



HR management during lean production adoption

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Abstract

Purpose – This paper aims to identify the success factors linked to human resources management during the lean production (LP) adoption process. A model of these factors and their interrelationships is also to be built to understand the sequence that leads to the cultural change required in lean production adoption.

Design/methodology/approach – A case study is carried out in selected same-industry companies that are on the same level in the supply chain and have recently completed LP adoption. Twelve first-tier production plants in the aeronautics industry were selected. Data were gathered from interviews with plant managers and the people in charge of LP in the plant. Data were analyzed using open and coaxial coding and triangulation both within cases and across cases.

Findings – The results highlight a number of success factors that depend on the phase of the LP adoption process. In the phase prior to adoption, the success factors are the incorporation of external change agents and the management averting inertia, whereas in the other phases of the adoption process five main factors were found: training, communication, rewards, job design and work organization.

Research limitations/implications – The findings stress the importance of human resources being managed appropriately during LP adoption for LP to be accepted and adapted. There are a number of key aspects related to human resource management that should be taken into account during each of the phases that occur during the LP adoption process. Further developments include measuring the intensity of the relationships identified and combining qualitative and quantitative methodologies simultaneously to overcome problems with the limited generalization of the results.

Practical implications – Practitioners in charge of LP adoption must be mindful of the key human resource management-related aspects before and during the LP adoption process and the guidelines to be followed in each of these aspects for the outcomes of LP to be achieved and maintained.

Originality/value – This paper contributes to research in the area of the role that people play in LP with a new line of research centered on the role of human resource management during the LP adoption process. Unlike prior research, this study analyzes the changes that take place in human resource management from the time the company makes the decision to adopt LP until it is implemented.

Keywords Lean production, Human resources management, Critical success factors, Adoption process, Case studies, Aeronautics industry

Paper type Research paper



Introduction

Lean production (LP) adoption is a radical techno-organizational innovation process (Smeds, 1994) whose application has spread to firms in a range of economic sectors and which has in many cases enabled these firms to improve their results and competitiveness (Moyano-Fuentes and Sacristán-Díaz, 2012).

However, LP adoption is a complex task and there are obstacles that can stand in the way of its success (Womack and Jones, 1996; Scherrer-Rathje *et al.*, 2009). These obstacles are often linked to the key role played by human resources (HR) rather than to technical aspects (Bateman, 2005; de Treville and Antonakis, 2006). Nonetheless, the literature puts greater stress on technical aspects than on the role of people and cultural change in the transition process to LP (Bhasin, 2012).

LP requires significant changes in HR policies and practices (Forza, 1996; Olivella *et al.*, 2008) that affect the role played by employees (Hiltrop, 1992; de Treville and Antonakis, 2006). However, the empirical evidence has focused on the role that HR play during advanced stages of LP implementation (Angelis *et al.*, 2011; Bonavia and Marín-García, 2011), while their role during the early stages of LP adoption has received less attention.

LP adoption entails radical organizational change as it involves a strategic change (Bhasin, 2012) and, therefore, substantially affects employees and requires major changes in their behavior, especially with respect to the engagement of workers (Pil and MacDuffie, 1996). This is why firms should manage the key factors that affect the success of HR management from the very first stages of the transition process to LP (Sawhney and Chason, 2005). Prior research does not show any consensus on these key factors and considers the transition process to LP as a whole without distinguishing between its different phases. In the same way, the literature does not analyze the changes that take place in HR management from the time that the firm makes the decision to adopt LP until the time that the transition process has been completed.

This study focuses on identifying the success factors in HR management during the LP adoption process depending on the different phases throughout the process. Our objectives are to:

- Identify the factors that explain the successful change in employee behavior during the adoption process.
- Categorize these success factors into main factors related to HR management.
- Propose a model that explains the relationships between factors during the adoption process to LP and helps to understand the change in employees' behavior.

Background

LP is an integrated socio-technical system whose aim is the elimination of waste through reducing or minimizing system variability as a whole, i.e. both internal and external variability (Shah and Ward, 2007). The main goal of this management system is to achieve maximum efficiency by running operations at a minimum cost and with zero wastage (Womack *et al.*, 1990).

When firms adopt LP, they adopt a management philosophy based on continuous improvement that involves all levels of the organization and offers the chance to improve results (Womack and Jones, 1996). Nonetheless, although some firms have made successful advances in LP implementation, others have not achieved the results

that were expected, and failed transitions to LP are common (Scherrer-Rathje *et al.*, 2009), many of them during the first months of LP adoption (Womack and Jones, 1996; Meade *et al.*, 2010). There is a broad consensus that inappropriate management of HR and cultural change plays a crucial role in the failure of Lean initiatives (Sawhney and Chason, 2005; Emiliani, 2006).

This is why HR management is such a major challenge for companies during the transition process to LP (Shadur *et al.*, 1995; Boyle *et al.*, 2011). Various authors have stated that a number of people-related factors, such as resistance to change, lack of the skills required or a low level of motivation should all be appropriately managed before adopting LP (Shadur *et al.*, 1995; Sawhney and Chason, 2005).

Some HR practices may facilitate the transition to LP. Olivella *et al.* (2008) identify a number of work organization strategies for LP, including standardization, ongoing training, teamwork, engagement and empowerment, multi-skilling, commitment to company values, and compensation and rewards. Meanwhile, Bonavía and Marín-García (2011) state that LP-oriented companies drive flexibility and multi-skilling, invest in training and commit to contingent rewards. The literature on high-performance HR practices also identifies HR factors adapted to an LP environment, including team work, job rotation, continuous training, extrinsic and intrinsic rewards, job security, multi-skilling and engagement (MacDuffie, 1995; Pil and MacDuffie, 1996).

A common factor in all these studies, however, is the consideration of LP adoption as a single process, assuming that people's roles during this process are the same whatever the stage of the process. This is why it is interesting to investigate whether distinguishing features exist in the management of human resources during the time interval from when the decision is made to adopt LP until the time when adoption has finalized been throughout the whole company. This study, therefore, focuses on identifying the success factors in HR management during the LP adoption process with distinctions made between the different stages in this process.

Research methodology

Our research method is the case study applied to the aeronautics industry. This study is exploratory because there is little empirical evidence of the role of HR in the LP adoption process and even less in the aeronautics industry. The case study is especially useful for answering "how" and "why" questions (Yin, 2003) and for studying longitudinal change processes (Eisenhardt, 1989). It provides a holistic view of a phenomenon and explaining complex relationships (McCutcheon and Meredith, 1993).

A multi-case method is used to explore these issues and build theory. This reinforces internal validity and enables findings to be replicated, thus driving up the external validity (Eisenhardt, 1989), guarding against observer bias (Handfield and Melnyk, 1998), aiding triangulation, improving the generality of findings (Yin, 2003) and making the overall research more robust (Herriot and Firestone, 1983).

A theoretical sampling model (Eisenhardt, 1989) was used to case selection. Our strategy was based on achieving literal replication (Yin, 2003) using information-rich cases that were distributed for maximum variation (Stuart *et al.*, 2002).

The basic unit of analysis was the plant, including plants that differ both in size and products manufactured, since the role of HR during LP adoption might vary due to each production plant's own organizational and technical factors. We selected firms in the aeronautics industry that were on the same level in the supply chain (first-tier

suppliers) and that had recently completed LP adoption. We thus selected twelve first-tier production plants in the Andalusian Aeronautics Industry (three of the world's major first-tier suppliers are located in Andalusia) that had initiated LP adoption and had made inroads into its implementation over a minimum period of one year. We relied on cooperation from the most representative agents in the Andalusian aeronautics industry to ensure that they had undertaken LP adoption in recent years.

A case study protocol was designed before beginning the field work. This was updated and improved with each visit that took place (de Weerd-Nederhof, 2001). A preliminary interview guide (Eisenhardt, 1989) was designed based on an LP literature review and tested with two researchers in operations management and two experts with extensive experience in the aeronautics industry. Finally, we conducted a pilot study in a manufacturing plant.

Both primary (in-depth semi-structured interviews, surveys, plant visits/factory tours and, in some cases, conversations with shop-floor workers) and secondary information sources (company documentation, web sites and similar sources) were used in order to triangulate data sources and ensure the construct validity of the research (Yin, 2003). Various respondents were also interviewed in all cases to further ensure construct validity. We used multiple interviewers, which improves convergence of observations and raises confidence in the findings (Eisenhardt, 1989; Voss *et al.*, 2002).

Data was collected between July, 2010 and March, 2011. Each semi-structured face-to-face interview lasted between 60 and 160 minutes. All the interviews were recorded and transcribed immediately afterwards. A database was developed in order to ensure reliability.

Both within-case and cross-case analyses were conducted, so triangulation has been carried out both within cases and across cases (Miles and Huberman, 1994). The external and internal validity of the research was controlled by confirming the findings of each case in subsequent cases (Yin, 2003).

Data analysis followed several stages (Strauss and Corbin, 1998) using open and axial coding. In the open coding phase the data were coded, analyzed and conceptualized. Concepts with the same meaning were subsequently grouped into sub-categories and more abstract initial (tentative) conceptual categories. In the axial coding phase the sub-categories and categories that had resulted from the open coding phase were interconnected. To ensure the consistency of the findings the authors analyzed the data separately and, subsequently, met to compare the sets of results. Furthermore, some details were also confirmed by respondents after the interview to control construct validity. Data were coded using a qualitative research software package (Atlas.ti).

Research findings

As a result of the analysis we have distinguished three phases in the LP adoption process closely linked to HR management:

- (1) pre-adoption of LP;
- (2) LP adoption in pilot areas; and
- (3) deployment of LP adoption to the whole plant.

These three phases both complement other authors' proposals which suggest the sequential implementation of LP comprising a preparatory phase, a pilot implementation

phase and a continuous improvement phase (Drew *et al.*, 2004; Pedersen and Huniche, 2011) and extend them to the area of human resource management.

Table I shows the main factors (categories), the explanatory success factors (sub-categories) and the key aspects for each of the phases. Each of the key aspects has also been illustrated with one or more quotations from the interviews.

The model resulting from the analysis includes both the main factors and the explanatory success factors, and the relationships between them according to the phase analyzed (see Figures 1 and 2).

Discussion and conclusion

This study provides a new line of research in the area of the role that people play in LP. To be specific, this line analyzes human resource management in the initial stage of the transition process to LP. We have identified a number of key aspects related to HR management that should be taken into account during each of the three phases of the LP adoption process, and the crucial factors that lead to the successful management of these key aspects.

LP pre-adoption phase

One success factor in this first preparatory phase was the incorporation of external change agents with experience in implementing LP. The objective was to incorporate people with innovative ideas and prior experience in LP to lead the change and break down historical inertia, such as the lack of a prior improvement-oriented culture. The incorporation of expert managers in LP, mainly from the automobile industry, or the outsourcing of consultants, was crucial to enabling a different mindset to be created directed at the need for change. In fact, these people coordinated the change alongside top management and acted as change process facilitators (Bateman, 2005). This finding is in line with Womack and Jones (1996), who stated that one of the most difficult steps in LP adoption is to overcome the inertia of the preexisting organization in order to initiate the process.

Once progress had been made in LP adoption thanks to the initial thrust given by external consultants, cultural change was driven internally by managers who had been appropriately trained up and had acquired the necessary experience in LP. This finding has received scant attention in the literature and reinforces the conclusions of Papadopoulos *et al.* (2011), who underscore the fact that during the transition process to LP each of the pressure groups, including the consultants, can turn the change process towards its own vested interests. As a result, the most suitable people for achieving the cultural change to LP are the inside personnel (Bhasin, 2012).

In this preparatory phase we also find a key role played by the adequate management of other inhibiting factors. Consequently, the change in reward systems traditionally linked to production volume must be managed as it could build up worker resistance to the Lean initiative.

LP adoption pilot phase

Piloting LP adoption in a given area is, in itself, a success factor because it is an example to other areas and makes the lean initiative visible to the rest of the plant. Pilot areas are therefore chosen for their greater visibility and for being areas that have stood out in the past for their good internal management and results. This finding is in line with the success of the gradual implementation process perspective (Wilson, 2009).

Main factors/explanatory success factors	Key aspects	Quotations
<i>Phase 0. Pre-adoption of lean production</i>	<p>Incorporation of managers with prior experience in implementing Lean (mainly from the automobile industry) due to the absence of a prior improvement-oriented culture and of human resources qualified to take on responsibility for LP adoption</p>	<p>“We’ve taken on people who’re experts on Lean to create a different mindset, to create a structure with a culture of continuous improvement, a Lean structure (..) for us to be able to develop the tools internally ... in the plant there wasn’t anyone who’d had the training and we wanted to do it with experienced people, get them onto our team (...). The great potential that we had was that we took on people with experience in LP to bring in Lean ideas and not have to do the training right from basics, and that’s great because it helps you improve faster.” (Plant M., P2).</p>
Incorporation of external change agents	<p>Consultancy services, current and future states audit (VSM), education and training of personnel in Lean Goals of incorporating External Change Agents: creating a different mindset in the organization (Lean- and, therefore, continuous improvement-oriented), structuring and deploying the LP implementation strategy, speedier progress, encouraging cultural change</p>	<p>“The first initiative involved the consultants ... and they were directly involved with the people on the shop floor, the consultants themselves went right up to the workstations and analyzed the current situation and the future one right there (..) but initiatives like these, they’re not worth a thing if you don’t let them run as much as they need, if you don’t give them all the investment they need afterwards, and support right from the top.” (Lean M., P10)</p> <p>“We started off with some consultants in the first work team and I started in there with them. Then it was Lean M. who took the Lean initiative over because the bottom line is, implementing Lean needs Human Resources to go forward ... , but it’s the people in here who have to make the change.” (Plant M., P7)</p>

(continued)

Table I.
Success factors in human resource management during the LP adoption processes

Main factors/explanatory success factors	Key aspects	Quotations
Absence of Prior Improvement-oriented culture	Absence of continuous improvement techniques in production management in the past Low level of competitiveness at this level of the supply chain in the past. Lack of qualified human resources (even at management level)	<p>“You just don’t have any idea of just how far away the aeronautics industry was from a basic Lean set-up at the beginning.” (Plant M, P1)</p> <p>“What we saw was really needed was the basics, an attitude aimed at improvement . . . There’s no Lean culture in the aeronautics industry. The aeronautics industry is 10 or 15 years behind the automotive sector as far as Lean is concerned.” (Plant M, P2)</p>
Management of inhibiting inertia	Need to manage a number of factors that could act as inhibitors prior to LP adoption, such as old production volume-linked reward systems	<p>“All the workers saw here was where their wages were coming from. All they were interested in was making parts and more parts, and if they didn’t come out right, well, that wasn’t their business . . . The very fact that we’ve managed to get an agreement on how work can be paid for in 5S and on training, it took a lot of hard work compared to what we had before, we had to work hard to change the reward system and link it up to Lean.” (Plant M, P2)</p>
<i>Phase 1. Lean production adoption in pilot areas</i>		
Reasons: to ensure successful adoption in the area, to target resources, to motivate people in the area and the rest of the organization after its success, to learn from the experience in the initiative, to standardize it, improve it, serve as an example and gain a pull effect on other areas		<p>“Starting out in pilot areas, that was the key. You can’t do it all at once. You have to go section by section, so people don’t get frustrated, you have to respond to them with your own resources.” (Plant M, P1)</p>
Training	Training programs, initially for the pilot area, at a later stage for the other areas where roll out is to take place. Training focused on changing the mindset of a critical mass of the organization to facilitate change	<p>“We made a really big investment in training. The thing is, people have no culture, and the main thing you have to do is transmit the cultural change that we need to have to these people.” (Plant M, P2). “At the beginning we started out with training on Lean awareness.” (Plant M, P13)</p>

(continued)

Main factors/explanatory success factors	Key aspects	Quotations
Practical training, focusing on simple and easily-applied tools	More practical training, applied LP methodology (on-the-job training) focused on simple and easily-applied tools, of direct benefit to workers	<p>"We began the first project with some training talks, and that's where a multidisciplinary team was chosen . . . and, well, after we were given the theory in those talks we took it and put it to use in the workshop." (Plant M., P7)</p> <p>"On all levels, and on the shop floor level too - it goes without saying - if you start by putting a tool into a guy's hands, and it's simple and easy to deal with, and then as a result the guy gets some kind of benefit out of it, well he holds on to it and just keeps on using it (. . .) We preferred to focus our training on simple tools in money and time terms, and on getting the workers to take them on board . . . we got some immediate and very obvious returns as far as worker involvement was concerned." (Plant M., P3)</p>
Communication Change in role of top and middle management (greater transparency and contact)	Change in the way that the management acts: greater transparency and direct contact with the shop floor, fewer hold-ups in information flow, more direct involvement in the shop floor and management's continual support of the Lean initiative	<p>"There was a change in the managers. They upped communication, there was more trust, we get involved a lot more instead of the old "command and control". We also tried to solve problems proactively, we tried to work on finding a solution to disputes instead of concentrating on who was to blame, and, especially, on how to solve the problem." (Plant M., P11)</p> <p>"At the beginning there's a lot of talking to be done. You have to convince people, convince them that changes have got to be made, and it's not an easy process . . . there's a lot of explaining that has to be done." (Plant M., P11)</p> <p>"The first people who have to get involved are the middle management. Once they're involved, the people a long way down the ladder the ladder also get involved." (Lean M., P4)</p>
Top-down persuasion	Presentation of Lean objectives by management, top down change of mindset	

(continued)

Table I.

Main factors/explanatory success factors	Key aspects	Quotations
Content focused on the need for change and the benefits of Lean	Meetings focused on need to adopt LP and its benefits, not only for the company but with special emphasis on the direct benefits for the worker	"At the start we gave a presentation on what LP was. They understood it in broad terms. Then they were told what was in it for them, for example, it's not that you work less, but you work better, and so on." (Plant M, P5)
Improvements shown to the rest of the plant (visibility)	Improvements made in the pilot area communicated to the rest of the sections in the organization, achieving a pull-effect on other areas	"After the pilot scheme, the idea was to extrapolate it and that people ... what's most important is that they see the results, you have to show the rest of the plant that these are valid principles and that you're not just playing to the gallery, but that it really does bring results." (Plant M, P12)
Reward	Importance of acts to recognize improvements achieved by the pilot team	"It's crucial the intrinsic reward of the improvements achieved by the team." (Plant M, P5)
<i>Job design</i>	Physical changes due to application of accessible, easily-understood Lean tools that are useful and provide direct positive results for the worker (5S)	"I think we're following the right steps. We started with 5S before any other tools ... The first move we made, the workers were skeptical, at the beginning they were reticent, but when they started to see that it wasn't going to be bad for them, but quite the opposite, they were going to get some benefits, that's when they want to be a part of it too (...). When a worker sees he's got his work place set up right, that's when he gets interested ... they can't deny the evidence, when work conditions are better, when accident levels go down, that's when they want to be in on it." (Plant M, P1)
Job standardization	Importance of standardizing the work station as a mainstay of Lean, through the step-by-step standardization of work procedures, and with the aim of reducing variability. Standardization by the workers themselves: structured method and achieving heightened feeling of ownership	"We began by standardizing jobs." (Plant M, P3) "We began by working hard on standardization, the thing about tools, implementations, work instructions and the like, to make the job easier for the worker. What I mean is, we put a lot of work into simplifying the day-to-day stuff and showing everyone where everything was so they didn't waste any time looking for the right tools ... with the aim of standardizing jobs." (Plant M, P7)

(continued)

Main factors/explanatory success factors	Key aspects	Quotations
<i>Work organization</i> Designation of a person to take charge of the Lean initiative in the plant	The person in charge of Lean is a resource fully engaged in the initiative to structure and deploy the implementation and monitor the results. Provides direct help and support to the rest of the organization in LP	"For Lean to move forward you have to put the resources in, the means, that's key, and we've got that resource, someone in charge of Lean." (Plant M, P1) "LP has got someone in charge of implementing it full time and structuring all the Lean activities. That person is the key." (Plant M., P12) "We began the first project with a multidisciplinary team who were implementing Lean in one part of the workshop, both the workers in that area and the support people who were involved." (Plant M., P7)
Creation of work teams with external support	Creation of work teams assisted by support departments (production, engineering, quality, etc.) for goals to be achieved jointly. Accustom workers to work in Lean teams	
<i>Phase 2. Deployment of lean production adoption to the whole plant</i> Training Specific Lean training by level	Training in Lean appropriate to the level. Depends on management level, work shop manager, team managers and direct workers. Focused on the role of each of the members of the organization in Lean	"We've all been trained ... the first thing is a preparatory session with people from the support areas, the manufacturing engineer, middle management like the workshop manager, of course, team chiefs, it depends on the level of training we're talking about ... you get a planning session and a training session depending on the level." (Plant M., P3) "All the management team have done Lean courses and all the workers too on certain aspects of Lean." (Lean M., P9)
Multifunctional training (versatility)	Training to improve skills and abilities in order to achieve a greater level of versatility among the workers. On-the-job-training	"We're working on versatility now; in the standardized sections we're trying to work with the Skill Matrix, with display boards on the plant level to begin a specific training plan." (Plant M., P1)

(continued)

Table I.

Main factors/explanatory success factors	Key aspects	Quotations
<p>Communication</p> <p>Devices put in place to monitor Lean results</p>	<p>Setting up appropriate monitoring of Lean results (Key Performance Indicators, KPIs), Periodic meeting systems, visual management displays</p> <p>Objective: to achieve smooth information, greater levels of internal coordination and integration, visual management of plant, structured communication</p>	<p>“We began working with the typical KPIs: Safety, Quality, Delivery and Cost, and now we’ve got information display boards so we can keep an eye on the indicators, see deviations and how the whole structure and the workers can set about dealing with them . . . We’re putting in this communication system so it’s constantly there in the whole system, the incident is dealt with and people don’t forget about it.” (Plant M, P2).</p> <p>“We want to standardize work meetings, set some specific times, follow a methodology in them, and monitor the typical KPIs.” (Plant M, P12)</p>
<p>Reward</p> <p>Non-monetary reward</p>	<p>Importance of acts to recognize improvements achieved by the plant on the collective and individual levels. Efforts aimed at achieving a structured model so as to afford them greater meaning and to give greater importance to non-monetary reward</p>	<p>“It’s the workers who implement Lean and the bottom line is you have to instill a culture into the personnel. In the promotion scheme we’ve made it compulsory for people to have done a certain course on LP if they want to be classed as a skilled worker. It’s a way of giving them an incentive and we’re also going to introduce a suggestion box where suggestions are rewarded, we’re going to start on that right away. Any ideas that lead to improvements will be rewarded with 50 - 200 € cash depending on the suggestion. And even more important, it’s public, so everyone can see it.” (Plant M, P7)</p>

(continued)

Main factors/explanatory success factors	Key aspects	Quotations
Interest in implementing monetary reward linked to Lean	Vision that agreed economic incentives linked to achieving Lean objectives can improve worker commitment and facilitate LP implementation	<p>"We're planning the economic incentives. We're designing them with great care because we believe that it could help with the implementation, but, you know, I don't think it's just about money, that's not the only thing that should be behind the change to LP. They have to see that we're all part of the company, and if we don't get better at what we do, then we're out of the market, and if we get better, we're more competitive and we get more programs (contracts) with the customers and as a result, more work for everyone." (Plant M., P5)</p>
Work organization Job rotation (versatility)	Encouragement of job rotation thanks to job standardization achieved in more advanced sections of the organization. Achieving greater worker versatility	<p>"Now that we've managed to standardize some of the sections we have the chance to work in a versatile way . . . , before it was as though the tools belonged to the worker but now they belong to the job. Now the worker knows that if he goes on some other assembly he's got it all there, the instruction sheets, everything he needs, absolutely everything. That used to be unthinkable." (Plant M., P1).</p>

Table I.

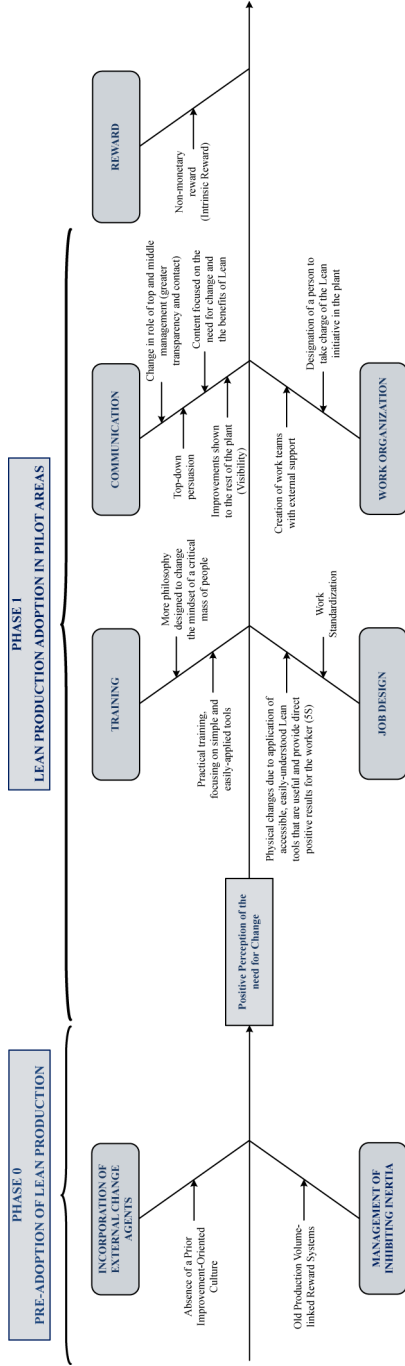


Figure 1. Model of success factors for HRM during phases 0 and 1 of LP adoption

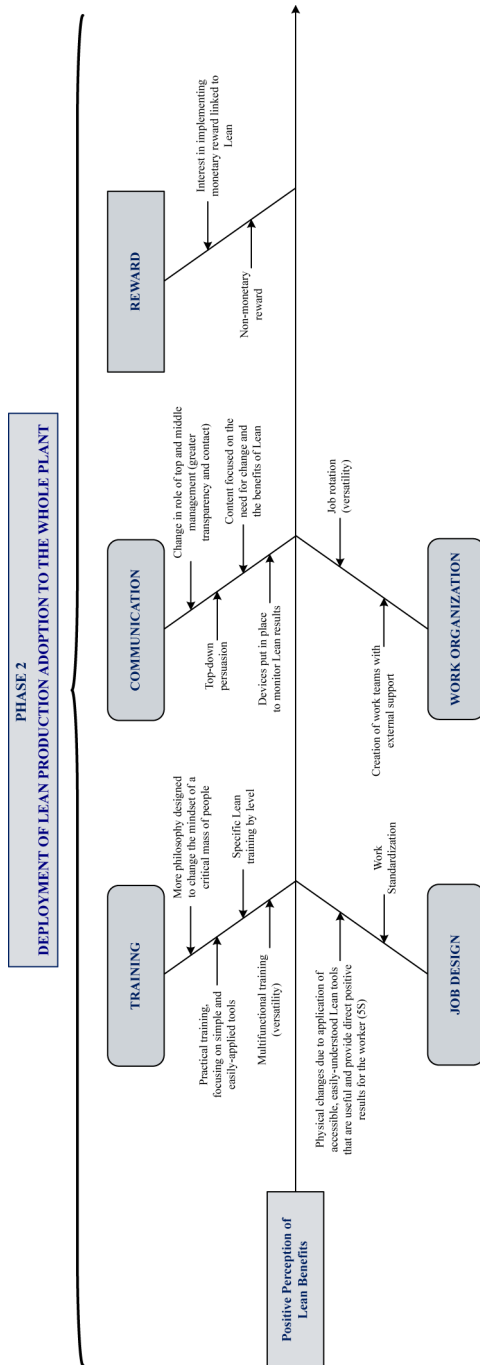


Figure 2. Model of success factors for HRM during the second phase of LP adoption

Despite the incorporation of external change agents in order to highlight the urgent need for change in the organization, we nonetheless identified an attitude of skepticism and resistance to LP among people during this stage which had to be managed through five main factors.

- (1) *Training.* We found training focused on changing the mindset of employees in the area. In this line, various authors state that a change in mentality is crucial for LP to be successful (e.g. Niepce and Molleman, 1996; Bhasin, 2012). We must also highlight the use of on-the-job-training, focused on the learning of simple and easily-applied tools. This type of training is extremely important for people to be more receptive to the first Lean tools (Stewart *et al.*, 2010).
- (2) *Communication.* Communication has been widely recognized in the literature as a vital part of LP (Womack *et al.*, 1990). We found that the explanatory success factors were, in the first instance, the change in the role of top and middle management. Managers should be the first to get involved in the process, encouraging greater contact with shop floor workers and greater transparency and feedback. We also found that communication centered on top-down persuasion and focusing on the need for change and the benefits that come from LP were key to overcoming people's resistance to LP (Scherrer-Rathje *et al.*, 2009). Consequently, communication must be reinforced during the first stages of the transition process to LP because LP is not only a set of tools, but a philosophy where people are the core (Saurin *et al.*, 2011). Finally, we found that making the improvements in the pilot area visible to the rest of the organization was key to recognizing team efforts, understanding the benefits of LP and creating a positive perception of Lean. These results complement the findings of Scherrer-Rathje *et al.* (2009) regarding the generation of a positive image of LP.
- (3) *Rewards.* We found the use of intrinsic – non-monetary – rewards linked to improvements achieved by a team to be an explanatory factor. This is in line with Lee and Peccei (2008).
- (4) *Job design.* The explanatory success factors found were the physical changes that came from the accessible and easily-understood tools (VSM, 5S and Visual Management) applied with the aim of improving the workplace and making it more ergonomic. This led to greater worker engagement in the lean initiative; when people think that the potential consequences of an initiative will most likely have a positive impact on them, they begin to take the change on board (Bhasin, 2012). A second explanatory factor was work standardization (Womack *et al.*, 1990) and, specifically, that this was done by the workers with the support departments to increase the feeling of ownership, monitoring, maintenance and continuous improvement.
- (5) *Work organization.* We found that one explanatory success factor was the designation of a committed person taking charge of the Lean initiative in the plant on a full-time basis. Little attention has been paid to this finding in the literature, but it is nonetheless crucial during the first stages of LP implementation (Pedersen and Huniche, 2011; Bhasin, 2012). It was also noted that the creation of work teams with external support was key to developing the principles of participatory management and for delegating responsibilities to the workers. Although our finding has not been analyzed to a great extent in the prior

literature, it does nonetheless corroborate the findings of Åhlström (1998), who states that the first work teams in LP adoption should be supported externally. HR management

LP adoption roll-out to the rest of the plant

A new wave of resistance was detected in this phase. However, our analysis shows that both the role of the change agents and the visibility of the improvements achieved in the pilot area to the rest of the plant helped to temper this attitude. The results also show the same five main factors as in the previous stage, although the explanatory factors were different.

- (1) *Training.* We found that training, apart from focusing on changing people's mindsets and emphasizing on-the-job-training, as in the previous phase was focused by level. So, training deployed according to level (top managers, middle managers, team managers and shop-floor workers) was essential for each member of the organization learning what his/her role was in the Lean environment. We also found that multifunctional training was useful for achieving a greater degree of flexibility in the organization. This was possible in more advanced areas where workstations were able to be standardized and workers were trained both theoretically and practically to undertake different types of tasks by rotating them between jobs (Karlsson and Åhlström, 1996).
- (2) *Communication.* Apart from the explanatory success factors found in the previous phase, we found that the implementation of devices to monitor the results of LP (KPIs) through periodic meetings and visual management boards helped to develop structured communication flows and higher levels of internal integration. These findings corroborate those of several authors who underscore the importance of transparency and continuous feedback of Lean outcomes (Worley and Doolen, 2006).
- (3) *Rewards.* We found that non-monetary rewards linked to LP prevailed over monetary rewards on both the individual and team levels. This finding sheds light on the role of rewards in LP and corroborates the findings of Karlsson and Åhlström (1996), who pointed out that monetary incentives are a hindrance in the adoption phase but with time tend to facilitate the implementation process.
- (4) *Job design.* The same explanatory success factors were found as in the previous stage. The learning acquired in the pilot areas was therefore extended to the rest of the plant.
- (5) *Work organization.* Unlike the previous phase, we found greater job rotation between workstations as a direct result of training focused on improving versatility.

These findings can serve as a guide for companies proposing to adopt LP and for management in charge of the LP adoption process for defining aligned and time-sequenced plans of action aimed at achieving and maintaining the outcomes derived from LP.

The proposed model could be of special interest for managers, as it indicates the key HR management factors that they should manage before and during the LP adoption process, and the guidelines to be followed to guarantee the success of the transition to LP. It should be highlighted that the different factors should not be considered in isolation in

each of these phases, but from a systemic viewpoint, where each of the factors interacts with the others, in order to understand the sequence that leads to the cultural change associated with LP. LP and the associated changes in the management of HR should be seen as a dynamic process, and not as a state that is reached after a certain time.

Finally, it should be stated that our study is not without its limitations. First, the study is qualitative and exploratory and has been carried out at a certain level of the supply chain in one industry. As a result, the generalization of our results is limited. Nonetheless, we have no reason to believe that the same HR management success factors cannot be applied to other levels of the supply chain. Second, although the study identifies the relationships between the explanatory success factors and their main factors, it does not enable the intensity or strength of these relationships to be measured.

Being mindful of these limitations, we suggest some future lines of research. One suggestion is to validate our model on other levels of the supply chain, in this or some other industry, in accordance with logical replication. A more in-depth analysis is also proposed to try and measure the intensity of the relationships identified. Finally, a combination of qualitative and quantitative methodologies is proposed with a view to overcoming the above-mentioned problems with generalization.

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