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COMBINING LEAN AND AGILE PROJECT MANAGEMENT IN A MULTI-PROJECT ENVIRONMENT: CASE STUDY IN A RETAIL COMPANY

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ABSTRACT

Both the Last Planner System (LPS) and Scrum have been suggested as suitable planning and control methods for dealing with complex project environments. However, most previous studies have investigated the use of those methods for planning and control in single projects, in general managed separately from other projects. This paper reports the results of an investigation which aims to propose a planning and control model for managing construction projects in a multi-project environment. Using Design Science Research (DSR) as a methodological approach, an empirical study has been carried out in a fashion retailer company from Brazil. The model has been built by using a research strategy similar to Action Research. These are the main findings so far: (a) the nature of the project management activities demand a different planning and control approach, compared to what is normally found in relation to planning and control design or construction; and (b) there are challenges on the systematic use of performance measures to support learning and decision-making. These initial conclusions will serve as a basis for incorporating improvements in the model.

KEYWORDS

Lean construction, agile project management, planning and control, project management, construction projects.

INTRODUCTION

The starting point of this investigation was a practical problem identified by a fashion retailer company from Brazil, which has a portfolio of over 60 projects a year. Those

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projects are built in different parts of the country, and in other Latin American countries. The company has a Department of Architecture and Engineering (DAE), which is in charge of managing the design and construction stages. DAE coordinates the work of several types of suppliers, including designers, construction management companies, general contractors, and furniture suppliers, which are directly responsible for the design and delivery of the projects. In the department routine, multiple projects are developed simultaneously, with relatively short lead-time (typically within a year). Some of them are refurbishment or retrofit projects. The individual characteristics of each project and the fact that there is some degree of interdependence between projects, due to shared resources, make this project management environment highly complex. Before the beginning of this study, the company had been adopting a very traditional project management approach, strongly based on the Project Management Body of Knowledge (PMBOK), produced by the Project Management Institute (PMI): Critical Path Method (CPM) as a planning and control tool, emphasis on the control of deliverables, performance measurement focused on results, etc. Based on an assessment of the company's project deliverable system, one of the main improvement opportunities identified was to change the planning and control process, which included both design and construction stages at a project management level. In fact, the company had been faced several problems related to additional costs, project delays and lack of quality.

The underlying assumptions of project management have evolved over time in an attempt to improve managers' ability to cope with different circumstances (Laufer et al. 1996). Although management styles have evolved over time, companies from different industries continue to face problems and obtain failed results (Atkinson 1999). Several causes have been pointed out for those problems. Shenhar and Dvir (1996) and Turner (1999) pointed out the lack of an explicit theory for the area. Koskela and Howell (2002) argue that the underlying theoretical foundation of project management as espoused in the PMBOK is the most applied in practice. Based on a comparison of the PMBOK implicit theories with alternative theories, those authors argue that this foundation is obsolete and has to be replaced by a broader and more powerful theoretical foundation. In fact, previous studies indicate that the poor performance of construction projects can be related to the fact that the traditional project management approach is used in isolation from other managerial approaches (Laufer et al. 2015).

One of the main criticisms related to the traditional project management approach is the fact that it ignores some of the attributes of complexity and its effects (Williams 2002), mostly due to the limitations of its implicit theories (Koskela and Howell 2002). The importance of understanding complexity (from a management point of view) is related to the need to adjust the managerial processes in such a way as to help in reducing the problems that can be generated from their attributes (Bosch-ekveldt et al. 2011). Looking specifically at the construction industry, Telem, Laufer, and Shapira (2006) argue that the industry, in general, is increasingly complex, both in technical and organizational aspects.

Researchers have widely argued that complex environments require appropriate actions, methods, techniques, and tools to be successfully managed (Baccarini 1996). In this context, Lean Construction (LC) and Agile Project Management (APM) concepts and methods have been gradually accepted and implemented in the construction industry, having the advantage of considering to a certain extent the concept of complexity and its effects (Chen et al. 2007).

Focusing specifically on planning and control systems, both LC and APM managerial approaches have well-established planning and control methods: Last Planner System (LPS) (Ballard and Howell 1998) and Scrum (Schwaber and Beedle 2002). It has been argued that those two methods overcome to a certain extent the theoretical limitations of the traditional project management approaches, pointed out by Koskela and Howell (2002) and have been used successfully in the management of complex projects (Ballard and Howell 1998; Schwaber and Beedle 2002).

However, the context in which each of these methods has been applied is not the same. The majority of LPS implementations have been in the construction industry, in design and construction stages and for the management of prefabricated building systems (Ballard and Howell 1994; Ballard and Howell 1998; Ballard 2000; Castillo et al. 2018). By contrast, Scrum has been mostly used in the software industry (Rising and Janoff 2000; Schwaber and Beedle 2002; Conboy 2009; Dingsøyr et al. 2012; Perkusich et al. 2017).

These two methods have focused on the planning and control of projects, sometimes complex, but managed individually. In the LC context, it is worth mentioning that most research and implementations have been carried out within the conceptual limit of a single project (Sacks 2004). Only recently some studies have paid attention to portfolio management, however, focused on the management of subcontractors to improve production flows in the industry (Sacks 2016). Also related to LC, there is an isolated attempt reported in the literature on planning and control in multi-project environments, in which LPS was adapted for the planning and control of the design process of prefabricated engineer-to-order systems (ETO) (Wesz et al. 2018). Regarding APM, Stettina and Hörz (2014) have suggested that the success of applying Scrum to the projects (managed in an isolated manner) indicates that it should be extended to the practice of portfolio management.

It is important to emphasize that there are some attempts to combine LC and APM (Naim et al. 1999; Cristopher and Towill 2000; Court et al. 2006; Owen et al. 2006). However, it can be argued that these efforts have in most cases focused on theoretical discussions or initiatives on supply chain management (Naim et al. 1999; Cristopher and Towill 2000; Owen et al. 2006; Owen and Koskela 2006; Court et al. 2006; Virmani et al. 2017), rather than on combining LC and APM for proposing a planning and control approach. Furthermore, most studies that have attempted to combine elements of LC and APM are concerned with design or construction management, rather than at the project management level.

The aim of this research study is to propose a planning and control model for managing construction projects in a multi-project environment that combines theoretical elements from LC and APM. This research is relevant due to the need to make the portfolio management in this environment more reliable, by improving the effectiveness of project planning and control. The model has been devised as a combination of elements from LPS and from Scrum. This paper presents some initial results of this investigation.

RESEARCH METHOD

Design Science Research (DSR) is the methodological approach adopted in this investigation. This type of research typically involves the proposition of an artefact that aims to solve classes of practical problems, while at the same time it produces scientific knowledge (Holmström et al. 2009). The main artefact that is being devised is a planning and control model for managing construction projects in a multi-project environment.

This research process has been carried out in close collaboration and engagement of the professionals from the fashion retail company's DAE. Thus, the research process is adopting a research strategy similar to Action Research. As suggested by Järvinen (2007), this type of action research fits well the DSR approach.

The organization in question is one of the largest retailers in Brazil, with more than 20.000 employees. DAE - specific department under study, has 58 construction projects being developed in 2019, including the development of new stores and the renovation of existing ones. In addition, the department has several other special projects: development and implementation of new technologies or information systems, changes in process and in the organizational structure, among others. This study is focused on construction projects, and specifically on the development of new stores.

Figure 1 presents an outline of the research design. From the definition of the scope and the context of the research, two major stages were defined.

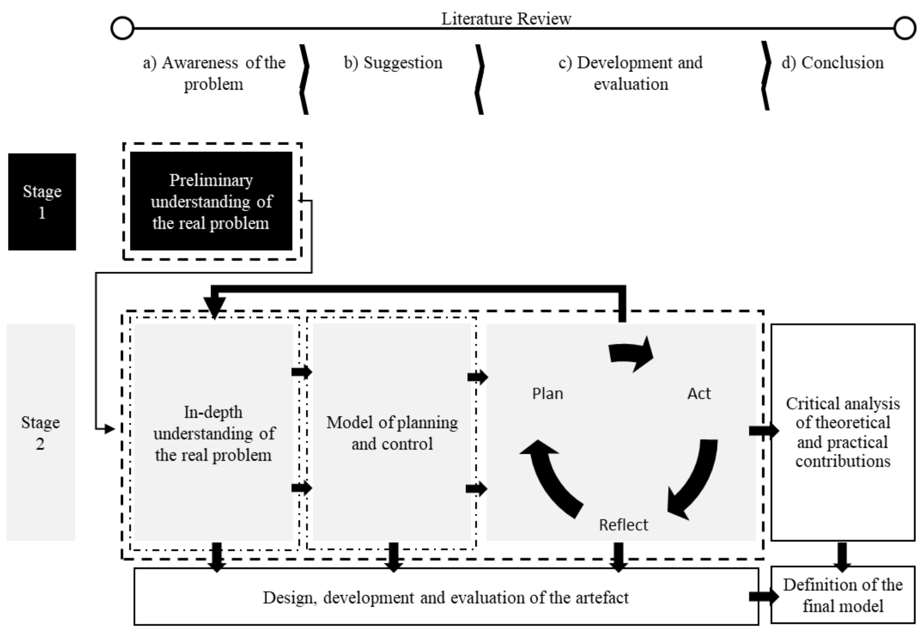

Figure 1: Outline of the research design

The purpose of the first stage was to have an initial understanding of the real problem in a preliminary, looking at the project delivery process as a whole. This stage was carried out between September 2017 and January 2018. The second stage consists of designing, developing and evaluating the artefact to be devised in this research study. The development of the artefact is based on the literature review and on the understanding of the real problem (stage 1). This stage began in January 2018 and it is expected to be finished by May 2019 (the initial idea was to complete this step in March 2019, however, the implementation process faced some difficulties which delayed its completion).

Figure 1 indicates that the model is being devised after several learning cycles. Throughout the development of this research study, the artefact is being assessed against criteria, as suggested by March and Smith (1995). The evaluation of the model is being carried out based on a set of criteria jointly established by the authors and the company's participants, based on two constructs: utility and applicability (at this moment, the data obtained with all the implementation process are being analysed and the final evaluation of the artefact is being carried out).

Different sources of evidence have been used in this research work: semi-structured interviews, open interviews, participant observation, primary data collection, document analysis, among others. The purpose of the multiple sources of evidence is to create a corroborative style of research (triangulation), as suggested by Yin (2003).

As mentioned before, the starting point of this investigation was a practical problem identified by a fashion retailer company from Brazil. As it is typical of DSR, the artefact has been designed, developed, and evaluated (through learning cycles) in collaboration with professionals of this organization. As this whole process requires considerable time and dedication from the researcher, a single empirical study has been carried out in this research. Therefore, the artefact has been highly influenced by the context of the company involved in this investigation, which represents a limitation of this study. Further work is necessary to refine the artefact and test its applicability to other contexts.

RESULTS

GENERAL DESCRIPTION OF DAE

The organization's product development process (PDP) for the development of new stores can be divided into the following stages: (a) Pre-project; (b) Design; (c) Construction; and, (d) Post-completion. This process was formalized in a process protocol (Cevallos 2018), which was an adaptation of principles used by Kagioglou et al. (2000) to develop construction project process protocols. This protocol was developed as a guide that provides an overview of everything that is necessary to know for the development of new stores of the organization. It includes the tasks carried out by DAE in the management of the design and construction stages, and also by other departments of the organization.

DAE consists of five teams: Planning and Control, Architecture, Visual Merchandising, Engineering, and Maintenance. The main focus of this study is on the Architecture and Engineering teams, which are mainly responsible for the design and construction stages, respectively. The Architecture and Engineering teams have four professionals each and are led by their managers. On average, each DAE architect/engineer manages simultaneously four construction projects (not counting special projects).

Regarding the short lead-times, the development of new stores in shopping centres, for example, the design stage lasts 75 days on average, while the construction stage lasts 100 days on average. In some projects, there is a need to overlap some activities, which, together with the number of projects being developed simultaneously and other factors, such as uncertainty in downstream processes, increases the complexity of the management processes.

The managerial processes carried out by DAE has been strongly based on a long-term plan, which has a fine level of detail. There has been no other formal levels of planning. It is assumed, therefore, that the plan generated at the beginning can be executed. In addition, weekly meetings are held in which architects/engineers report the status of their projects based on the long-term plan, but little is done to increase compliance with deadlines. It is possible to identify the use of a predominantly reactive style, which seeks to solve problems after they have happened. These problems are strongly related to the fact that a traditional project management approach has been adopted.

OVERVIEW OF THE PROPOSED MODEL

Figure 2 presents an overview of the planning and control model that has been developed. It has the purpose of managing multiple projects at a project management level, focusing on the conduct of design and construction stages (after the definition of the portfolio). The model is divided into three hierarchical levels - long-term planning, stage planning (defined by hard gates) and short-term planning, and, in two different perspectives – single project view and multi-project view. The model is based on a process protocol previously developed in the organization and on some key elements of LPS and Scrum.

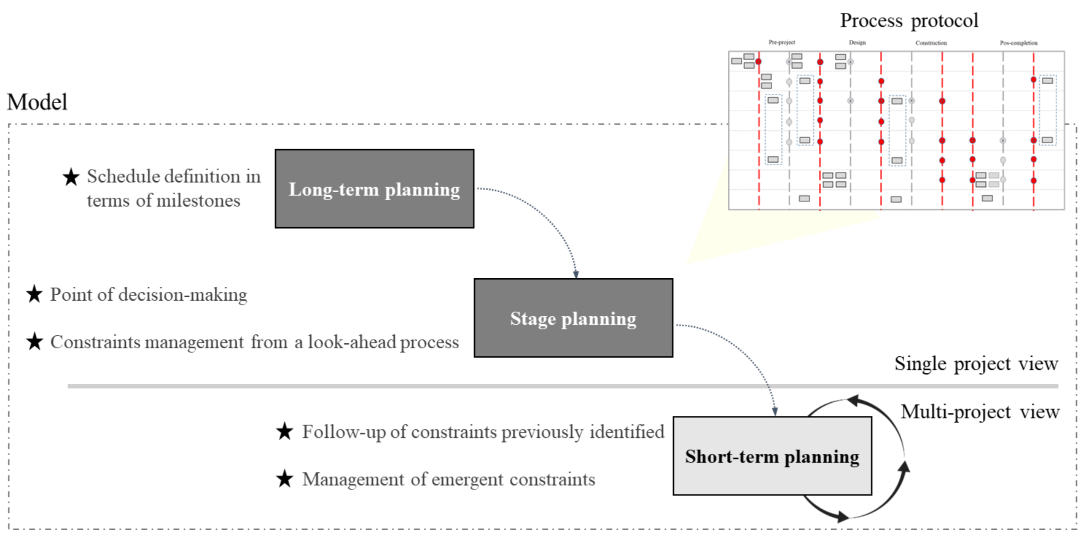

Figure 2: Overview of the planning and control model being developed

Level 1 is related to long-term planning (master plan) and is carried out "by project". This plan is developed by the architect and engineer in charge of the project, in which milestones used as a reference for control are established. This plan is based on the store opening date from the portfolio definition (which is related to the organization's strategic objectives).

Level 2 refers to the stage planning that occurs throughout the development of the project and is also performed "by project". These meetings are connected to the hard gates of the existing process protocol. Different stakeholders participate in these meetings, including the architect (design managers) and engineers (construction project managers), representatives from other sectors of the organization and sometimes suppliers. These meetings are divided into two main stages: (a) point of decision-making - based on a verification of documents and information available and analysis of long-term plans; and, (b) constraints management considering a look-ahead horizon. At these meetings, the look-ahead process is at least one stage ahead of the next meeting (next hard gate). The purpose of this is to ensure that two subsequent planning horizons overlap. The average time between one meeting and another at this level of planning is 30 days.

Level 3, in turn, is related to short-term planning (commitment planning) and is carried out weekly, considering a multi-project environment, ie, several projects are discussed in the same meeting. In these meeting, all architects (in the design management meeting) and all engineers (in the construction project management meeting) and their respective managers participate. It is worth mentioning that the main role of these meetings is coordination, and are carried out separately for the design management and for the construction project management teams. These meetings are also divided into two main stages: (a) follow-up of the constraints identified during stage planning meetings; and (b) management of emerging constraints.

RESULTS FROM THE IMPLEMENTATION PROCESS

A partial implementation of the model has been carried out. Most advances were made at the short-term planning level, and these are highlighted in the paper. Some improvements implemented at the other levels of planning are only briefly presented in this paper. As mentioned before, this investigation has not been fully concluded, as the evaluation of the artefact is being carried out.

Regarding the development of the long term plan, a major change was use the project process protocol as a reference for the definition of activities and deliverables. Moreover, some visual devices have been used to increase process transparency: an integrated panel for visualizing the long-term planning of all projects was produced.

The demands of the management system that the company had been using before the beginning of this study (strongly based on the PMBOK) was very time consuming for design and construction project managers. For that reason, a set of procedures was developed for stage planning with the purpose of giving agility and focus in planning meetings. One of the points addressed by these procedures was the management of constraints: some of the constraints were pre-established (as they typically repeat for the same type of project - example: new store development), and some of them were considered to be emerging events (which had to be identified during the meeting).

Short-term planning level

The short-term planning meetings usually starts by doing an overall analysis of on-going projects (usually 16 per team), by projecting some data on a screen. One-by-one, each project is analysed, under the coordination of the team leader. For each project, some questions are asked to the architect or engineer in charge. The same questions asked in the daily Scrum meeting, but adapted to a weekly time horizon: what was done last week? What will be done this week? Is there any kind of constraint that blocks what should be done?) (Schwaber and Beedle 2002). Based on that a brief understanding of the status of each project is obtained. It is expected that with the answers (explanation) of the architect or engineer it is possible to capture some emergent constraints of the project. This process of capturing emerging constraints is supported by the diversity of perspectives from all meeting participants. Based on emerging constraints or remaining constraints from stage planning meetings, assignments are negotiated between the parts (team leader and architect or engineer in charge). The negotiated assignments, which are typically related to constraint removal, are then included in the short-term plan. This plan is in a "cloud" file that can be easily accessed by everyone. At the end of the short-term planning cycle, a general evaluation of the effectiveness of this level of planning is performed, using an indicator similar to Percent Plan Complete (PPC) proposed by Ballard and Howell (1998). This indicator is calculated by the ratio between the number of assignments concluded and the number of assignments scheduled, with the particularity that, in this case, assignments have the function of removing constraints. It was chosen the name PPC, because the frequency of analysis is weekly, as it typically is in conventional LPS implementations.

During the implementation process, some difficulties emerged, most of them related to the nature of the activities carried out by project managers in this specific context. The activities of DAE architects and engineers are of a different nature from what we usually find in the literature related to design processes (Reinertsen 2009) and to construction processes (Koskela 2000). In fact, the nature of the activities found is in line with the characteristics presented by Mintzberg (1973) to describe the operations performed by CEOs, but which are often cited as common characteristics to operations performed by managers in general. These characteristics are brevity, variety, and fragmentation (Mintzberg 1973).

This was observed during the participation of research team members in the existing managerial routines and confirmed during the implementation of the model at the short-term planning level. Most of the assignments negotiated during the meetings, which actually aim to remove previously identified or emerging constraints, typically start with expressions such as: "*check, call, confirm, communicate, align, request,* etc." In fact, the plan at this level comprises a large number of small activities, but which does not take up a whole week, as usually happens in the weekly work planning of planning and control systems focused on design or construction processes. This large number of activities can also be explained by the fact that this level of planning is being implemented in a multi-project environment.

Figure 3 presents the PPC obtained at the short-term planning meetings during two months of implementation in the Architecture and Engineering teams. The PPC variability showed below can be derived from different sources. On one hand, because short-term planning consists of a large number of small activities but does not take up a whole week, as explained earlier, in some cases, the goal of 100% is reached, something unusual when implementing LPS to the design or construction processes (Moura and Formoso 2010). On the other hand, due to the lack of available time/commitment of architects/engineers due to the demands of the management system that the company had been adopting until the beginning of this study (which has a high level of complexity due to the fact that it is strongly based on PMI), sometimes, planning effectiveness is low. As an example of the complexity of the existing management system, there are more than 210 documents that need to be managed in the development of new stores.

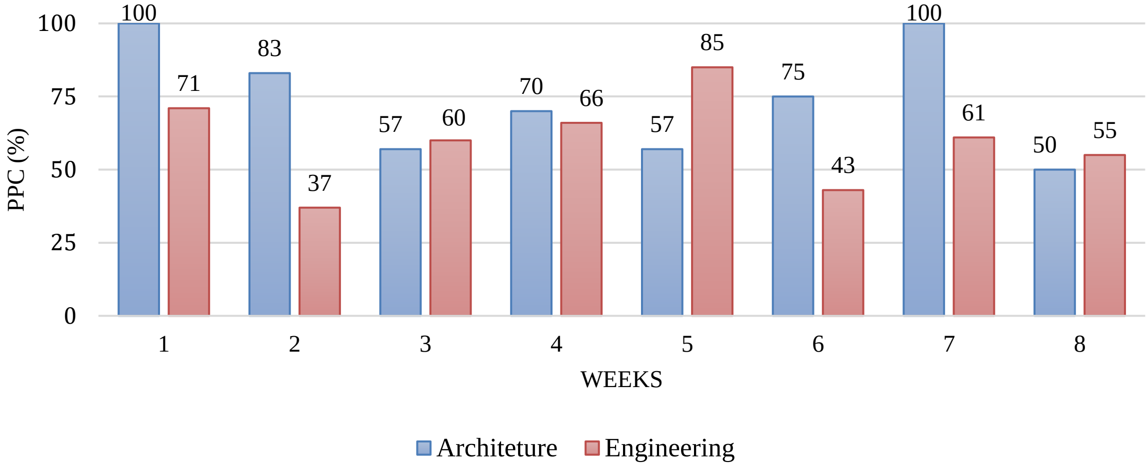

Figure 3: PPC obtained at the short-term planning during two months of implementation

This PPC variability is in line with the general difficulty of using metrics in this context, which has been discussed in the project management literature. Mintzberg (1973) has identified, for example, that managers work verbally with fresh information, rather than analytically with systematic information. In fact, Sproull (1984) found that managers spend 80% of their time talking with people. This is in line with Jönsson's (1998) statement that "*managers work with words*". Despite the importance of communication, the research team believes that the benefits from this practice could be increased through the systematic support and use of a performance measurement system, as suggested by Neely, Gregory, and Platts (1995).

As "*managers work with words*", they usually have great communication skills, which also happens in this case. DAE professionals consider themselves as highly qualified. As the professionals have PMI training, there has been a strong resistance to change. This issue seems to affect in parts, the process of negotiating the assignments, for example. Architects and engineers are not always enthusiastic about this process, sometimes facing it as a kind of change imposed by the team leaders. In this case, team leaders have to deal with some of the challenges present in this type of human resources, as argued by Kotter (1982), to criticize (suggest assignments/discuss) and at the same time motivate their subordinates.

Along the implementation process of the short-term planning level, some improvements have been observed, such as the separation of one part of the weekly meeting (which was initially less orderly) to do planning and control. Further improvements are expected, such as: improve the preparation of the architects/engineers for the meeting, improve the assignment negotiation process and also the commitment of the professionals to the weekly goals, among others.

CONCLUSIONS

This paper discusses the initial results of a research project under development which aims to propose a planning and control model for managing construction projects in a multi-project environment, having as a theoretical foundation LC and APM. This investigation has been developed in partnership with a fashion retailer company from Brazil, more specifically, with the sector in charge of managing of construction projects. At the beginning of this investigation, the existing managerial system was strongly based on the traditional project management approach.

The proposed model has been partially implemented and tested in this. These are the main findings so far: (a) the nature of the project management activities demand a different planning and control approach, compared to what is normally found in relation to planning and control design or construction; and, (b) there are challenges on the systematic use of performance measures to support learning and decision-making.

One of the limitations of this study is the fact that the proposed planning and control model has been developed to the project management level. The connections to the managerial processes carried out in the design and construction stages have not been fully explored. Therefore, further work will extend the proposed planning and control model to suppliers, i.e. designers, construction management companies and general contractors.

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