

LEAN OFFICE AT A CONSTRUCTION COMPANY

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ABSTRACT

This paper presents the initial efforts of a construction company to implement the Lean philosophy at their main office. The company has reaped many benefits from the Lean philosophy at its construction sites but it realized that the office was left behind in the process and needed to catch up to sustain the gains reached by site operations. In order to engage the office personnel in a Lean Office initiative, the first step was to disseminate the Lean philosophy in a seminar and brainstorm possible actions to be taken at the office. After that, participants visited one of the company's construction sites to see how the concepts, principles and tools presented at the seminar are used at the site. The process of payment was chosen to be the pilot project for the Lean Office initiative because it was deemed to require urgent action due to its importance to the construction site activities as well as because of the time and effort it demanded from the office personnel. The company expects to reduce the time to process bills and make payments, to reduce the incidence of rework, and to discipline site engineers, construction managers, and suppliers about the new processes to sustain the gains throughout time.

KEY WORDS

Lean office, invoice, payment.

INTRODUCTION

The literature presents numerous examples of the application of the Lean Thinking in construction sites (e.g., Barros Neto et al. 2006, Kemmer et al. 2006, 2008) and the gains obtained with the changes based on Lean concepts, principles, and tools. However, the study of the administrative flows that happen inside a company's office and between the office and its construction sites is often overlooked.

Lareau (2003) suggests that there are three levels of administrative processes in a construction company: micro-, macro-, and mega-processes. According to the same author, the micro-processes are related to daily activities and deals with questions such as "how can we reduce orders lead times?" or "how can we reduce the customer service lead time?" Regarding the macro-processes, Lareau suggests that they are

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related to tactical decisions such as how a company develops its activities related to customer service. Finally, the mega-processes relate to a company's strategic decisions, e.g., what market niche is more appropriate to the company's business. According to Lareau (2003), the administrative processes at the micro-level form the basis for all the other levels. He suggests that competitors may be able to copy products but not the internal capabilities a company has to develop its activities at the micro-level and how it interacts with external agents in its value chain. Thus, understanding and strengthening activities at the micro-level may give companies an edge over their competitors.

Along these lines, Reis and Picchi (2003) and Fontanini and Picchi (2005) developed a study to improve administrative activities and the business flow of construction companies. The aforementioned authors studied the process to approve design plans and specs in different government- and utilities-related agencies as well as in offices that deal with the official registration of states, buildings, and contracts.

In order to complement Reis and Picchi's (2003) research, Fontanini and Picchi (2005) used value stream mapping (VSM) to analyze the approval process in the city of Campinas (São Paulo state, Brazil). They concluded that initiatives related to the standardization of activities, the definition of work cells as in manufacturing, and the organization of activities to promote a continuous flow can reduce the lead time of the approval process for plans and specs in different government agencies. The use of VSM helped the authors to map the approval process and to identify the main bottlenecks where documents accumulated. Fontanini and Picchi (2005) observed that the lack of standardization of the activities and documents provided by both sides (the construction companies and the agencies) resulted in variable lead times for approving documents. The accumulation of documents to be transferred to the next activities in big batches also contributed to the variable and long lead times.

Based on what is suggested by the literature, this paper aims to contribute to the literature on Lean Office in Construction given the importance of the administrative processes carried out in construction companies' offices as a support system to its core activities on site.

THE PURSUIT OF A LEAN OFFICE

In the construction industry the construction site sets the demand for other activities (e.g., administrative, shop work, procurement, and logistics) that support daily site operations. However, often times due to lack of planning at construction sites, support activities are performed in a suboptimal fashion or are buffered to deal with the variability in the timing, sizing, and complexity of construction site orders (see Alves (2005) for examples of buffering practices in fabrication shops owned by mechanical contractors to deal with variable site demands). Some of the wastes generated by mismanagement at construction sites and at the offices remains invisible and/or are treated as a cost of doing business in this industry. Lareau (2003, p.20) stresses that:

“More often, waste is not visible or noticeable as it eats away at profits beneath the surface of everyday work. The requirement for an extra signature here, a delayed response to a phone inquiry there, two people doing the same work on different systems with different numbers, poorly run meetings, and project teams floundering without direction are all waste. Each of these wastes, and many, many more are voraciously devouring profits and alienating customers every day in every business. In all too many cases, the obvious

surface wastes are accepted as “the way it is” or “part of the cost of doing business” or “people will be people”. This is not the attitude that world-class organizations tolerate.”

Along these lines, the pursuit of a Lean Office goes through the recognition of the different types of wastes that happen in administrative processes. The seven wastes identified by Ohno (1988) can also be found in an office environment, even though they take different forms and shapes and relate to paperwork, signatures, approvals, information, and other products of office work. Lareau (2003) presents a comprehensive list of types of waste that may happen in offices grouped into four categories:

- People wastes: they occur due to lack of leadership and the structure of the work environment.
- Process wastes: these are a result of poor process design and execution.
- Information waste: “(...) is a subset of process waste but one so important that it must be called out on its own. It is the loss of value caused by less than optimum information.” (Lareau, 2003, p.32)
- Asset waste: “Asset waste is created by the less than optimal utilization of material and property.” (Lareau, 2003, p.35)

Another important distinction to be made regarding the types of waste and the work developed at the office is that related to failure demand and value demand. According to Seddon (2009, p.2): “Failure demand is demand caused by a failure to do something or do something right for the customer”. Value demand is caused by the system that works to effectively delivery value to the customer at the first time. According to Seddon (2009), failure demand may be generated by the system design and/or management that may generate more work than necessary to those performing the tasks at the office. Seddon highlights that demand should not be considered as “all the work to be done” at the office, as it may be requested to perform work that is related to fixing things (failure demand). Also, setting ambitious targets is not the way to get rid of failure demand; instead the redesign of the system should be carried out based on what the customer values.

Finally, in order to identify these wastes and where they occur in an office it is necessary to map the processes. Tapping and Shuker (2002) suggest the use of value stream maps that depict how the process happens. In addition to that, it is necessary to define metrics capable of indicating the real situation of the process depicted in the mapping phase. *“The key word here is “impact”. If the person or group that is presented with the measurement cannot do something significant to affect it, it is not a metric for the group or person”* (Lareau, 2003, p.130).

CASE DESCRIPTION

The study was carried out in a medium-sized construction company in the city of Fortaleza, Northeastern Brazil. The company has been involved with different programs related to quality management and innovation, and its quality management system is ISO 9000 certified. The company is friendly and open to academic studies and has been good in absorbing innovations and improvements proposed by academics and practitioners. The initiative to implement Lean concepts in the

company's administrative environment at its head office came out after the company reaped many benefits from the use of Lean at its construction sites (e.g., Kemmer et al. 2006, 2008 for details). The top management realized that the company needed to involve all of its collaborators in the change to a leaner environment.

The main limitation of this study is that data was collected for six weeks only and not all indicators necessary to evaluate the process are available, the indicators were collected so that the performance of the process of billing and payment could be evaluated over time. It is worth noting that no pattern can be defined from the data. Also, the process had never been analyzed by the company therefore there are no indicators available before the changes were made. Thus, this paper presents the initial findings of the study.

METHODOLOGY

According to Tapping and Shuker (2002), the process to create a Lean Office goes through eight steps: 1. Commit to Lean; 2. Choose the value stream; 3. Learn about lean; 4. Map the current state; 5. Identify Lean metrics; 6. Map the future state (using the demand, flow, and leveling concepts); 7. Create Kaizen plans; 8. Implement Kaizen plans. The study presented herein follows the steps proposed by Tapping and Shuker, however, the steps were not performed in the same exact sequence.

For instance, the process (value stream) analyzed was selected only after those involved with its activities went through a seminar about Lean Thinking. Also, the authors used a graphic tool to map the current and future states of the process analyzed instead of the traditional form of Value Stream Mapping.

The company is very committed to applying the Lean Thinking at its projects, however its office personnel was not familiar with the Lean concepts. Along these lines, after deciding to start the Lean Office pilot project, the company scheduled a training session with two professors from the Federal University of Ceará. During the training session, the professors presented basic concepts and examples of Lean applications in construction sites and in the industry. At the end of the presentation, the participants discussed how the material presented could be used at the office and were challenged to define a process for the pilot study.

Also during the training session, the company's technical director suggested a visit to one of the company's construction sites so that the participants could see most of the concepts presented being used by site managers. The participants visited the site of the Mar & Mar project where they could see the use of the Last Planner System, tools like *kanban* and *andon*, and several other examples that promoted transparency, e.g., the use of line of balance and indicators. The managers who hosted the visit also highlighted the importance of the stability of site operations for the achievement of good product and process results.

After the visit, the activities related to the Lean Office pilot project started. The payment process was chosen after the technical director, the administrative and finance manager, and the supervisors of the administrative and finance sectors reached a consensus. According to these collaborators, the process was chosen because it consumed a lot of their time due to errors found along the process and to the way the process was managed. Besides, the company owner who was responsible for signing up the checks for payment wanted the process to be improved because he preferred to sign checks only once a week instead of several times a week (client

requirement). While this requirement is counterintuitive according to Lean concepts, the company owner had this wish and the system had to be adapted to match his needs.

Once the process was defined, weekly meetings were set. The participants of the meetings were the administrative and finance manager, the production manager, the coordinator of supply and logistics, and the finance and supply supervisors. In these meetings the participants worked to map the current state as well as to define a desired future state map of the process.

The participants also defined indicators to evaluate the efficiency of the process and to identify the problems that prevented the smooth flow of work. The first indicator was collected by the administrative and finance sector so that the problems found in the invoices billed to the company by subcontractors in different construction sites could be tracked. The other indicator was collected by the coordination of supply and logistics to track the frequency and types of problems found in the approval of the payments.

DISCUSSION OF RESULTS FOR THE PILOT PROJECT

This section presents the description of the current state of the process when the pilot project started, the future state devised by the team, and the results of the indicators used in the analysis.

CURRENT STATE MAP

Every week, on Tuesdays, the construction managers have to send to the company's headquarters all the invoices and requests for payment (RFP) that are due from Thursday (same week) to Wednesday (following week). In the current state, each project accumulates the invoices for all the resources acquired over the week and sends the invoices with the RFPs in a single large batch to the headquarters every Tuesday by 6 PM (end of work day). On Wednesday, starting from 8 AM, the administrative and finance sector checks the invoices and RFPs for taxes, bank payment invoices, receipts, and types of payments. At 2 PM the same sector delivers in a single batch all the invoices and RFPs to the coordinator of supply and logistics (CSL), who checks them in terms of quantities billed and contracts, and controls the payments that have to be made before resources are delivered on site (e.g., ceramic tiles).

On Wednesday in the afternoon, and often times after the regular work hours, the CSL checks all the invoices and RFPs received and categorizes them in terms of money value. Then, usually on Thursday mornings, the CSL and the person in charge of the final authorization of the payment analyze each category. The Technical Director and the Technical Manager also participate of the analysis of the invoices and the RFPs. Finally, after the authorization of the invoices and their payments by different managers at the office, the CSL sends the documents to the finance supervisor so that she can prepare, during her (supposed) lunch break, all the checks to be signed by the company owner starting from 2 PM of the same day.

Figure 1 graphically depicts all the steps (full cycle) necessary to process a RFP and authorize its payment. The analysis of Figure 1 reveals that the starting point of the process, i.e., sending the invoices and RFPs from the construction site to the office, represents a large batch of documents sent all at once. This practice (large batch) leads to the overload of people who deal with these documents at the office.

The existing process requires that the administrative and finance sector and the supply and logistics sector work extra hours to comply with what has been defined by the upper management (the company VP = the process customer). The CSL works after hours in the end of the day to check all the invoices and RFPs, the finance supervisor has to work during her lunch break to meet the deadline for giving the checks ready to be signed to the administrative and finance manager who finally meets the company owner for the check-signing process.

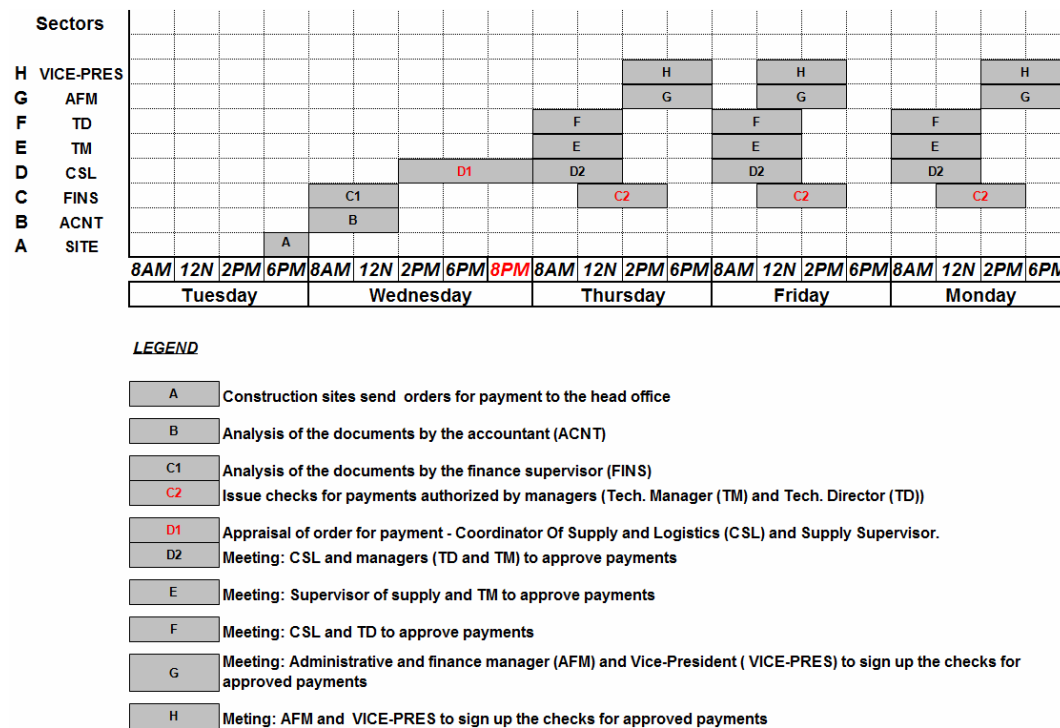


Figure 1: Current State Map

FUTURE STATE MAP

The future state map for the process is based on the value as perceived by the final client of the billing and payment process, i.e., the company VP wants to sign the checks once a week on Thursday starting from 2 PM. The process owners, the coordinator of supply and logistics (CSL) and the finance supervisor, would rather receive small batches of invoices and RFPs regularly over the week to avoid the concentration of work in the day before payments are due. Figure 1 was altered to reflect the future state based on the customer and process owners demands (Figure 2).

The first change from the current to the future state was the transfer batch for invoices and RFPs send from the sites to the office. Instead of sending all the RFPs to the company’s headquarters once a week in a big batch, the project sites started to send the payments daily (frequent and small batches, milk runs). As the office receives small daily batches sent by the project sites, it is possible to level the processing of these documents in different sectors. Before the change, the batch of bills was pushed from the administrative and finance department to the coordination of supply and logistics always on Wednesdays at 2 PM. Now, the CSL pulls the bills according to his capacity throughout the week. Pulling the bills daily based on its

actual conditions has reduced the peaks (on Wednesdays) and valleys that once existed in the coordination of supply and logistics.

There were also changes at the construction sites. Before the change, the site manager had to sign all the RFPs always on Tuesdays. After the proposed changes, the site manager signs the RFPs daily so that small batches can be sent to the head office. Sending invoices and RFPs in small and frequent batches allowed the errors in the billing process to be quickly detected and corrected over the week so that the payments could be made on time.

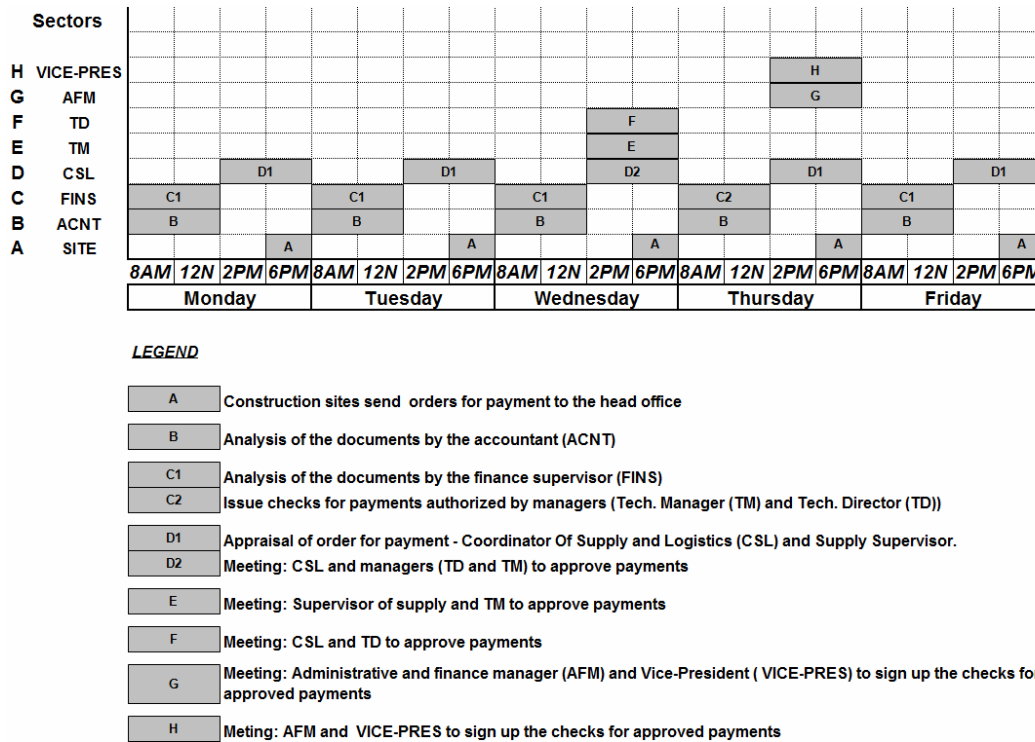


Figure 2: Future State Map

ANALYSIS OF INDICATORS

The indicators were collected during the first weeks of the pilot project so that managers could get familiar with the problems that halted the flow of payment. Based on the results provided by the indicators, during the meetings, managers involved in the pilot project have searched for ways to improve the process and mitigate the problems identified. They have tried to provide initial ideas for improving the process.

The indicator collected by the administrative and finance department reveals the problems found in the invoices sent by the different project sites (Figure 3), whereas the indicator collected the coordination of supply and logistics reveals the number of RFPs that were not authorized during the checking process (Figure 4). Figure 3 shows that the problems identified are concentrated into three factors: lack of documents sent with the invoice (receipts, payment authorization), errors in inputting the data in the company's system, and the due dates of the invoices.

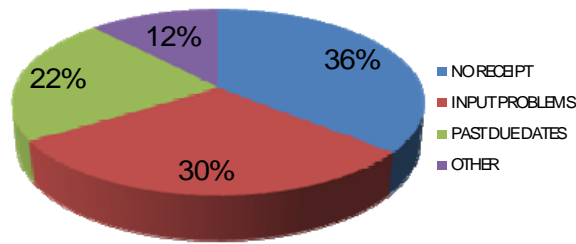


Figure 3: Problems Identified In the Invoices Send For Payment

Regarding the indicator collected by the coordination of supply and logistics, it shows a reduction in the percentage of the number of RFPs not authorized when compared to the total number RFPs. In the first week of the study, 20% of all payments were not authorized whereas in the sixth week a total of 5.32% were not approved. The main cause identified for the non-authorized payments was due to the lack of documents necessary for the appraisal and approval. Figure 4 shows that the initial changes proposed have resulted in a reduction in the failure demand.

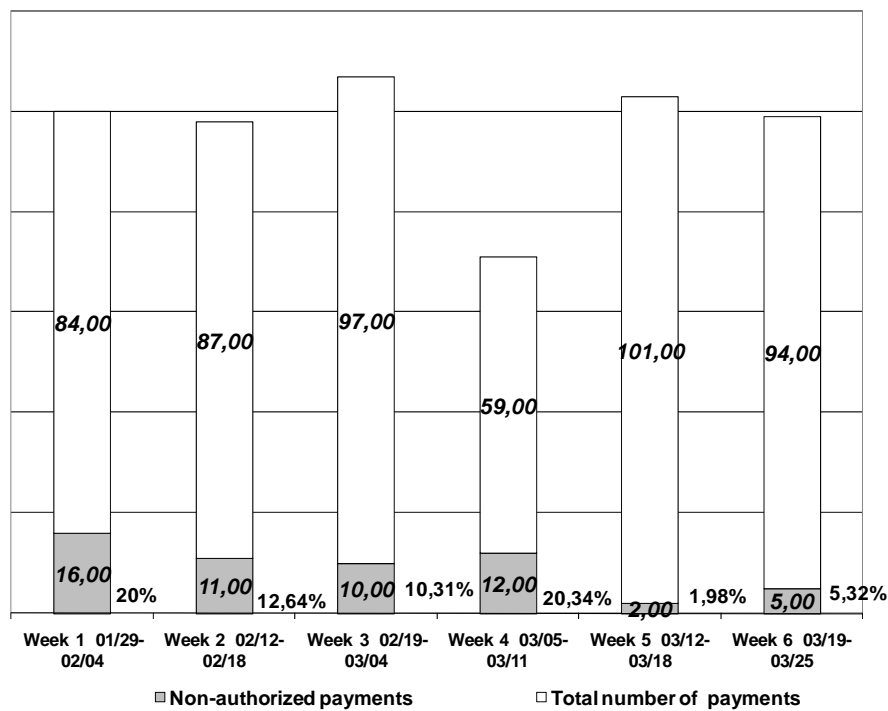


Figure 4: Total Number of RFPs and Non-authorized RFPs

The administrative and finance department and the coordination for supply and logistics have realized that they needed to train the site personnel and explain the main prerequisites for a bill to go through a smooth flow of appraisal and approval. In other words, people at the project sites have to know what the client requirements at the office are.

Also, after the data was analyzed, the office personnel perceived that some suppliers interfered negatively in the process of billing and payment. According to

the finance supervisor the way some suppliers sent their invoices and RFPs to the head office, without first sending these documents to be checked and approved by the site that had contracted them, was inadequate. Every invoice must be first sent to the site manager who hired the supplier and if approved it should be sent to the company's headquarters for processing and payment. This would avoid wrong invoices or invoices lacking documents necessary for the approval process (avoid failure demand).

COMMENTS ON THE PILOT PROJECT

Some comments made by participants of the pilot projects caught the authors' attention, especially those related to the need to change people mindset at the office and the construction sites.

The finance supervisor pointed out that she liked to have invoices and RFPs delivered early to her so that she would have enough time to solve problems related to the documentation sent by project sites. The finance supervisor always tried to deal with the problems when they happened (failure demand) without ever questioning the root causes of these problems, as a consequence they kept showing up every week.

After a brief presentation of the problems identified during the study, some of the people who had their performance evaluated by the indicators demonstrated they were discontent with the results. Some collaborators at the project sites (administrative staff), who were in charge of organizing the invoices and RFPs before they are sent to the head office, felt uncomfortable to have the problems they somehow had helped to generate displayed to others in the company. Thus, to avoid this situation in the meeting when the results were displayed, those in charge of the pilot project discussed the objectives of the project and the Lean concepts considered to avoid future misunderstandings.

The coordinator of supply and logistics pointed out that his daily work has improved a lot due to the new process defined in the future state (Figure 2). According to him, now he and his co-workers only need the regular work hours to adequately analyze and check the bills they receive.

The administrative staff at the construction sites complained about the daily milk runs that send invoices and RFPs to the head office as they are not convinced that is the best way to carry out this process, they cannot see the benefits for the office personnel yet, and because they were used to the old way of doing things. The documents still arrive at the office in variable batches and tend to arrive in larger batches close to the last time available to process them. Therefore, it is necessary to bring all people involved with the process to a seminar so that they can get familiar with the Lean Thinking and its advantages to the company in the long run.

CONCLUSIONS

The paper presented the use of Lean concepts, principles and tools applied to administrative activities, i.e., billing and payment process, performed at a construction company's headquarters. Even though the company has advanced in the implementation of Lean Thinking at its construction sites, only the activities related to production have been directly affected. The administrative staffs who work at the project site still cannot see the benefits of the Lean Thinking and have presented some discontent with the Lean Office initiative. The company still needs to discuss the

entire process with site and office personnel in a single meeting so that all participants of this process can understand and define what a clean invoice and a clean request for payment mean. All people involved should contribute to meet the final client's needs as well as the process owners' needs.

Before the Lean Office pilot project, the invoices and RFPs were sent to the company's head office once a week in a single large batch and caused the overload of office workers who also had to work overtime to get the work done by the deadline defined by the final client of the process (the company VP). After the pilot project, small daily batches are sent to the office and have contributed to establish a pulled process, level the work load throughout the week, reduce the inventory of bills waiting to be processed, and reduce the cycle to identify and correct the problems identified. Collaborators have suggested that the company needs a standard format to guide staff through the preparation of the documents necessary to the appraisal and approval of invoices at the office.

However, the Lean Office initiative must go on through more training (e.g., seminars, games, book discussions) to all people involved to avoid misunderstandings, *kaizen* initiatives should be encouraged to standardize and improve this and other processes at the office.

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