 1 means 'strongly disagree', 2 means 'partially disagree', 3 means 'agree', 4 means 'partially agree' and 5, 'fully agree', consistent with the proposed assessment. Finally, the optimistic result is expressed in Table II.

TABLE II.   TABULATION OF SCORES OF ASSESSORS

Surveyed	Grades									Average
Specialists	5	4	5							4.67
Non-Specialists	4	5	4	5	3	4	5	5	5	4.44
Project Managers	4	5	4	5						4.50
Total Average										4.54

b. Produced by the authors.

The assessment of this work is very satisfactory, since the percentage among the assessors numbered 90.8% (4.54/5.00) at the final average, as demonstrated in Table II, ensuring effective use of the questionnaire. For a good Lessons Learned Process management, it is possible that a software development company measure through the questionnaire process, with axes of efficiency and weights for each alternative of the question.

In this summary, we have demonstrated that 50% of project managers pointed favourably for the use of this methodology, giving evidence that the results are satisfactory for the Lessons Learned Process in software development. With this favourable outcome, the process becomes an opportunity for improvement in software development, boosting the possibility of investing in the assessment and improvement of Lessons Learned Processes.

VI. CONCLUSIONS

The main objective in the Lessons Learned Process will be achieved in a collaborative way among project participants when sharing experiences about several criteria that are being met. It will not be possible to achieve a positive benefit of a Lesson Learned unless the different parts of the process are seen as complementary.

Although methods for assessing a process aim at measuring the efficiency and effectiveness within a determined period of time, a survey conducted using the questionnaire has the advantage of obtaining accurate results with a specialisation according to the organisation. Depending on the questionnaire, whether it is prepared with the axes of efficiency and alternatives on scales, the results may be precise and reliable.

In this article, it is evident that the interrelationship among the axes of efficiency, with the intention of Lessons Learned, will be essential to this process. To ensure that the axes are kept in balance, there is a need to plan and execute a periodic assessment [5]. The ongoing assessment will ensure that all improvements will be identify to maintain the balance among the axes of efficiency aiming at maintaining the Lessons Learned Process. If one of the axes suffers greater positive change, the other must also be revised so that they are all levelled.

Much of the evolution of these processes – including Lessons Learned – is improved from constant assessment. According to [28], conducting questionnaires in assessment processes has advantages for both the staff and the process. Likewise, this advantage was verified by the assessment of team project GAIA, mainly by specialists and project managers, certifying that this questionnaire model is valid to maintain and improve the Lessons Learned Process in software development organisations.

Without the questionnaire it would be impossible to identify the possible need for changes in the Lessons Learned Process. Each member who answered the questionnaire can review how the Lessons Learned Process can impact the quality of software development. When answering the questionnaire, the member of the development team reflects on their performance before the alternatives of the questions. This reflection is notice in accordance with the objective of pushing the Lessons Learned Process.

Following the good results of the questionnaire model we envisage, in a future work, the application of the same model in private companies in the North region of the State of Paraná. This region has several technology companies, with the potential of producing high quality software and diversity training for more than three hundred professional graduates every year. The application of this model in organisations of various industries will demonstrate that the results are significant for more secure conclusions on the use of Lessons Learned within this market segment.

REFERENCES

[1] A. de Souza Goes and R. M. de Barros, "Gerenciamento do conhecimento em uma fábrica de software: Um estudo de caso aplicando a ferramenta GAIA – L.A.", In Conferencia Latinoamericana en Informática (CLEI), 2012.

[2] A. de Souza Goes, M. I. Hisatomi, B. M. Omena, and R. M. de Barros,, "Applying Lessons Learned as an Improved Methodology for Softtware Project Management", International Conference Information Systems (IADIS), 2013, pp 302-306.

[3] T. H. Roe, "Establishing a Lessons Learned Program: Observation, Insights and Lessons", Center for Army Lessons Learned: USA, 2011, pp. 88.

[4] PMBOK, "Um Guia do Conhecimento em Gerenciamento de Projetos", Quarta Edição, Project Management Institute, Inc, Newtown Square, Pennsylvania EUA, 2008.

[5] MPS-BR (Lições Aprendidas), "Associação para Promoção da Excelência do Software Brasileiro"; "Melhoria de Processo do Software Brasileiro Guia Geral Sumário", SOFTEX, 56p., 2011.

[6] B. H. Reich, A. Gemino, and C. Sauer, "Knowledge management and project-based knowledge in it projects: A model and preliminary empirical results", International Journal of Project Management, 2012, pp. 663-674.

[7] M. G. Aldenucci, "Um modelo de maturidade para o processo de gerenciamento de riscos", Dissertação de Mestrado, Pontifícia Universidade Católica: PUC-PR, 2009.

[8] K. F. Brett and D. Dressler, "The 24 Keys to high performance", Frontline Group Organizational Learning Division, 2000.

[9] J. Westland, "The Project Management Life Cycle: Complete Step by Step Methodology for Initiating, Planning, Executing & Closing a Project Successfully", Philadelphia, PA: Kogan Page, 2006.

[10] P. C. Torreão, "Ambiente Inteligente de Aprendizado para Educação em Gerenciamento de Projetos". Dissertação de mestrado, Universidade Federal de Pernambuco. Recife: UFPE, 2005.

[11] L. V. Martins, "Gestão Profissional de Projetos". Revista TecHoje. Belo Horizonte: ITEC, 2003.

[12] P. C. Dinsmore and J. Cabanisbrewin, "The AMA Handbook of Project Management", Second Edition. New York: AMACOM, 2006.

[13] H. Kerzner, "Project Management: A systems Approach to Planning, Scheduling and Controlling", Eighth Edition. Hoboken, New Jersey: John Wiley & Sons, 2003, pp. 211.

[14] J. Andrade, J. Ares, M.-A. Martinez, J. Pazos, S. Rodríguez, J. Romera, and S. Suárez, "An architectural model for software testing lesson learned systems, Information and Software Technology", vol. 55, n. 1, 2013, pp. 18-34.

[15] E. W. Rogers, R. L. Dillon, and C. H. Tinsley, "Avoiding Common Pitfalls in Lessons Learned Processes that Support Decisions with Significant Risks", Aerospace Conference, 2007, pp. 1-7.

[16] D. Mendoza and R. Johnson, "Using a Lessons Learned Process to Develop and Maintain Institutional Memory and Intelligence", Aerospace Conference, 2006, pp. 1-10.

[17] I. Rus, M. Lindvall, C. Seaman, and V. Basili, "Packaging and Disseminating Lessons Learned from COTS-Based Software Development", Proceedings of the 27 th Annual NASA Goddard/IEEE Software Engineering Workshop, 2003, pp. 131-138.

[18] H. Günther, "Como Elaborar um Questionário", 2003, pp. 01-14.

[19] Y.-Y. Chen and H.-L. Huang, "Knowledge management fit and its implications for business performance: A profile deviation analysis", Knowledge-Based Systems, 2012, pp. 262-270.

[20] G. U. Briganó, "Um framework para desenvolvimento de governança de TIC. 2012. 155. Dissertação de Mestrado em Ciência da Computação – Universidade Estadual de Londrina, Londrina, 2012, pp. 18, 29-55.

[21] S. Rautenberg, A. V. Steil, and J. L. Todesco, "Modelo de Conhecimento para mapeamento de instrumentos da gestão do conhecimento e de agentes computacionais da engenharia do conhecimento" Perspectivas em Ciência da Informação, v.16, n.3, 2011, pp. 26-46.

[22] P. Carrillo, K. Ruikar, and P. Fuller, "When will we learn? Improving lessons learned practice in construction", International Journal of Project Management, 2013, pp. 567-578.

[23] I. Nonaka, R. Toyama, and N. Konno, "SECI, Ba and Leadership: a Unified Model of Dynamic Knowledge Creation", Leadership, vol. 33, 2000, pp. 5-34.

[24] J. Xue and Z. Zhang, "The Research on the Application Strategies of Information and Communication Technologies to Promote the Knowledge Transfer in Regional Innovation System", 2006, pp. 138-145.

[25] B. Cakici and M. Boman, "A workflow for software development within computational epidemiology", Journal of Computational Science, 2011, pp. 216-222.

[26] ITIL Version 3 Service Transition, pp. 65 – 68.

[27] E. Serna M., "Maturity model of Knowledge Management in the interpretativist perspective", International Journal of Information Management, 2012, pp. 365-371.

[28] F. E. A. Horita, M. I. Hisatomi, F. H. Gaffo, and R. M. de Barros, "Maturity Model and Lesson Learned for improve the Quality of Organizational Knowledge and Human Resources Management in Software Development", International Journal os Software Engineering and Knowledge Engineering, 2013, pp. 552-555.