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The relationship between leadership style and the success of Lean management implementation

Leadership style and the success of LM implementation

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Abstract

Purpose – The purpose of this paper is to better understand the role that leadership plays in the success of Lean management (LM) implementation, by trying to identify what is the impact of the transactional, transformational, directive and empowering leadership styles on the success of such an implementation in Portuguese companies, and what are the most important leaders' attributes.

Design/methodology/approach – An on-line questionnaire was distributed to 65 manufacturing and services Portuguese organizations that have implemented LM.

Findings – The results suggest that the empowering leadership style has a positive impact on the success of LM implementation. Even though results do not allow concluding about the impact of the other styles, several leader's attributes were identified as having influence: individualized consideration, information sharing, skill development, intellectual stimulation, assigned goals and self-directed decision making.

Originality/value – Very few studies have addressed the role of leadership in the success of adopting LM and, to the best knowledge, only one paper studied the critical attributes of leaders in LM implementation. Moreover, the present study focuses in Portugal, country where this topic has rarely been investigated.

Keywords Performance, Lean, Leadership style

Paper type Research paper

1. Introduction

The successful implementation of LM in some well-known organizations boosted its implementation in many others around the world. In addition, the last economic recession increased the need for competition and therefore the need to implement tools and techniques that improve the competitive level (Alsmadi *et al.*, 2012), with LM practices among those. However, several cases in which the LM implementation has been reported unsuccessful (Sorooshian *et al.*, 2017), justify the increasing concern about implementation aspects (Van Landeghem, 2014).

Some studies have identified the critical success factors for the successful Lean implementation, specifying leadership as one of them (Achanga *et al.*, 2006). In effect, leaders' role in an organization is nowadays recognized as critical to support change (Pamfilie *et al.*, 2012). Surprisingly, only a few studies address the role of this specific factor in LM deployment (Gelei *et al.*, 2015, studied the attributes, not the leadership styles and Tortorella *et al.*, 2018, analyzed specific contextual factors such as the age of the leader). The purpose of our research is to fulfill this gap in the literature.

Following this research direction, this study tries to identify what is the impact of leadership style on the success of LM implementation (this is not performed by Gelei *et al.*, 2015 neither by Tortorella *et al.*, 2018), seeking to identify the leadership style that is more conducive to a successful LM implementation, and what are the most important attributes that leaders should have to facilitate this implementation.

Our results are expected to help organizations that are already implementing LM or planning to implement it to check whether their leadership has the right attributes to facilitate success.



This research was based on a questionnaire distributed to 65 Portuguese companies that have implemented Lean. The data collected from the questionnaire were subsequently statistically analyzed, enabling us the determination of the styles and attributes of leadership associated with success in the procedure of implementing LM.

The paper is structured as follows. The subsequent section provides the literature review conducted prior to the research work. The third section provides the information about the research hypotheses. The fourth section presents the results and, the final section provides the concluding remarks of the research work carried out.

2. Literature review

2.1 *Lean management*

Lean is a “systematic approach to identify and eliminate waste through continuous improvement, flowing the product at the pull of the customer in pursuit of perfection” (Sunder, 2015, p. 282). It was introduced in Toyota in the 1950s by Taiichi Ohno, through the Toyota Production System (TPS), which objective was to achieve improvements in efficiency by reducing muda, the Japanese word that means waste. “The term ‘muda’ became one of the most important concepts in quality improvement activities” (Dahlgaard and Dahlgaard-Park, 2006, p. 264). The TPS was later transformed in a management philosophy in which waste of all types is reduced by eliminating inefficient activities (Alsmadi *et al.*, 2012). The waste of “all types” means, for Lean, seven types of waste, namely, overproduction, waiting, transportation, inappropriate processing, excess inventory, unnecessary motion and defects (Endlsey *et al.*, 2006).

Along with the removal of waste, Lean can be based on other three concepts: Lean tools and techniques, the involvement of people and continuous improvement (Bhuiyan and Baghel, 2005). One of the notable Lean tools and techniques is the Value Stream Mapping, used to map and analyze the activities in the process, to allow the identification and elimination of the non-value added ones. Among the benefits of using the Value Stream Mapping, it is possible to identify the common language that it provides and the fact that it incorporates all the Lean techniques (Rother and Shook, 2003).

In a deeper analysis, Shah and Ward (2007) identify ten components of a Lean system, namely: supplier feedback; just-in-time (JIT) delivery by suppliers; supplier development; customer involvement; pull production; continuous flow; set-up time reduction; total productive/preventive maintenance; statistical process control and employee involvement.

2.2 *Leadership styles*

There are several definitions of leadership in the literature. In the first Global Leadership and Organizational Behavior Effectiveness research conference, in 1994, 54 researchers reached a consensus about it, defining leadership as “the ability of an individual to influence, motivate, and enable others to contribute toward the effectiveness and success of the organizations of which they are members” (House *et al.*, 2001, p. 494).

In terms of leadership styles, the dominant typology is the Bass’s one (Opoku *et al.*, 2015; Sarti, 2014; Yahaya and Ebrahim, 2016), that defines the transactional and transformational leadership (Bass, 1990). Based on this typology, Liu *et al.* (2003) propose four different styles of leadership: directive, transactional, transformational and empowering.

These styles are different from each other and have distinct characteristics (Pearce *et al.*, 2003).

Transactional leadership. This type of leadership is based on transactions between managers and employees, where leaders recognize accomplishments and promise rewards for good performance and effort (Bass, 1990). The transactional leadership has two dimensions: contingent reward and management by exception (active and passive).

These leadership dimensions are then reflected in the behavior of the leader, being recognized as leaders' attributes. The first dimension, contingent reward, is characterized by the reward that leaders give to employees when they achieve a certain level of performance, which means that the leader provides the goals and expectations. The other dimension represents a management by exception, i.e. the leader only makes interventions if something occurs differently than expected. In the passive case, the leader takes actions only if standards are not accomplished, while in an active case, the leader searches for standards deviations and takes corrective actions (Hartog *et al.*, 1997).

Transformational leadership. This style of leadership is present when leaders expand and raise the interests of the employees, creating consciousness of the group mission and giving employees incentives to look for the good of the group instead of looking for the personal good. This may be achieved through one or a combination of the following ways: leaders may be charismatic, providing vision and sense of mission, instilling pride and gaining respect and trust; leaders may meet the emotional needs of each employee, paying attention to the differences among them; leaders may intellectually stimulate employees, showing new ways of looking to problems, instructing them to see difficulties as problems to solve, and emphasizing rational solutions (Bass, 1990).

According to Rafferty and Griffin (2004, pp. 332-334) there are five dimensions of transformational leadership: vision, defined as "the expression of an idealized picture of the future"; inspirational communication, viewed as "the expression of positive and encouraging messages about the organization, and statements that build motivation and confidence"; intellectual stimulation, that means "enhancing employees' interest in and awareness of problems, and increasing their ability to think about problems in new ways"; supportive leadership, that means "expressing concern for followers and taking account of their individual needs"; and personal recognition, that can be viewed as "the provision of rewards such as praise and acknowledgment of effort for achievement of specified goals."

Directive leadership. Directive leaders make decisions single-handedly, which means that the subordinates rarely participate in decision making (Liu *et al.*, 2003). The directive leader provides direction and command, assigns goals and expectations, and gives intimidation and reprimand (Pearce *et al.*, 2003).

Empowering leadership. Empowering leadership can be defined from two perspectives: the "power-sharing" perspective and the "self-efficacy" perspective. The first one emphasizes the power and responsibility that it gives to the subordinates, while the second one emphasizes the removal of the feeling of helplessness and the raise of the employees' task-related intrinsic motivation (Li *et al.*, 2016). Zhang and Bartol (2010, p. 109) integrate these two perspectives and define this leadership style as "the process of implementing conditions that enable sharing power with an employee by delineating the significance of the employee's job, providing greater decision-making autonomy, expressing confidence in the employee's capabilities, and removing hindrances to performance." This leadership type has six different dimensions (Konczak *et al.*, 2000): delegation of authority, accountability, self-directed decision making, information sharing, skill development and coaching for innovative performance.

2.3 Leadership and Lean

When analyzing the relationship between leadership and Lean, Gelei *et al.* (2015) divided the leadership attributes into three groups: contributor, inhibitor and neutral. They concluded that none of the leadership behaviors (a set of leadership attributes) were inhibitors to the successful adaptation of Lean techniques. In addition, two of the leadership behaviors were considered as contributors: communicative and micro-manager. On a similar perspective,

Aij *et al.* (2015) highlighted that the leader should understand the processes by seeing them in practice, being communicative and promoting employee empowerment, trust, and openness. Later, Assen (2016) showed that empowering leadership is positively related to Lean implementation success, while servant leadership is negatively related and transformational leadership has no impact. More recently, Tortorella and Fogliatto (2017) employed the matrix of ideal leadership styles onto automotive companies and concluded that it helped identifying implementation phases in the Lean process.

No author identifies one leadership style as being more conducive to LM implementation success, although Poksinska *et al.* (2013) pointed out that many leadership behaviors exhibited by Lean managers can be classified as transformational leadership. Aij *et al.* (2015) and Gelei *et al.* (2015) only studied the leader attributes, not linking them to specific styles. Only Assen (2016) made an analysis of both, styles and individual factors, but restricted to senior managers.

3. Hypotheses

A transactional leader recognizes accomplishments and promises rewards for performance and effort (Bass, 1990). Laohavichien *et al.* (2009) states that this type of leadership can lead to successful quality performance, as the leader can reward the accomplishment of quality goals and give penalties to the ones that do not meet them. This clarification of what are the leader's expectations builds commitment from employees to achieve the goals, such as innovative activities and aligns the employees' expectations with the firm improvement needs, which also leads to a higher quality performance. The contingent reward creates employees' awareness about the expectation to develop new ideas and solutions regarding the processes and practices. In addition, through the management by exception, leaders closely monitor employees and give constructive feedback, which allows identifying which processes and practices need to be improved (Prasad and Junni, 2016). Therefore, we should test the following hypothesis (*H1*):

H₀. Transactional leadership is not positively related to Lean implementation success.

H1. Transactional leadership is positively related to Lean implementation success.

Transformational leaders provide vision, mission awareness, instill pride, respect and trust. They build motivation and confidence, and stimulate the employees, increasing their consciousness and capability to look at problems in different ways. They are supportive leaders, showing concern and recognition, and looking to individual needs (Rafferty and Griffin, 2004). Jung *et al.* (2003, p. 528) state that, through the vision and sense of mission, leaders increase employees' "understanding of the importance and values associated with desired outcomes, raise their performance expectations and increase their willingness to transcend their self-interests for the sake of the collective entity"; and through the confidence in employees' skills, leaders increase their commitment to long-term goals, mission and vision. In addition, Pongpearchan (2016) states that transformational leadership has a positive impact on the performance of staffs, as it enhances the cohesiveness, commitment, motivation and trust. Consequently, we should test the following hypothesis (*H2*):

H₀. Transformational leadership is not positively related to Lean implementation success.

H2. Transformational leadership is positively related to Lean implementation success.

In a directive leadership, the leader makes decisions single-handedly, which means that the employees do not participate in this process (Liu *et al.*, 2003). Instead, the leader provides clear directions, command and expectations (Pearce and Sims, 2002). Directive leaders help followers in task completion, and provide monitoring and performance feedback, which

reduces process loss and allows quick decisions (Kahai *et al.*, 2004; Lorinkova *et al.*, 2013). As a result, we should test the following hypothesis (*H3*):

H₀. Directive leadership is not positively related to Lean implementation success.

H3. Directive leadership is positively related to Lean implementation success.

Dombrowski and Mielke (2013) identified the culture of improvement and the qualification as the principles of Lean leadership, considering that the most adequate way to improve the processes is to continuously challenge them. The improvement culture includes the long-term thinking, considering the failure as an opportunity to improve and learn. To allow the employees to take part in the continuous improvement, their qualification is essential. It must occur not only in classes or training sessions, but essentially on a daily basis, through the solution of problems at the shop floor. The coaching approaches lead to a sustainable continuous improvement process, that is the aim of Lean. As we discussed before, an empowering leader shares the power with the employees by providing autonomy and encouraging them to make decisions, giving training to enable the necessary skill development, and encouraging new ideas (Konczak *et al.*, 2000). Therefore, we should test the following hypothesis (*H4*):

H₀. Empowering leadership is not positively related to Lean implementation success.

H4. Empowering leadership is positively related to Lean implementation success.

Notice that we are not stating that all leadership styles are positively related to Lean implementation success, but just that we will test the positivity of the relationships, so that we can identify the leadership style that is in fact associated with Lean implementation success.

4. Methodology

Similarly to Assen (2016), Dun and Wilderom (2016), Gelei *et al.* (2015), Pamfilie *et al.* (2012) and Sureerattanan *et al.* (2014), when researching leadership and/or Lean-related topics, a questionnaire was used to collect data, also following the advice of Saunders *et al.* (2009), who point out that a questionnaire is the most indicated gathering method when the aim is not to have a detailed perspective, but a high volume of observations. By contrast, Aij *et al.* (2015) and Laureani and Antony (2017) drew on interviews.

Our questionnaire, that was distributed to 65 Portuguese companies that may have implemented the LM, consists of five different parts: to assess general data; to determine the leadership characteristics and style; to assess the success of Lean implementation; and to assess the perception of the leader about the Lean implementation and leadership style, respectively.

4.1 Measures

To determine the leadership styles and attributes of the leaders (through the correspondent leadership dimensions), our questionnaire was developed adapting three previous questionnaires from literature.

Transactional and transformational leadership are measured using the Multifactor Leadership Questionnaire (Avolio and Bass, 2004), form 5X-Short. Transactional leadership is measured by two dimensions, contingent reward and active management by exception, composing a total of seven items. The transformational leadership is assessed through five dimensions: idealized influence—attributed, idealized influence—behavior, inspirational motivation, intellectual stimulation and individualized consideration, reflecting 18 items.

Directive leadership was measured using the questionnaire developed by Pearce and Sims (2002), composing a total of two items, and representing two dimensions (assigned goals and instruction and command).

Empowering leadership is measured using Konczak *et al.*'s (2000) Leader Empowering Behavior Questionnaire. The empowering scale consists of 13 items for the six dimensions: delegation of authority, accountability, self-directed decision making, information sharing, skill development and coaching for innovative performance.

The first one consists of an adaptation of the ten measures of Lean manufacturing practices developed by Shah and Ward (2007). Shah and Ward's measures are widely adopted by studies that research Lean-related topics (Alsmadi *et al.*, 2012; Assen, 2016; Gelei *et al.*, 2015; Sureerattanan *et al.*, 2014). These ten measures include three measures of supplier involvement (supplier feedback, JIT delivery, developing suppliers), one of customer involvement (involved customers) and six measures of internal processes (pull, flow, low set-up, controlled processes, productive maintenance, and involved employee), which substantiate a total of 43 items. Some adaptations were performed to apply these measures to service companies too, likewise Assen (2016, p. 10).

The second one is through the company performance. According to Büyükožkan *et al.* (2015), business performance can be divided into operational, market and financial performance. The operational performance is measured using the extent of improvement in organization processes (e.g. less waste), the financial performance is measured using the profitability and the market performance is measured through the market share.

In order to define the structure and type of scales (Likert scale) of the questionnaire, we examined the questionnaires used by Dun and Wilderom (2016), Pamfile *et al.* (2012) and Rossum *et al.* (2016). These questionnaires are usually divided in different parts, among them: a part to get access to the information about Lean; and a part to collect information about leadership.

A brief description of each part of our questionnaire can be seen in Table I. The structure of the questionnaire is presented in Appendix.

The leadership style is determined by the arithmetic mean of the items of each style's scores, i.e. the scores of each style are summed and divided by the number of items corresponding to that style (Sarver and Miller, 2014). The correspondence between each dimension of the style and the questionnaire items included to ascertain the attribute of the leader is presented in Table II.

The Lean implementation success is determined, on one hand, by the score of the items related to the practices implemented, and, on the other hand, by the score of the items related to the business performance. For this reason, each one of the hypotheses is divided into two different hypotheses, as described in Table III.

Finally, to end the measurement detailing, Table IV presents a description of the questionnaire, showing the correspondences between the items and the LM dimensions.

4.2 Sample

To identify the Portuguese companies that may have implemented Lean, the Kaizen Institute Portugal was contacted by phone. As this institute does not have a formal and

Part	Content	Description
I	General information	5 open questions: job position, activity sector, NACE Rev. 2, sales volume, number of employees
II	Leadership style	5-point Likert scale questions about the leadership styles
III	Lean practices	5-point Likert scale questions about the Lean implementation
IV	Lean performance	5 questions
V	Leadership style perception	1 question

Table I.
Questionnaire description

Table II.
Correspondence
between questionnaire
items and leadership
styles

Style	Total items	Attribute/dimension	Questionnaire items
Transactional	7	Contingent reward	22–24, 26
		Active management by exception	16–18
Transformational	18	Idealized influence—attributed	12, 19, 37, 38
		Idealized influence—behavior	31–33, 36
		Inspirational motivation	25, 34, 35
		Intellectual stimulation	6, 9, 10, 13
		Individualized consideration	2, 3, 14
Directive	2	Assigned goals	27
		Instruction and command	4
Empowering	13	Delegation of authority	20, 21
		Accountability	23, 28
		Self-directed decision making	7, 8
		Information sharing	29, 30
		Skill development	1, 5
		Coaching for innovative performance	11, 12, 15

Hypotheses	Description	Authors
H1.1	Transactional leadership is positively related to lean implementation success, measured through the practices implemented	Bass (1990), Laohavichien <i>et al.</i> (2009), Prasad and Junni (2016)
H1.2	Transactional leadership is positively related to lean implementation success, measured through the business performance	
H2.1	Transformational leadership is positively related to lean implementation success, measured through the practices implemented	Jung <i>et al.</i> (2003), Pongpearchan (2016), Rafferty and Griffin (2004)
H2.2	Transformational leadership is positively related to lean implementation success, measured through the business performance	
H3.1	Directive leadership is positively related to lean implementation success, measured through the practices implemented	Kahai <i>et al.</i> (2004), Liu <i>et al.</i> (2003), Lorinkova <i>et al.</i> (2013), Pearce and Sims (2002)
H3.2	Directive leadership is positively related to lean implementation success, measured through the business performance	
H4.1	Empowering leadership is positively related to lean implementation success, measured through the practices implemented	Dombrowski and Mielke (2013), Konczak <i>et al.</i> (2000)
H4.2	Empowering leadership is positively related to lean implementation success, measured through the business performance	

Table III.
Hypotheses to
be tested

available database with this information, we searched for companies that may have implemented the Lean, in various sources: (1) the pool of winners of the annual Kaizen Institute Portugal prize (several categories, several years), (2) the periodic newsletter of the Kaizen Institute Portugal and (3) LinkedIn (companies that have potentially implemented Lean). This effort led to the identification of 65 companies that have implemented Lean in Portugal. Subsequently, the questionnaire was launched online, and the leader of each

company's Lean implementation was contacted by e-mail (indistinctively, leaders from the Board or Lean practitioners).

The questionnaire was open from 13 August to 13 September, 2017 and the collected data was analyzed by IBM SPSS Statistics software (24.0 version).

5. Results

5.1 Descriptive analysis

From the 65 companies contacted, we only received 25 responses, which correspond to a response rate of 38 percent.

Most of the organizations (76 percent) are manufacturing industries, such as drinks, wood and cork, paper and cardboard, textile and automobiles industries. The remaining 24 percent includes, for example, construction, consulting, transport and administration organizations.

The number of employees is, on average, 680. Only one company has less than 50 employees, 54 percent have less than 250 and 46 percent above this number. Regarding the sales volume, the companies present average values of 170m (in euros), with 21 percent below 10m and 25 percent above 200m.

Concerning the Lean tools, organizations started to use them, on average, seven years ago. The helpfulness of this implementation in the achievement of organizations' goals was recognized by 92 percent of the leaders, with 96 percent of those recognizing a high or very high impact. In terms of financial profitability, most of leaders (92 percent) indicated that Lean implementation had a positive impact, high or very high in 61 percent of these cases. The Lean impact in market share was only recognized by 68 percent of leaders, and less than half (41 percent) indicated a high or very high impact.

In terms of the leadership style that leaders think that describes them better, the responses were almost equally distributed among the four styles. Transactional style was indicated by 20 percent of leaders, transformational collected 32 percent of the responses and the remaining percentage was divided by directive and empowering styles, with 24 percent each.

5.2 Empirical validation of the research hypotheses

This section describes and evaluates the proposed research hypotheses. The analysis is divided into two parts: first, the research hypotheses are tested, and then an analysis of the correlations is conducted.

To test the four types of hypothesis ($H1-H4$), the non-parametric Mann-Whitney test was applied. For the first type of hypotheses ($H1.1$, $H2.1$, $H3.1$ and $H4.1$), the groups were defined according to the part of the questionnaire corresponding to the implementation of Lean practices. One group corresponds to the companies that have currently implemented at least half of the practices included in the questionnaire (22 practices that is more than one

Dimensions	Total Items	Factors	Questionnaire Items
Supplier related	14	Supplier feedback	1-5
		JIT delivery	6-8
		Developing suppliers	9-12, 40, 41
Customer related	6	Involved customers	13-18
Internally related	23	Pull	19, 20
		Flow	21-25
		Low set-up	26, 27, 42
		Controlled processes	28-31, 43
		Involved employee	32-35
		Productive maintenance	36-39

Table IV.
Correspondence between questionnaire items and lean dimensions

half of the 43 items) and the other group was constituted by the companies with a lower number of Lean practices (less than 22). When the company answers “never” (level 1 in Likert scale), “rarely” (level 2) or “sometimes” (level 3), we considered that the practice is not fully implemented yet. When the answer is “fairly often” (level 4) or “very often, if not always” (level 5), we assumed it is implemented and make part of the company daily practices. We considered statistically significant the tests with a p -value $\leq \alpha = 0.05$. The results are presented in Table V.

There is only one null hypothesis that is rejected: the $H4.1$ (the p -value is 0.008), corresponding to the empowering leadership style. Thus, we reject the hypothesis that the level of empowering leadership is the same in the two defined groups, and we can say that there is significant statistical evidence that the empowering leadership style influences positively the success of Lean implementation. Concerning the other leadership styles (transactional, transformational and directive), as we cannot reject the null hypothesis ($H1.1$, $H2.1$ and $H3.1$) that the two samples median values are equal in the two defined groups, we cannot consequently conclude that these leadership styles have any impact on the Lean implementation success. This conclusion is in line with Aij *et al.* (2015), that recognizes employee empowerment as important when implementing Lean, and with Assen (2016), who concludes that a leadership based in the involvement of employees, by delegating authority and giving accountability, is positively related to the success of Lean and the use of Lean tools. Consequently, we can recommend to companies that are thinking about implementing Lean, to pay attention to the attitudes (dimensions) of this style: “delegation of authority,” “accountability,” “self-directed decision making,” “information sharing,” “skill development,” and “coaching for innovative performance.”

A similar analysis was carried out to test the other hypotheses ($H1b$, $H2b$, $H3b$ and $H4c$). Again, the Mann–Whitney was used, but now the groups were formed according to the fourth part of the questionnaire (impact on performance).

Concerning the financial profitability (the hypothesis with an “a” next to the name; e.g. $H1.2a$), one group corresponds to the companies that report no improvement on the financial profitability due to Lean implementation (when the company answers “very low” (1 in Likert scale), “low” (2) or “moderate” (3)) and the other was constituted by the companies that report an improvement (when the company answers “high” (4) or “very high” (5)). To test the remaining hypotheses, the companies were sorted among the two groups depending on the intensity of impact of Lean implementation on market share (the hypothesis with a “b” next to the name), and the achievement/reaching of the company’s goals (the hypothesis with a “c” next to the name). The results are presented in Table VI.

Taking into consideration the obtained p -values, it is not possible to reject none of the null hypotheses but $H3.2b$. By rejecting $H3.2b$, we reject the hypothesis that the level of directive leadership is the same in the two defined groups (the ones that have a market share improvement (success) and the ones that do not). We can say that there is significant statistical evidence that the directive leadership style is associated to the success (when measured by market share increase) of Lean implementation. Surprisingly, this association is negative, as the group of companies that have an increase in their market shares (i.e. have success) have a lower level of directive attitudes (an average of 3.57 vs an average of 4.17 in the other group).

Group	Hypotheses	Mann–Whitney U	Exact sig. (two tailed)	Decision ($\alpha = 0.05$)
Implementation of lean practices	$H1.1$	57.5	0.759	Not reject H_0
	$H2.1$	44.5	0.273	Not reject H_0
	$H3.1$	55.0	0.663	Not reject H_0
	$H4.1$	20.5	0.008	Reject H_0

Table V.
Results of Mann–Whitney tests

Table VI.
Results of Mann-Whitney tests

Group	Hypotheses	Mann-Whitney U	Exact sig. (two tailed)	Decision ($\alpha = 0.05$)
Financial profitability	<i>H1.2a</i>	59.5	0.347	Not reject H_0
	<i>H2.2a</i>	75.0	0.925	Not reject H_0
	<i>H3.2a</i>	57.5	0.289	Not reject H_0
	<i>H4.2a</i>	75.0	0.912	Not reject H_0
Market share	<i>H1.2b</i>	53.5	0.586	Not reject H_0
	<i>H2.2b</i>	61.5	0.942	Not reject H_0
	<i>H3.2b</i>	28.5	0.031	Reject H_0
	<i>H4.2b</i>	54.5	0.625	Not reject H_0
Achievement of the company's goals	<i>H1.2c</i>	24.0	0.503	Not reject H_0
	<i>H2.2c</i>	32.0	0.951	Not reject H_0
	<i>H3.2c</i>	15.0	0.140	Not reject H_0
	<i>H4.2c</i>	20.5	0.293	Not reject H_0

Consequently, we can infer that the companies whose leader has less directive attitudes have a greater success in their LM implementation. Then, we suggest that companies that plan to implement Lean pay attention to the dimensions of the directive leadership style, to avoid this kind of attitudes.

Concerning the other leadership styles (transactional, transformational and empowering), we cannot reject the null hypothesis that the two median values are equal in the two defined groups. Hence, we are not able to draw conclusions about the impact of those leadership styles on the LM implementation success as measured by the financial profitability, market share increase and achievement of the company's goals.

Figure 1 summarizes these results. The dashed bold arrows indicate hypotheses that are rejected. In all remaining cases, we cannot reject the null hypothesis.

The second part of this section includes an analysis of correlations, using the Spearman correlation test (with a level significance of 5 percent). Three correlations studies are performed: correlation between each pair of leadership styles; correlations between each leadership style and each measure of Lean implementation success; and correlation between each leadership dimension (attribute of the leader) and each measure of Lean implementation success.

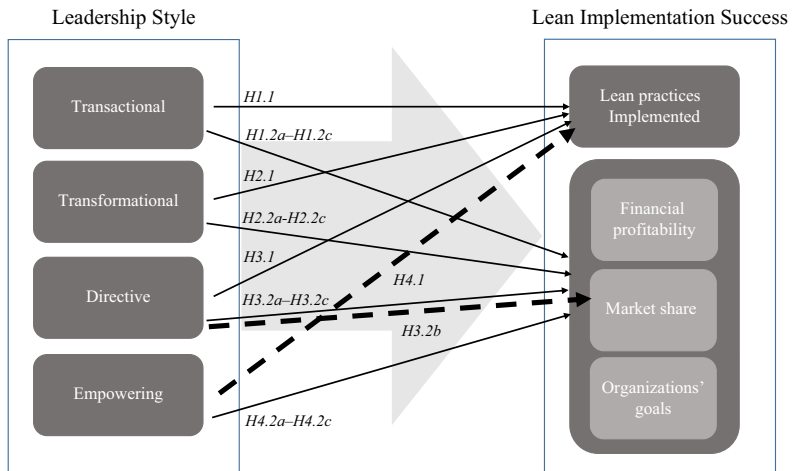


Figure 1.
Hypotheses validation

The correlation matrix containing the Spearman correlation coefficients for the leadership styles and the corresponding p -values (in brackets) are presented in Table VII.

All the styles are positively correlated with each other, as all p -values are below 0.05, except in the case of the correlation between the directive and the empowering styles that is only statistically significant at $\alpha = 0.10$. Despite being statistically significant, half of the correlation coefficients present values lower than 0.5, meaning that the correlation is not strong. The strongest correlation is between transformational and empowering leaderships, with a value of 0.687.

Since all correlations are significant, no leadership style is dominant—leadership styles seem to coexist in practice. The bootstrapped confidence intervals (confidence level of 95 percent), presented in Table VIII, reinforce this conclusion.

Despite the fact that leadership is considered a critical success factor for Lean implementation (Achanga *et al.*, 2006), there is no leadership style dominating. Thus, it may be claimed that it is the power of the leadership that influences Lean, instead of the power of the leadership style.

To assess the impact of the leadership style on the LM implementation success, we compute the Spearman coefficient between each leadership style and the success of the Lean implementation (as measured by the average number of LM practices implemented). Table IX shows the correlation coefficients (significance level of 5 percent) and the respective bootstrapped confidence intervals (confidence level of 95 percent).

The correlation between the empowering style and the Lean implementation success measure is significant, which seems to be confirmed by the respective confidence interval. This conclusion corroborates the empirical validation of *H1.4* previously presented.

With caution, we can conclude the same regarding the correlation between the transformational style and the Lean implementation success measure, as the p -value is

	Transactional	Transformational	Directive	Empowering
Transactional	1			
Transformational		0.544 (0.005)	0.474 (0.017)	0.655 (0.000)
Directive			0.469 (0.018)	0.687 (0.000)
Empowering				0.347 (0.089)
				1

Table VII. Spearman correlation coefficients among leadership styles

	Lower bound	Upper bound
Transactional–Transformational	0.11	0.84
Transactional–Directive	0.10	0.75
Transactional–Empowering	0.38	0.85
Transformational–Directive	0.09	0.74
Transformational–Empowering	0.39	0.91
Directive–Empowering	0.02	0.65

Table VIII. Confidence intervals of spearman correlation coefficients

	Transactional	Transformational	Directive	Empowering
Lean Correlation coefficient	0.088 (0.674)	0.347 (0.089)	0.154 (0.463)	0.530 (0.006)
Confidence interval	Lower bound	-0.36	-0.11	-0.23
	Upper bound	0.59	0.72	0.58

Table IX. Spearman coefficient correlation and confidence interval

somewhat high (9 percent) and the confidence interval is very wide (high uncertainty) and marginally contains zero. All the remaining correlations are not significant.

The last correlations tested are between each leadership dimension (attribute) and the Lean implementation success measure. The results are presented in Table X. The cells painted in gray refer to correlations statistically significant, the darkest at 5 percent of significance and the lighter at 10 percent.

Several dimensions (belonging to different leadership styles) significantly correlate with the Lean implementation success measure: “individualized consideration,” “information sharing,” “skill development,” “intellectual stimulation,” “assigned goals,” and “self-directed decision making.”

Consequently, it is suggested to companies to be aware of the importance of leadership in the success of Lean implementation and, more than just adopting a single style, adopt attitudes akin the dimensions just mentioned.

6. Conclusion

Leadership has been identified as a critical success factor of Lean implementation. The purpose of the present study was to identify what is the impact of leadership style on the success of Lean implementation, and find out the most important leader attributes that facilitate LM implementation. To accomplish that goal, a questionnaire was developed and distributed to 65 Portuguese companies that have implemented LM. The results suggest that empowering leadership has a positive impact in the success of Lean implementation (measured through the implementation of Lean practices). Therefore, we can recommend to companies that are thinking about implementing Lean, to pay attention to the attitudes of the leaders associated to this style: “Delegation of authority,” “accountability,” “self-directed decision making,” “information sharing,” “skill development,” and “coaching for innovative performance.” When the Lean implementation success was measured through the increase of market share, the directive leadership showed a negative impact. Consequently, we suggest to companies taking into consideration the dimensions of this directive style (assigned goals, and instruction and command). Moreover, we identified that none of the leadership style proved to be dominant. This seems to suggest that it is the power of leadership that influences LM, instead of the power of leadership style. Accordingly, when testing separately which leader’s attributes are more important in the success of Lean implementation, several dimensions exhibited statistical

Table X.
Spearman correlation coefficient between each leadership dimensions and the lean implementation success measure

Attributes	Lean management	
	Correlation coefficient	Sig. (two tailed)
Contingent reward	0.142	0.498
Management by exception active	0.131	0.534
Idealized influence—attributed	0.186	0.374
Idealized influence—behavior	0.204	0.327
Inspirational motivation	0.199	0.341
Intellectual stimulation	0.337	0.099
Individualized consideration	0.401	0.047
Assigned goals	0.358	0.079
Instruction and command	0.060	0.776
Delegation of authority	0.318	0.121
Accountability	0.259	0.211
Self-directed decision making	0.335	0.100
Information sharing	0.447	0.025
Skill development	0.592	0.002
Coaching for innovative performance	0.171	0.414

significance: “Individualized consideration,” “information sharing,” “skill development,” “intellectual stimulation,” “assigned goals” and “self-directed decision making.” Consequently, organizations that are in the beginning of the LM implementation process should be aware of the importance of leadership and, more than just adopting a single style, adopt attitudes related to these attributes.

6.1 Limitations and future research

Our work has a few limitations. One of them is that it does not distinguish Lean implementation phases. Another one is it does not discriminate between tiers of leadership—it considers only the leader responsible for Lean implementation. The enumerated limitations justify further research effort to overcome them.

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(The Appendix follows overleaf.)

Appendix. Questionnaire structure

I. General information about the company

1. Job role in the company
2. Company activity sector
3. Sales volume (in euros) in 2017
4. Number of employees (2017)

II. Assess the leadership style

This part of the questionnaire consists of 38 items and corresponds to an adaptation of three questionnaires: the Avolio and Bass (2004) Multifactor Leadership Questionnaire (form 5X-Short), the Leader Empowering Behavior Questionnaire of Konczak *et al.*'s (2000), and the questionnaire developed Pearce and Sims (2002).

(1)not at all (2)once in a while (3)sometimes (4)fairly often (5)frequently, if not always

		1	2	3	4	5
1.	I ensure that continuous learning and skill development are priorities in my department					
2.	I spend time teaching and coaching					
3.	I help others to develop their strengths					
4.	I give instructions to others on how to carry out their work					
5.	I encourage others to use systematic problem-solving methods					
6.	I get others to look at problems from many different angles					
7.	I try to help others arrive at their own solutions when problems arise, rather than telling them what they would do					
8.	I encourage others to develop their own solutions and make their own decisions about problems they encounter in their work					
9.	I suggest new ways of looking at how to complete assignments					
10.	I re-examine critical assumptions to question whether they are appropriate					
11.	I encourage others to try out new ideas even if there is a chance they may not succeed					
12.	I am willing to risk mistakes on others part if, over the long term, they will learn and develop as a result of the experience					
13.	I seek differing perspectives when solving problems					
14.	I consider an individual as having different needs, abilities, and aspirations from others, and not just as a member of a group					
15.	I focus on corrective action rather than placing blame when others make a mistake					
16.	I focus attention on irregularities, mistakes, exceptions, deviations from standards and complaints					
17.	I keep track of all mistakes					
18.	I direct my attention toward failures to meet standards					
19.	I display a sense of power and confidence					
20.	I give others the authority they need to make decisions and changes that improve work processes and procedures					
21.	I delegate authority to others that is equal to the level of responsibility that they are assigned					
22.	I provide others with assistance in exchange for their efforts					
23.	I discuss in specific terms who is responsible for achieving performance targets, and those are held accountable for results					
24.	I make clear what one can expect to receive when performance goals are achieved					
25.	I express confidence that goals will be achieved					

26.	I express satisfaction when others meet expectations					
27.	I establish others' performance goals					
28.	I hold people in the department accountable for customer satisfaction					
29.	I provide others with the information they need to meet customers' needs					
30.	I share information that others need to ensure high quality results					
31.	I specify the importance of having a strong sense of purpose					
32.	I consider the moral and ethical consequences of decisions					
33.	I emphasize the importance of having a collective sense of mission					
34.	I talk enthusiastically about what needs to be accomplished					
35.	I talk optimistically about the future, articulating a compelling vision					
36.	I talk about my most important values and beliefs					
37.	I instill pride in other for being associated with me					
38.	I act in ways that build others' respect for me					

III. Assess Lean manufacturing implementation

The 43 items presented below (adapted from the topics developed by Shah and Ward, 2007) provide a description of practices related to lean in the manufacturing system/service provision of a company.

(1)never (2)rarely (3)sometimes (4)fairly often (5)frequently, if not always

		1	2	3	4	5
1.	We are in close contact with our suppliers					
2.	Our suppliers visit our plants					
3.	We visit our suppliers' plants					
4.	We give our suppliers feedback on quality and delivery performance					
5.	We strive to establish long-term relationship with our suppliers					
6.	Suppliers are directly involved in the new product/service development process					
7.	Our key suppliers deliver to plant on JIT (just-in-time) basis					
8.	We have a formal supplier certification program					
9.	We have corporate level communication on important issues, with key suppliers					
10.	We take active steps to reduce the number of suppliers in each category of products/consumables					
11.	Our key suppliers manage our inventory (concerning the component they provide)					
12.	We evaluate suppliers on a basis of total cost and not per unit price					
13.	We are in close contact with our customers					
14.	Our customers visit our plants					
15.	Our customers give us feedback on quality and delivery performance					
16.	Our customers are actively and directly involved in current and future product/service offerings					
17.	Our customers share current and future demand information with marketing department					
18.	We conduct customer satisfaction surveys					
19.	Production decisions are made only after the arrival of an order or need for an intermediate product (ie, production is "pulled" by the shipment of finished goods)					
20.	We use Kanban***, squares, or containers of signals for production control					
21.	Products/services are classified with similar processing /service provision requirements					
22.	Products are classified with similar production/ service provision routing requirements					
23.	Equipment is grouped to produce a continuous flow of families of products (or to provide a continuous service)					
24.	Families of products/services determine our factory layout					
25.	Pace of production/service provision is directly linked with the rate of customer demand					
26.	Our employees practice the preparation/set-up of the equipment to reduce the time required to start up (set-up)					
27.	We are working to lower set-up times of production/preparation of equipment in our company					

28.	We use statistical techniques to reduce production process/service provision variance					
29.	Charts showing defect rates are used as tools on production/service provision area					
30.	We use fishbone type diagrams to identify causes of quality problems					
31.	We conduct production/service provision process capability studies before product/service launch in the market					
32.	Production/service provision employees are key to problem solving teams					
33.	Production/service provision employees drive suggestion programs					
34.	Production/service provision employees lead product/process improvement efforts					
35.	Production/service provision employees undergo cross functional training					
36.	We dedicate a portion of everyday to planned equipment maintenance related activities					
37.	We provide maintenance to all our equipment					
38.	We maintain excellent records of all equipment maintenance related activities					
39.	We post equipment maintenance records on shop-floor for active sharing with employees					

* *Just in time* means "at the defined time (neither advanced nor late) and the defined quantity"

**Pull production is based on demand

** Kaban is a Japanese word that means "visual signal"

(1)none (2)very little (3)some (4)substantial (5)very much/all

		1	2	3	4	5
40.	Our suppliers are contractually committed to annual costs reduction					
41.	Our key suppliers are located in close proximity to our plants					
42.	The machines in our plant have low setup times					
43.	Our equipment/ processes in the production area are currently being controlled using a statistical process quality control tool					

IV. Awareness about lean manufacturing

1. How long (years) has the company been using Lean tools
2. Lean implementation has improved production/service provision processes (e.g. production time, less waste)?
(1)very low (2)low (3)moderate (4)high (5)very high
3. Lean implementation in the organization has increased its financial profitability (e.g. profit)?
(1)very low (2)low (3)moderate (4)high (5)very high
4. Lean implementation in the organization has increased its market share?
(1)very low (2)low (3)moderate (4)high (5)very high
5. Has Lean been successful in reaching goals/expectations of your organization?
(1)very low (2)low (3)moderate (4)high (5)very high

V. Awareness about leadership style

1. Please identify the leadership style that best describe your behavior. Order them from 1 (the most similar to your style) to 4 (the less similar).
 - Recognize accomplishments and promise rewards for good performance and effort (Transactional)
 - Expand the interests of the employees and incentive the employees to look for the good of the group instead of looking to the personal good (Transformational)
 - Recognition of the potential of the employees, giving them power rather than directing them (Empowering)
 - Engages in providing direction and assigning goals to the followers (Directive)

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