EXPLOITING MOTIVATION IN THE CHANGE TOWARDS AUTONOMATION IN CONSTRUCTION PROJECTS

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ABSTRACT

By strictly focusing on variables in the work environment, project managers are likely to overlook why workers behave differently when exposed to similar challenges under the same motivational factors. This is a problem that calls for a better understanding on worker motivation and personality types considered proper to the new production paradigm. The interest in the subject comes from the speculation that the implementation of autonomation in the construction sector may lie beyond the best practice programmes and the discussion of adequate cultural and leadership characteristics.

This paper summarizes an empirical qualitative study, which aims to illustrate differences in personal motives and how such differences can be balanced to better suit lean practices. The discussion is based on lessons learned from two case studies where autonomous crews were implemented to react to the vicissitudes of work in a construction projects context. The conclusions show the close relationship between worker motivation and strategic choices in production strategy. This has allowed the identification of two important conditions that need to be attained by firms interested in autonomous crews.

KEY WORDS

Worker motivation, teambuilding, strategic choices, lean production.

INTRODUCTION

Lean principles and practices aim at the removal of buffers and non value adding activities to shorten workflow interruptions and cycle times. By doing so, production operates with balanced, synchronized material flow, which improves performance by increasing productive work hours and production rate. Under certain circumstances, such increase in the proportion of work time actually spent performing tasks may seem to worsen job stress. However, as Conti et al. (2006) put it, lean production is not inherently stressful and worker well-being is not deterministic.

Whether or not lean practices are viewed as stressful is most likely to depend on each individual's motivation to make the best use of them. If the right motives are in place, lean practices may even be seen as facilitators to both individual and organizational goals. In this case, lean production will be considered to have stress reduction characteristics as it diminishes flow problems and provides support for the achievement of production

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goals. Thus, it is important that the implementation of lean techniques and principles be made regarding aspects of human motivation.

Although motivation is usually raised as a general concept, a motive should be understood to result from the interaction between an underlying need and environmental factors. In fact, the negative or positive stimulus created by organizational policies and management practices has been the subject of different studies in construction (e.g., Buch and Sander 2005, Zuo and Zillante 2005). But the understanding of why each individual behaves differently under the same external press still remains a challenge to organizations. The answer is likely to be found in the realm of personal needs, which has not been addressed by researchers who usually study relationships between work-related variables without reference to employee's lives outside of the workplace.

Owing to the increasing interest on autonomation in construction, this paper further develops on the subject of worker motivation and explores strategic choices made by companies that have conducted the change process. Therefore, this paper is based on a literature review on motivation and on two case-stories: one from a high rise building firm and one from a geotechnical engineering firm. It is suggested that companies must become increasingly aware of the need to match employees with certain personal characteristics that suit best the new roles of middle managers and work teams. It is also argued that to fully profit from lean construction, organizations must increase the use of permanent teams so that the different individual characteristics be gradually accommodated and used in the most effective manner.

MOTIVATION

EXTERNAL MOTIVATIONAL FACTORS IN TALL STRUCTURES

The traditional view on motivation in construction firms like in many other business organizations can be explained by the Taylor model and Maslow's Hierarchy of Human Needs. As mentioned by Buch and Sander (2005), its origin can be traced to the technological development of the construction sector, which increased the division of the working functions. This contributed to the employment of middle managers in the linking role of planning and controlling tasks and thereby to the elimination of the workers' independent thinking. Gradually, an organizational paradigm was established where managers were seen as valuable while workers as disposable.

The motivational factors used by traditional hierarchical organizations to stimulate the staff reflect this top-bottom order of importance and command approach of the Taylor model. For instance, top managers in general do not perceive earnings and promotions as motivational factors, since they are usually graduated and well paid. What drives them is exercising power, influence and prestige among other employees. Companies may create a stimulus by offering opportunities to extend their knowledge in conferences and courses. For employees holding the position of middle managers the earnings, bonus schemes and training to improve skills are important, but satisfaction comes more from recognition and possible promotions. As part of the permanent staff, employees at this level share the desire for more autonomy and feel rewarded whenever they are delegated with responsibility. But the greatest challenge lies in the motivation of work teams at the level of operations. Workers at this level generally present poor education, few abilities, high turnover and low productivity. They are mainly focused in assuring security both in

terms of revenues and employment. So simply offering performance related pay may not make up for the anguish of being dismissed whenever the production volume is down.
What stands out is that people are not motivated to work by money alone but by a combination of factors. According to Chiavenato (2000), in Abraham Maslow's theory humans seek to meet basic needs and only then aim at satisfying successively higher needs that occupy a set hierarchy: physiological, safety, belonging, esteem, and self-actualization. The higher needs only come into focus once all the needs that are lower down are mainly satisfied. As discussed above, in hierarchical structures people in each level seek exactly what the organization hasn't offered them at that particular level (Figure 1). It is clear that employees possess different needs that can hardly be fulfilled by the organization, specially when it follows an organizational model that segregates different levels by an order of importance and provides their needs according to this logic.

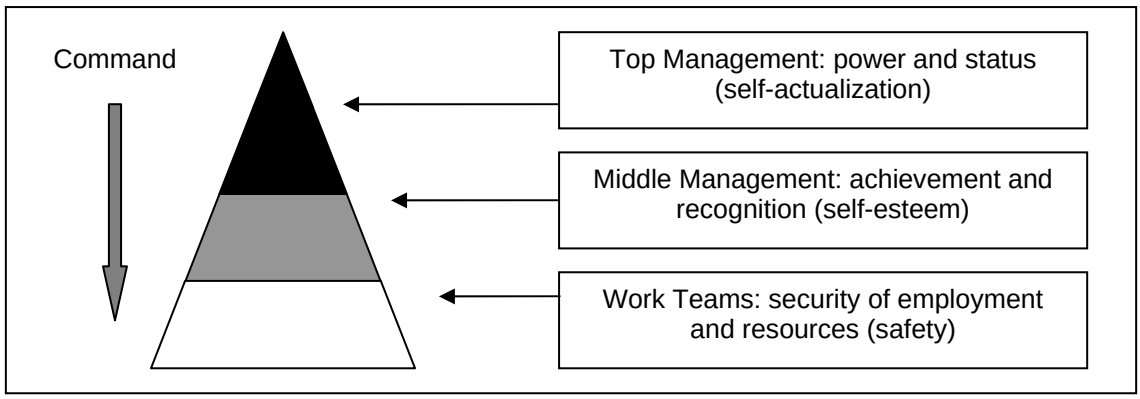

Figure 1: Hierarchy of Needs in Traditional Organizations

EXTERNAL MOTIVATIONAL FACTORS IN FLAT STRUCTURES

Traditionally, the motivational factors adopted in hierarchical organizations make middle management the level in charge for pulling production. But centralization is only suitable for organizations facing stable, homogeneous environments. Van Der Merwer (2002) argues that organizations facing a shifting heterogeneous environment will find the flat structure more effective as it applies fewer horizontal layers of management and fewer distinct policies along them. Among other aspects, such structure intends to create similar motivational factors to both middle managers and work teams and to bring them closer in terms of responsibility and commitment to strategic goals. This is a pre-requisite for delegation of responsibility, which provides to employees in different levels the authority to pull production and to respond to problems in a dynamic environment.

In the actual stage of technological development, the Construction Industry is dependent on the behaviour of individuals. Thus, any organizational change to lean construction must also aim at improving the human aspect. Therefore, management choices in designing and operating lean systems require caution as they impact heavily on motivation, stress levels and project culture (e.g., Zuo and Zillante 2005, Conti et al. 2006). The synergy between the two sets of choices and each individual's expectations to satisfy personal needs is what generates the potential for motivation.

To this regard, production system design involves a wide set of policies that help shape the organizational structure and environmental factors for motivation. Researchers

contend that manufacturing strategies like mobile cells and operating practices, such as Andon, can enhance autonomation in construction processes (e.g., Santos et al. 2002, Kemmer et al. 2006). Others like Buch and Sander (2005) suggest that such initiatives will not be enough without the introduction of performance-related pay and teambuilding training activities. These adjustments build up teamwork and favour the organization in many ways by improving interdependencies and creating intangible competencies. But most important of all, they provide low levels of job control, which characterizes a typical lean plant. As mentioned by Conti et al. (2006), low lean control can actually improve both product and work-life quality.

In addition, the operation of lean systems must adapt under the penalty of suppressing the motivational efforts. This involves a change in management style towards management of people and their needs. Since leadership and human motivation are two ever crossing subjects, managers must fulfil a number of roles including those of coordinator, facilitator, motivator and politician. Such roles reveal the importance of motivation under any circumstance to achieve successful project delivery. In accordance, Dainty et al. (2003) found that contracting organizations consider the most demanding and important task of the project manager be to build, develop and maintain the project team. Howell et al. (2004) describe it as shaping circumstances for team members to deepen their relatedness by cultivating commitment-making and producing coherence of intentions. As conflicts are likely to occur during this process, project success is highly dependable on the effectiveness of managing team social-dynamics.

PERSONAL NEEDS

There are personal aspects that need to be addressed since they affect motivation. Defying underlying assumptions in each individual's conceptual system is one, which is most critical during periods of strategic changes (e.g., Werther Jr. 2003). Not meeting individual underlying needs is another, since motivation is no longer understood to arise exclusively from externally applied forces. However, project and process managers are poorly trained and equipped to address issues that cause behaviours. As mentioned by Dainty et al. (2003), there have been attempts to determine the factors that lead to project success, but it remains unclear as to the precise individual characteristics and intra-team processes that lead to effective project performance.

Nevertheless, the good leaders are those perceptive to what makes people in the group going: status, knowledge, ambition, security, etc. Such knowledge of individual needs and characteristics helps to better manage people as it highlights potential strengths and weaknesses. This gives managers the confidence of knowing what can be expected from employees in highly unstable processes where the controlling style has given way to autonomous crews.

An individual has different levels of conscience concerning each of his/her own personal characteristics: capabilities, knowledge, social role, self image, personality and needs. In general, an individual is capable of describing many personal characteristics during an interview, but McClelland (1984) states that needs constitute a characteristic lying in the subconscious. However, implicit motives that cause the behaviour can be assessed using Picture Story Exercise (PSE). Traces of personality and needs are also identified by asking people who directly work with the individual. According to David McClelland's Motivation Theory there are three basic motivational needs:

- Power: is the need to influence and control other's behaviour. The individual seeks to increase his position and strength;
- Achievement: is the drive to accomplish or excel goals. The individual appreciates challenging environments and recognition;
- Affiliation: is the desire to maintain close relationships with others. The individual obtains much satisfaction from interpersonal and teamwork activities.

The need for power and achievement correspond with Maslow's higher-level needs, that of sell-actualisation and self-esteem. But the difference in McClelland's theory is that each individual is dominated by one of the three needs independently of environmental factors or which position he/she occupies in the organization. Although the needs can be learned to a certain extent, adult learning research states that they are acquired and fixated during childhood years. Once formed, the dominant need is hard to change unless the individual goes through a traumatic experience. Thus, understanding different personality types helps to predict behaviours and appreciate differences. For instance, a construction worker dominated by power tends to have a more coach and teacher-like behaviour towards other team mates. On the other hand, a worker dominated by achievement is usually a high achiever and tends to be well rewarded financially by the employer. The first should not be judged by others as lazy nor should the second as cold and ambitious.

The same understanding should be applied to managers. Leaders tend to be more effective if their personalities are adjusted to deal with the present problem. A leader with the need for achievement is more indicated to push deep changes while a leader with the need for affiliation is very good for mediating conflicts. Obviously the leader may no longer be the most appropriate person for the job when the situation changes. For instance, a leader with the need for achievement may consider stimulating a period of organizational change and loose interest afterwards during a period of stability. But there are also leaders with the capability of adapting to circumstances. Similar to organizations that adapt to changes in the external environment, these individuals are also somewhat successful in developing other needs throughout their career. Evidence of such learning even inside the same function is provided by Cox et al. (2003), who found that construction managers become aware of more performance issues other than just cost and on-time completion as they gain experience through the years. The individual learns to combine the dominant need with another to deal with specific situations.

MOTIVES FOR AUTONOMOUS CREWS

The Situational Leadership method from Hersey and Blanchard (1986) holds that managers must use different leadership styles depending on the workers' "maturity" for the task. Maturity is based on how ready (competence) and willing (motivation) the worker is to perform the required task. Therefore, an individual or group may be mature to some tasks and immature to others. According to the method, there are four leadership styles that match the four combinations of high/low readiness and willingness. Delegating is among the four leadership styles and should only be applied to highly mature employees who are both competent and motivated.

Although low job control and high worker maturity are essential aspects to Lean Production, lean practices can only support the readiness dimension of task maturity. Other aspects and underlying strategies of the Toyota Production System need to be

unveiled to fully understand the workers' willingness to perform tasks. It is likely that the use of permanent teams not only allows the development of skills and shared values through time, but also the arrangement of workers with different task maturity in a way that suits best individual needs and organizational goals. For this, organizations must see employees as internal clients and should try as best as possible to identify and satisfy their needs. Like any other client, an employee also "pulls" value from the organization and will only be compelled to take on the assignment if he feels that it strongly meets his expectations. So satisfaction of employees' technical and humane expectations is required in order to turn them into quality workers. Only then they will be capable and motivated to help the firm meet the final costumer's expectations.

LESSONS LEARNED FROM PRACTICE

In order to develop a basis for effective delegation of responsibility in construction processes, an empirical qualitative study was carried out to draw lessons from the experience gained in firms focusing on autonomous crews. Open-ended interviews were conducted with managers from two civil engineering firms to understand their perception of personalities and needs considered to be adequate to the new production paradigm. This was done through the collection of examples of both good and bad behaviour together with managerial practices and strategic choices in their work environment.

CASE 1: EXPERIENCE FROM A CONSTRUCTION FIRM

The firm is a contractor for private investors and occasionally both a developer and builder of multi-storey residential building projects. At the time of this study it had an annual construction volume of 50,000 square meters and was simultaneously undertaking six luxury high rise residential building projects in the city of Fortaleza (Brazil). Product quality, delivery and flexibility are considered to be the three important performance criteria in its niche market. Therefore, the firm opted to self perform some activities in the critical path to reduce problems that might affect other subsystems and project goals.

According to the interviewees, the firm has been implementing a lean construction programme for over three years now. The introduction of performance related pay schemes and supplementary training activities together with bundles of best practices and strategic choices like 5S, Kanban, Andon, Last Planner System, Line of Balance, Prototyping, Partnering and Mobile Production Cells were cited among the main reasons for the improvements in quality and productivity rates. But more humane practices are also adopted and just as likely to respond for the positive impacts. Signs and educational posters are fixated in the main rest areas and in passages used by the workers in the construction sites. Distribution of performance certificates, celebration of birthdays, night school programmes, teamwork seminars, sports events and musical contests with lyrics about lean construction are some of the activities sponsored by the firm to increase the welfare of employees and to reduce absenteeism and staff turnover.

All these initiatives comprise external motivational factors and are the most obvious characteristics of the production system when visiting the construction sites. But what stood out during the interviews were the less obvious managerial practices concerning labour motivation, which are used to develop quality personnel. For instance, the firm believes that a small group of people has a much better chance of solving individual differences. So in each team a leader naturally arises, usually being an experienced

worker with the healthy desire for power as well as the will to exercise it. Such worker becomes the team's spokesperson for re-negotiating the payment of work packages whenever changes occur in the original scope of work. These leaders are also effective in standing up for the team's interests and getting things done from internal suppliers.
The firm perceived the production system design to improve the workers' cooperative and proactive behaviour within the teams, but also to propitiate a certain level of competition among teams. Such dispute for individual benefits at the level of operations led the firm to consider adding collective production goals and bonus schemes in the hope of creating intra-team collaboration. However, managers feel that friction will continue to occur since there are many variables that lie outside of their control which can impact on the achievement of goals. Therefore, proactive management towards the organization of production is complemented by reactive management regarding the accommodation of conflicts. It was mentioned that as the project stress increases and control over dynamics decreases, the higher is the manager's need for affiliation in order to maintain a friendly work environment and to gain commitment for successful project delivery.

Friction also occurs inside the teams and requires attention to avoid dissatisfaction. In the beginning the firm faced problems by creating "heterogeneous" teams of workers who performed activities with different productivity rates and quality standards. Complaints of high achievement individuals having to carry the work of others were common and attempts to outline the profile of workers soon followed. Data collecting procedures and the foreman's observations were critical to evaluate and build teams according to each worker's profile. The problem is now considered surpassed and the firm has become less task-focused and more people-oriented. The change originated a policy to allocate only the right people to participate in the team and to perform the task or function.

CASE 2: EXPERIENCE FROM A GEOTECHNICAL ENGINEERING FIRM

The firm is headquartered in the city of Fortaleza and has been working for more than thirty years as a sub-contractor in construction projects in all Northeast Brazil, an area three times larger than France. Over the years the firm has invested time and money developing technical expertise and acquiring equipments to increase the efficiency of its conversion activities. Moreover, flow improvements are a major concern, especially in services that use the most expensive equipments, present low cycle time and have a great local market demand, such as pile construction using all terrain track mounted hydraulic drill rigs. Single Minute Exchange of Dies (SMED) and Work Sampling are some of the techniques the firm occasionally uses to analyze, reduce and standardize changeovers.

The firm has long used an on-the-job-training programme to develop multi-skilled teams. The number of workers in each team varies from 3 to 7 depending on the task. These are equipped and assigned to perform rotary drilling, percussion drilling, root piles, tiebacks and other services in building projects and civil infrastructure projects in both urban and remote sites. As a subcontractor the firm is much concerned with mix flexibility, delivery flexibility and volume flexibility. According to the interviewees, all three types are strongly supported by labour flexibility. Hence, the firm maintains 9 teams that can be combined according to the type of flexibility required.

The firm's strategy needs permanent teams to be effective. So performance related pay and bonus schemes are some of the incentives the firm uses to alleviate the workers' dissatisfaction for being frequently on the road. But having the right people is considered just as important. Unlike the previous case study, these are truly autonomous crews that

require proficient, high achievement team leaders because of the expensive machinery and the frequent absence of a foreman or any other supervisor at the project site. Thus, each team has a worker carefully selected by middle management as the permanent leader. These team leaders are said to lead by example, to involve subordinates in setting targets and to drive them towards the project goals. The interviewees mentioned that the firm avoids indicating workers with a high affiliation need to the role of team leader because they tend to be more lawful to their team mates than to the firm. Experience has shown that their subordinates take advantage of this. They also argue that failure to choose the right person for the job of leader implies that the firm will either loose by having to dismiss what was once a good worker or by maintaining an inadequate leader.

Differently to what is found in manufacturing literature, the interviewees describe these high performance teams as reacting negatively to the rotation of team members and even to the temporary movement of multi-skilled workers between parties to absorb demand fluctuations. Although the exchange of workers has to be done occasionally in order to support the firm's flexibility capabilities and to provide on-the-job-training, it sometimes requires managers to exercise a certain amount of power and coercion to happen. Clan culture and rejection of workers with a different work pace are part of the cause. But it was said that such behaviour lies more in the fact that achievers prefer to work with high achievers and are not motivated to perform services that pay less.

REQUIREMENTS FOR THE NEW ORGANIZATIONS

The experience gained in the two workplaces shows that the use of autonomous crews requires certain conditions to be beneficial for construction projects. Besides the initiatives described, two major conditions and their implications have been outlined: the need for teams to be built from within and the need to allocate the right people for the job.

The first condition requires continuity in the organization. As mentioned by Conti et al (2006), the updated Toyota philosophy states that JIT should not be applied to the people. Thus, several humane practices need to be employed to reduce job stress, hiring difficulties, and high labour turnover. Similar to subcontracting decisions regarding make or buy, a firm must carefully decide whether it is going to develop quality labour from within or if it is going to buy supposedly mature workers elsewhere for its self performed activities. The decision to develop internally requires strategic choices and structural changes to maintain and invest on people in the firm. On the other hand, buying experienced workers may seem cheaper, but there is no guarantee that they will be as motivated and effective in the new environment.

Perhaps it is time for lean academics and practitioners to look at Volvo's strategies and techniques developed to reduce high labour turnover and absenteeism and verify its complementarity with those of lean production. The analysis of the two case studies suggests that both sets of techniques may not be at odds and could very well converge towards a single best practice model. Worker motivation for delegation appears to be the linking element between Toyota's lean philosophy and Volvo's human-centred approach.

The second condition requires motivation to be no longer seen as external. Under the new organizational paradigm the companies are moving motivational factors that were once exclusive to middle managers to the work teams at the level of operations. By providing the work teams with basic needs, the firms clear the path for workers to pursue higher needs such as achievement, recognition, power and respect by others. This is the primordial step to bring employees closer in their commitment to organizational goals and

to turn delegation of responsibility into reality. But it will only be effective if people with the right needs are in place.

Regarding lean construction, experience from practice shows that competent individuals with the need for achievement are those that closely match the level of maturity required for regular workers in autonomous crews. Indeed, there are "natural habitats" for people with different needs and the high efficiency provided by lean practices creates the appropriate environment for high achievers. However, effective team based work in a more competitive environment requires fostering from individuals with a certain level of affiliation need. Leaders must develop it to manage conflicts and dissatisfaction. They should also avoid causing dissatisfaction by imposing their own standards to subordinates who are likewise high achievers. In addition, an individual with a higher need for power rather than for affiliation will make the best leader of a high performance team. In accordance with Jidoka, it takes authority to stop the production line in an environment where high achievers drive themselves hard towards the goals.

Even though external motivational factors applied to different levels are less distinct in flat structures, personal needs in autonomous crews can still be represented in a hierarchic manner. But unlike Maslow's hierarchy, it is proposed here that the needs be seen as cumulatively developed and as resulting from training programmes and practical experience (Figure 2). A worker's mobility throughout his career will depend on it.

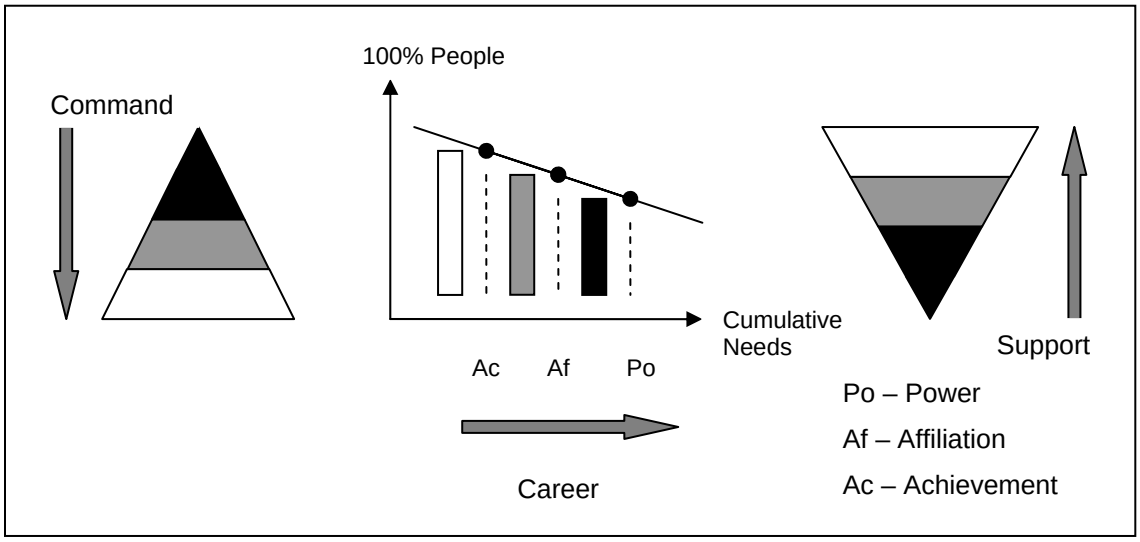

Figure 2: Hierarchies of Command, Cumulative Needs and Support for Firms in Lean Construction

CONCLUSIONS

Lean construction literature has dedicated attention to complexity at the project level, but further understanding on the organization's smallest complex element is still needed for the effectiveness of the new production paradigm. This paper has addressed some issues that hopefully will be useful to understanding why lean practices are more fruitful to some individuals and organizational environments than to others. Based in the findings of the two case studies, an individual's willingness to "pull" work instead of having it "pushed" to him will depend on how motivated he is to perform the assignment. Personal characteristics, such as underlying needs and competencies, combined with motivational

factors comprise the worker's maturity to perform a task. This individual complexity must be considered for effective delegation of responsibility and teambuilding.

The findings also indicate that teambuilding is more successfully developed in organizations using permanent staff. Knowing what a worker is likely to do or how he is likely to respond to different situations allows managers to position the right people in the right place. This helps to reduce non linear interactions, making the work environment less uncertain. Consequently, it relieves the leader from the role of buffering qualitative variables that could start harmful dynamics. Therefore, workflow stability in lean production is partially due to mature workers built within permanent organizations. These two conditions are a challenge to a project-based-industry where firms use staff turnover and high levels of subcontracting as strategies to attain different flexibility capabilities.

ACKNOWLEDGEMENTS

The authors are thankful to the Brazilian funding agency CAPES and to all firms involved.

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