UTILIZATION OF EXTRA PLANNING ACTIVITIES BY CONSTRUCTION COMPANIES IN SERGIPE, BRAZIL

Débora de G. Santos[1], Joana Grosskopf[2], Andreza Menezes Souza[3], Antônio T. dos Santos Neto[4] and Luiz Fernando M. Heineck[5]

ABSTRACT

The peculiar characteristics of civil construction associated with obstacles to the production process result in constraints that cause downtime for workers, often filled by non value-adding activities. This research work is directed to construction companies that are already using extra planning activities, informally, to remove these constraints.

We wanted to identify the tacit knowledge level of construction managers working in Sergipe, Brazil, relative to extra planning activities. We applied a structured checklist for the following knowledge areas: Learning, Work Safety, Constructability, Lean Construction, Reengineering, Theory of Constraints, Quality and Productivity, and Planning and Production Control.

Major findings of this research are related to those knowledge areas most applied by the respondents: Work Safety (92.31%), Reengineering (83.59%) and Lean Construction (77.62%). We could identify that the least widespread knowledge area was Theory of Constraints (67.31%). The authors are of the opinion that the informal implementation of these activities demonstrates the lack of dissemination of knowledge among managers. With this in mind, in future research, we will focus on facilitating the implementation of activities in these areas, and particularly in the area of Theory of Constraints, seeking to formalize it.

KEYWORDS

Lean Construction, continuous improvement, extra planning activities, constraints analysis, process, production, value.

INTRODUCTION

In the construction industry, the occurrence of unforeseen events from lack of adequate planning is more the norm than the exception. This sector has disadvantages when compared with traditional industry because it has many variables generally absent in industrialization, for example, technical specifications and flawed designs

1 Dr., Professor, Civil Engineering Department, Federal University of Sergipe (UFS), São Cristóvão, SE, Brazil, Phone +55 79 2105 6700, FAX +55 79 2105 6684; deboragois@ufs.br

2 Civil Engineering, Master's Student, Post-Graduation in Civil Engineering Program, Federal University of Sergipe, SE, Brazil. Phone +55 79 2105 6700; joanagross@hotmail.com

3 Civil Engineering, Master's Student, Post-Graduation in Civil Engineering Program, Federal University of Sergipe, SE, Brazil. Phone +55 79 2105 6700; andreza_sma@yahoo.com.br

4 Undergraduate Student, Civil Engineering Department, Federal University of Sergipe, SE, Brazil. Phone +55 79 2105 6700; eu_teles@hotmail.com

5 PhD., Professor, Production Engineering Department, Federal University of Ceará (UFC), Fortaleza, CE, Brazil, Phone +55 85 3267 0096; heineck@pesquisador.cnpq.br

and budgets that do not consider process improvements. With this in mind, Howell and Ballard (1996) suggest that managers must anticipate what will be implemented to ensure the availability of resources over time for the planned tasks, avoiding non value-adding activities.

These activities are divided into supportive and unproductive activities. In the first case, we cite the preparation for implementation of a service, which is necessary, but does not add value to the product. On the other hand, the unproductive activities are interruptions due to weather conditions, unnecessary handling, demolition and reconstruction of defective work, and search for tools and materials that could have been pre-planned (Kalsaas 2010). Although obvious, like the loss from overproduction, these actions result in losses and occur commonly in construction, irrespective to the differences of country, region and company, and are common examples of *Making-do*. These losses are probably very low cost, but their occurrence is significant because it destabilizes the flow of work.

It is known that tacit knowledge is often only in people's minds and that this experience is not passed on to others. This means that managers and workers, despite learning *Best Practices* on their construction sites, do not disseminate this knowledge to others. Liker and Meier (2008) highlight the importance of the key points for the execution of work that contribute to proper training and productivity gains, with continuity of work.

Ask yourself how you can investigate the construction process to contribute to the continuity of work flow. Treville and Antonakis (2006) contend that you can use actions to facilitate the work (*work facilitation*). For this, it is assumed that the main type of loss is related to the category *Making-do*, and a way to eliminate this loss is to make use of extra planning activities (Santos 2004), which resemble *work facilitation*.

The authors believe that extra planning activities (EPA) are activities that remove constraints and actions that facilitate work. These activities are the result of practical observations on the construction site in the short term. It is hoped that by calling attention to these activities is to eliminate or reduce the loss in production from the *Making-do* type.

Extra planning activities must be used for those situations that are beyond the control of programmers, which are caused by uncertainties in the short term and necessitate extra tasks. However, as we repeat, extra planning activities can be assembled into a packet of information to prevent future errors.

Koskela (2000) states that the cause of discontinuities in the construction process is related to the flow of information. Therefore, this research seeks to identify how managers understand the methodologies and philosophies that apply tools to enable tacit knowledge of content and its proper management, applying extra planning activities, since the problems of discontinuities on construction sites occur even when we apply formal planning. Bearing this in mind, we can study how to act in a systemic way to disseminate this knowledge and identify which methodologies or philosophies have been compromised.

PLANNING, SCHEDULING AND CONSTRUCTIVE PROCESS

To investigate how the managers' tacit knowledge can be explained, is necessary to known how planning, scheduling and constructive process interact with the

construction management. Santos et al. (2008) argue that the most interfering factors are "disorganization at the construction site and failures in internal communication." It appears that the barriers that impede communication, unfortunately, are part of everyday life at construction sites. These failures undermine relationships in the field that involve the participation of managers and account for much of the practical knowledge that is not disseminated. However, recognizing the *Making-do* brings a theoretical contribution to identifying these failures (Koskela 2004).

Mintzberg (2004) states that "planning should be seen as a process that provides a particular benefit in specific contexts." He contrasts planners and managers, as the latter have the authority and flexibility to develop strategies in a process. Regarding the former, Winch and Kelsey (2005) interviewed 18 experienced planners and found that the planner works on the proposal in the pre-construction phase and on-site, but not simultaneously, as is often observed in practice, which leads to generation of uncertainties and to deficient information in each one of the stages. In addition, they do not always consider the limited resources (Kastor and Sirakoulis 2009), due to interferences in communication with the managers, or even due to unexpected changes in programming.

Thus, there is a fine line between formal and informal planning. The latter predominates at construction sites. According to Mintzberg (2004), formalization means to "decompound, articulate and, especially, streamline the processes by which decisions are made and integrated into organizations." When we add this meaning to the statement that "studies of past behavior can influence future events", it is important that the registry of *Best Practices* prevent the occurrence of random actions that often result in work interruptions and in the practice of *Making-do*.

Dimma (1985, p. 22) cited Mintzberg (2004) as saying "I only know four ways to deal with the future: 1. Ignore it. 2. Predict it. 3. Control it. 4 Respond to it." The first and last are not planning and, according to Minntzberg (2004), everyone should be concerned with the second form, but in fact, even today, what is observed is that people are practicing only the third. This is directly reflected in the activities produced at the construction site and how the site deals with these activities.

Regarding the constructive process, Rivas et al. (2011) pointed out that the waiting resulting from a lack of material or equipment and the poor interpretation of the design are responsible for 59% of total downtime. These are instances that depend on managerial attitudes to avoid problems with low productivity (short term) that are the result of bad planning. On the other hand, medium-term planning involves a knowledge that comes from outside, being an offshoot of strategic planning. One may wonder how to explain this knowledge of construction that people cannot grasp, because it is a more thorough knowledge and because it is directly related to the technique and the interaction between activities.

Taylor (1913) cited Mintzberg (2004, p. 186) who stated that "the work processes that are not fully understood cannot be scheduled effectively." Studies started with *Lean Construction* (Koskela 1992), *Last Planner System*™ (Ballard 2000) and *Shielding Production* (Ballard and Howell 1998) show that their application has led to increases in production, assisting those managers in control (Ballard and Howell 2003).

AlSehaimi et al. (2009) claim that, in *Lean Construction*, planning and control are considered complementary, dynamic processes maintained during the project, being

the two sides of the same coin. However, even today, we live with the failure to control, to see problems with distribution of materials, equipment maintenance, design, lack of tools etc.

MAKING-DO

According to Santos et al. (2002), the "theory of management is constantly evolving with the continuous flow of new ideas that come in an attempt to turn theory into practice, and vice versa."

It is essential to control work flow in order to avoid wasting time, poor quality or poor use of resources. Koskela (2004) adds a further category of loss to the traditional list, *Making-do*, relating to the loss that occurs when a task is started without all the items of the work package available or to an action taken even if missing an input. This calls attention to the problems of everyday life on the construction site, such as the interruption of work because of inappropriate conditions, which is responsible for major losses in construction.

It is known that the pressure for quick answers comes from the thought that if a task is started before the deadline, even if all the necessary materials are not available, it also will end before the stipulated deadline, falling into the informal planning on the site.

Some authors study the content of work (Ballard and Howell 1998, Koskela 2000, Treville and Antonakis 2006, Liker and Meier 2008, Gonzales et al. 2009, Kalsaas 2010), while others investigate measures of performance (Thomas et al. 2002, Thomas et al. 2004, Souza and Araújo 2005). Often the thoughts are conflicting, but nevertheless, it appears that they all have concern about what causes the variability in construction due to flow issues or to work content, and, thus, leads to poor performance. On the site, these variabilities arise from unexpected changes in design, resource availability, equipment or scheduling.

To prevent *Making-do*, the extra planning activities help managers to anticipate and plan the resources needed to perform the necessary tasks. They are classified into categories: Access, Design, Work Preparation, Work Conference, Space Conflict, Sequencing, Workers Protection, Processes Protection and Work Scheduling (Santos 2004). It is important to spread this knowledge at the tacit level to identify the losses inherent in the process and those that can be reduced or eliminated (Coelho 2009).

METODOLOGY

This article attempts to identify the tacit knowledge of construction managers by applying a structured checklist that utilizes some management methodologies and philosophies, such as: *Learning, Work Safety, Constructability, Lean Construction, Reengineering, Theory of Constraints, Quality and Productivity, and Planning and Production Control*, among various others that contribute to that knowledge pertaining to production management.

We adopted the strategy of a qualitative and descriptive research. The field work included a sample of approximately 20% from 74 construction companies in Sergipe, Brazil, registered with the Builders Association of the State of Sergipe (SINDUSCON-SE) and/or the Sergipe Association of Entrepreneurs of Public and Private Works (ASEOPP), selected from those companies willing to participate.

After a literature review, we drew up a checklist in the form of a structured interview with the purpose of verifying the tacit knowledge level of construction managers, and in turn, to identify if they applied extra planning activities at their construction sites , even if without proper formalization.

Altogether, 14 construction managers were interviewed. After data collection, we organized the data into a spreadsheet for analysis and discussion of results. Data were analyzed by areas of managerial knowledge and also within each knowledge area. Furthermore, we observed the differentiated behavior of the respondents.

RESULTS AND DISCUSSION

Because of space limitations in this article, not all graphics are presented, being restricted to those shown in Figures 1-3. In Figure 1, we found that the highest percentage of application was for Work Safety (92.31%), followed by Reengineering (83.59%) and Lean Construction (77.62%). The other items maintained similar results around 75.00%. The exception was Theory of Constraints, which showed a lower rate, corresponding to 67.31%. In this case, we observed that 30.00% of the respondents had positive responses for 50.00 to 70.00% of the questions. Thus, even in this area, where the result was not so satisfactory, managers demonstrated the application of extra planning activities. As for the formalization of these activities in the construction processes, Santos et al. (2011), conducting case studies on the construction site of some of the respondents, noted that these activities were used day-to-day, although informally.

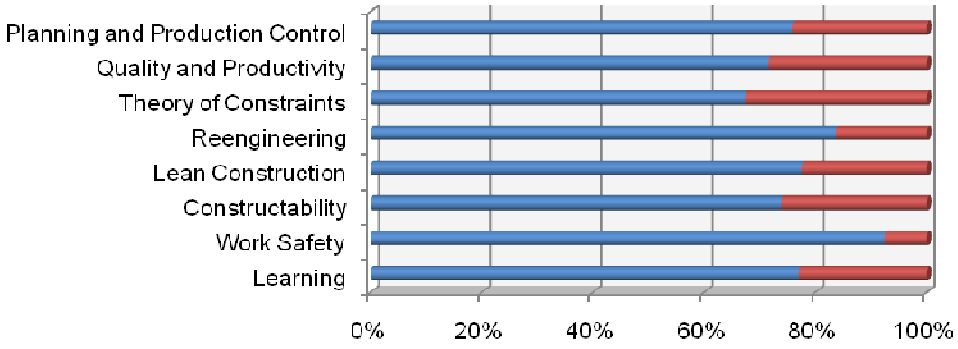

Figure 1: Percentage of positive responses for the areas of knowledge.

Figures 2 and 3 show the issues raised in the areas of knowledge, Work Safety and Lean Construction, respectively. The positive responses (YES) are colored blue and the negative (NO) are in red. In the area of Work Safety (Fig. 2) (Category EPA Workers Protection), the items that stand out are "Verification of unsafe working conditions" and "Constructive requirements for the safety of workers", as indicated by all respondents. However, the item "Constructive requirements for end-customers" was marked by only 69.23% of respondents. It was found that due to requirements of the Brazilian agencies responsible for workplace safety, this area of knowledge is internalized by the respondents.

In the area of Reengineering, only the questions "Verification of the reference level" and "Surface preparation for storage of materials" were marked by all respondents. The remaining questions were marked by about 80.00% of the

respondents, characterizing care with Work Preparation, Design, Access and Work Conference.

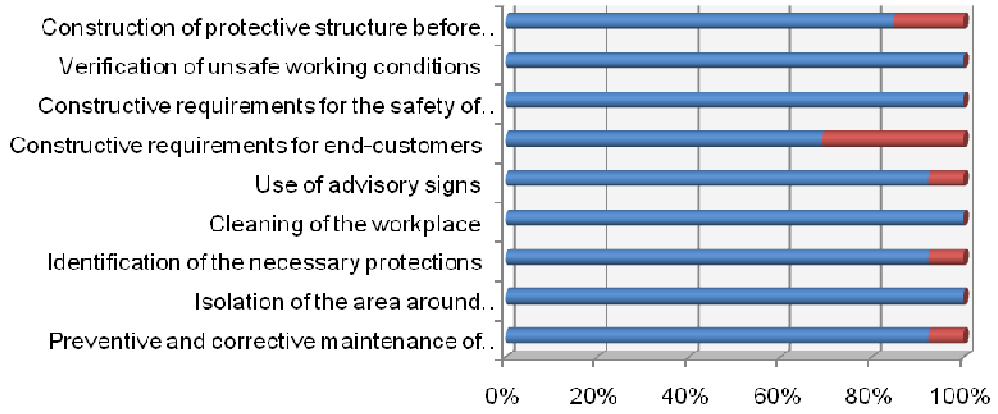

Figure 2: Percentage of positive responses for the area of Work Safety.

In the area of Lean Construction (Fig. 3), which is related to all EPA categories, only the question "Antecipated ordering of construction material" was marked by all respondents. The questions "Identification of flaws, defects or constraints in the process", “Survey of anticipated needs for services", "Control in the flow of material and information", and "Visual inspection" were marked by 90.00% of the respondents. The remaining questions, about 60.00% of positive responses, were more focused on the day-to-day construction site.

The area of Theory of Constraints had the lowest percentage of positive responses from the survey (67.31%). We found that the questions "Prevention of delays in receiving materials" and "Unexpected soil conditions," constraints common at construction sites, were marked by approximately 45.00% of the respondents only. This situation showed the correlation of this area with the categories of EPA Processes Protection and Work Preparation. It was also observed that work continuity was not a priority in these cases.

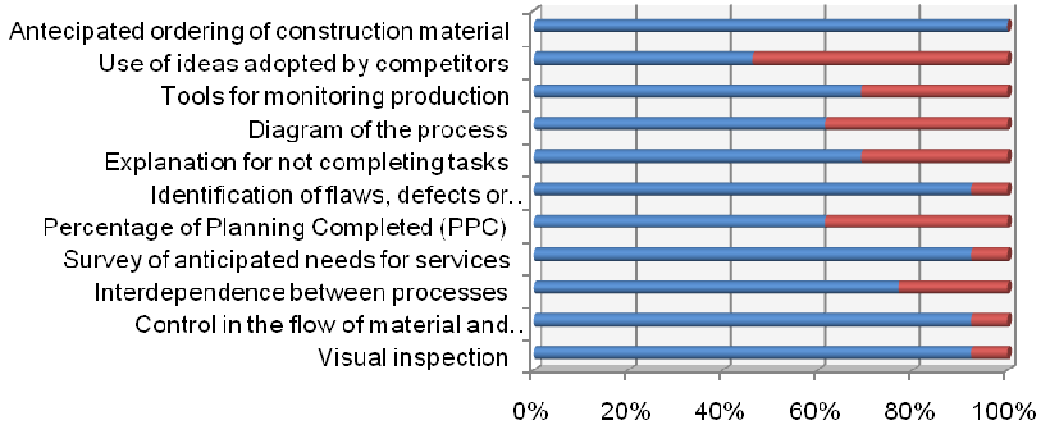

Figure 3: Percentage of positive responses for the area of Lean Construction.

The area of Learning, related to the EPA categories Work Conference and Worker Protection, showed positive responses to less than 65.00% for the questions “Periodic labor training" and "Construction of decorated apartment". This situation contrasts with the importance given to the area of Work Safety by the respondents. This showed a lack of care for what happens day-to-day on the construction site. In the area of Constructability, we observed possibilities for application of the EPA categories of Design, Access, Sequencing, Space Conflict and Processes Protection. As for the questions, all respondents answered positively only to the item "Design accessible at the job site." Ninety percent of the respondents indicated the items "Limitation of space for handling equipment", "Construction Designs" and "Adequate conditions for installations on-site." However, the question "Changes in constructive sequencing" was marked by only 23.08% of the respondents, although, in practice, a common situation at Brazilian construction sites.

For the area of Quality and Productivity, we verified the applicability of the EPA categories Work Preparation, Design and Work Conference. In this area, only the question "Materials used with proven quality and use according to manufacturer recommendations" was marked by all respondents. The remaining questions had about 75.00% positive responses, with the exception of the question "5S Program" that had only 23.08% positive responses. Attention is drawn to the problem already identified in the area of Learning, in which issues related to EPA Workers Protection were marked as positive in the area of Work Safety, but were, in fact, neglected in this area, and are common day-to-day on construction sites.

In the area of Planning and Production Control, we saw a relationship in this area with the EPA categories Processes Protection, Sequencing and Work Preparation. The most prominent item was "Production Control" with 92.31% positive responses, and the least prominent was "Kanban" with 53.85%.

In a comparison of the respondents, there was only one marked "yes" to all questions, which runs as a standard behavior. The remaining respondents marked positively more items in the area of Work Safety and less in the area of Theory of Constraints, followed by Constructability, as noted in the description of the results by area. Although Work Safety was checked by most respondents, for 35.70% of these, Learning was the highest scoring area.

Furthermore, the area of Work Safety surprised expectations with the best rates, as this situation does not portray the Brazilian reality, as can be seen in contrast to Learning and Quality and Productivity. According to Brazil (2010), construction ranks second among the industries with the highest number of work accidents, behind the industry of food and beverage products. Although this is the national reality, Sergipe State construction ranks third for accidents recorded in 2008.

We found that all the methodologies and philosophies discussed in this article are relevant to suitable production management, in particular on construction sites. However, to ensure work continuity on-site, we could separate the areas into those more related to managerial issues and those aimed at operational issues, the first acting from the tacit knowledge of the construction manager through extra planning activities or *work facilitation*, and the latter from the workers, highlighting key points. In the latter case, it is known that this is possible when there is adequate training of workers, with very detailed construction procedures and effective communication.

For tacit knowledge, it is necessary to develop actions in the areas of Lean Construction, Planning and Production Control, Reengineering, and Theory of Constraints. In the case of Constructability, its knowledge is needed from the initiation of the design phase to the maintenance and operation phase by the end-user. On the other hand, the knowledge areas of Learning, Work Safety, and Quality and Productivity are more effective on the job day-to-day.

It is known that among the various areas of knowledge that contribute to the methodologies and philosophies for production management, variability is an item to be thoroughly researched for its causing of impediments to the continuous improvement of the sector. One consequence of this variability in production is the interruption of work.

This article does not intend to exhaustively cover the knowledge of production management that has examples of improvements in civil construction, and it also does not intend to offset the problems of each one of these areas of knowledge. Moreover, the term *extra planning activities* is used in this article as a way to define the actions of *Best Practices* that ensure continuity of work and that result in the removal of constraints, or otherwise, that are believed to be due to informal planning, or even failures in formal planning, or to gross errors that exist on the job. These are not constraints in the medium term, although they incorporate a kind of knowledge that is a little more elaborate because of the complexity of the reality of construction sites.

CONCLUSIONS

This paper is a contribution of practical actions for builders who are always in search of waste reduction, increased productivity and, consequently, increased profit margins. The formalization of extra planning activities becomes essential in the current market scenario, requiring the exchange of information between those responsible for the tacit knowledge and the workers, for the continuity of work on the construction site.

The lack of formalization and application of tacit knowledge is evident when one notes that the areas that scored highest were Work Safety, Reengineering and Lean Construction, and the area that scored lowest was Theory of Constraints. In the first area, this lack of synchronization was evident when identifying contradictory responses between this area and Learning and with Quality and Productivity.

By comparing methodologies and philosophies with categories of extra planning activities, we observed that the respondents gave more emphasis to managerial aspects, but without reinforcing those related to the daily construction site, where the constraints related to the lack of work continuity actually happen.

This text presents ideas about the possibility of avoiding or eliminating the *Making-do* in work by identifying and implementing extra planning activities. We studied examples practiced at construction sites in order to discuss whether scheduling can really foresee all situations that cause constraints during work or that portray the peculiarities of the sector compared with manufacturing. We found that situations do arise that cannot be predicted. If you can standardize this type of situation, what can be done to formalize and include in the scheduling to take more efficient control of tasks, even those related to *Making-do*?

ACKNOWLEDGEMENTS

We thank the companies that participated in the research, the people who evaluated the work, and the funding agencies: UFS, UFC, CNPq and CAPES.

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