

Implementation of lean manufacturing and situational leadership styles

An empirical study

Guilherme Tortorella

Federal University of Santa Catarina, Florianópolis, Brazil, and

Flávio Fogliatto

*Federal University of Rio Grande do Sul,
Porto Alegre, Brazil*

Abstract

Purpose – The purpose of this paper is to determine leadership styles at each hierarchic level that best support the LM implementation process in a given company.

Design/methodology/approach – To achieve that, the authors propose a method that combines information from two sources in three major steps. First, using opinions from experts on lean implementation from an activity sector of interest the authors determine leadership styles that best suit each phase of the LM roadmap for that sector. Next, the authors analyze a specific company within the activity sector to determine: at which lean roadmap phase the company is at the moment; and the style of its current leaderships at each hierarchical level. Finally, the authors combine information from previous steps to diagnose the suitability of company's leaderships to its lean implementation needs.

Findings – The method points at improvement alternatives that may be developed simultaneously at different leadership hierarchical levels in companies. Further, using the matrix of ideal leadership styles, companies may be able to identify implementation phases in the lean process that are poorly served by current leadership styles, anticipating problems and developing HRM practices to mitigate them. That is quite relevant, since changes in leadership behaviors and expectations may take longer time to be implemented; therefore, it is important to understand these opportunities and have a clear vision of current gaps within the company.

Originality/value – The identification of leaderships' attributes and behaviors in companies at different phases of the lean implementation roadmap contributes to the existing body of knowledge on lean manufacturing. The method is intended as a supporting tool for lean implementation, as it enables the assessment of gaps in leadership behaviors in the organization, and directs to improvements according to the phase of lean implementation. The goal is to complement existing lean roadmaps by driving improvements in leadership-related aspects of the implementation process.

Keywords Leadership styles, Empirical study, Lean manufacturing implementation

Paper type Research paper

Corrigendum: It has come to the attention of the publisher that the article Guilherme Tortorella and Flávio Fogliatto (2017) "Implementation of lean manufacturing and situational leadership styles: an empirical study", published in *Leadership & Organization Development Journal*, Vol. 38, No. 7, did not reference one source drawn upon. This was: Guilherme Luz Tortorella, Diego de Castro Fettermann, and Carlos Ernani Fries, "Relationship between lean manufacturing implementation and leadership styles", *Proceedings of the 2016 International Conference on Industrial Engineering and Operations Management*, Detroit, Michigan, USA, 23–25 September, 2016.

Another article, Tortorella, G.L. and Fogliatto, F.S. (2014) "Method for assessing human resources management practices and organisational learning factors in a company under lean manufacturing implementation", published in *International Journal of Production Research*, Vol. 52 No. 15, pp. 4623-4645, <https://doi.org/10.1080/00207543.2014.881577>, was included in the reference list but was not sufficiently referenced in the text of the article. The author guidelines for *Leadership & Organization Development* state that sources must be fully referenced. The author sincerely apologises for this.



1. Introduction

Lean manufacturing (LM) implementation promotes significant changes in the managerial systems of companies, across the organizational levels (Karlsson and Ahlstrom, 1996; Wan and Chen, 2008). To succeed in such process the literature emphasizes the importance of an underlying culture of lean practices, a fundamental element for its long-term sustainability (Hines *et al.*, 2004; Bhasin and Burcher, 2006). Leaders play a crucial role in the establishment of such lean culture (Shook, 2010); they have the responsibility of influencing individuals and directing them to achieve strategic objectives (Sethuraman and Suresh, 2014). According to House *et al.* (2004), the implementation of lean practices creates expectations regarding leaderships' attributes and behaviors. Mann (2009) reinforces that 20 percent of the effort in the lean transformation process relates to the implementation of lean practices and tools, while 80 percent focuses on changing leaders' behaviors.

Previous studies have focused on lean leadership (Womack and Jones, 2003; Spear, 2004; Doss and Orr, 2007) highlighting the importance of attributes such as commitment and communication skills. A common belief is that leaders in companies undergoing lean implementation must be cooperative, delegators and excellent motivators of personnel (Angelis *et al.*, 2011; Pamfilie *et al.*, 2012). Further evidence suggests that in order to implement a change process such as LM successfully, organizations need to have transformational leaders at the top (Suresh *et al.*, 2012) emphasizing the desired behaviors toward the expected culture and outcomes, which must be carried out by transactional leaders in middle management ranks (Emiliani, 2008; van Dun *et al.*, 2017). However, detailed descriptions of the desirable attributes and styles of leadership along the evolution of lean implementation have not been provided in the literature. Such gap was reported by Liker (2004), Mann (2009), Rother (2009), Dibia (2012), Liker and Convis (2011), Marodin and Saurin (2013), and Dombrowski and Mielke (2014).

Several studies addressed the subject of lean implementation maturity assessment (Karlsson and Ahlstrom, 1996; Shah and Ward, 2007; Wan and Chen, 2008; Tortorella and Fogliatto, 2014). In general, these studies relate the adoption level of lean to corresponding required human resources management (HRM) practices. Specifically, Gelei *et al.* (2015) investigate leadership attributes that contribute to (or inhibit) a successful lean implementation. Although addressing the topic of this paper the authors perform a *post hoc* analysis focusing on high maturity companies such as Toyota, and disregard the evolutionary nature of the implementation process, and its resulting demands for adaptive and transient leaderships' attributes and styles (Emiliani and Stec, 2004; Marksberry, 2010). In this sense, many other organizations are struggling to succeed in LM implementation due to a number of limiting factors (Emiliani and Stec, 2005; Albliwi *et al.*, 2014). The relevant question that arises here is whether different styles of leadership are determinant in transforming LM results into organizational success (Emiliani and Emiliani, 2013). It is our belief that not only LM management principles must be taken into account as a leadership contextual factor, but also the phase of lean implementation in which the company is.

Thus, based on the aforementioned arguments, two research questions arise:

RQ1. Which leadership styles best support the phases of LM implementation?

RQ2. How do leadership styles vary across different organizational hierarchical levels?

This article aims at determining leadership styles at each hierarchic level that best support the LM implementation process in a given company. To achieve that we propose a method that combines information from two sources in three major steps. First, using opinions from experts on lean implementation from an activity sector of interest we determine leadership styles that best suit each phase of the LM roadmap for that sector. Next, we analyze a specific company within the activity sector to determine: (i) at which lean roadmap phase the company is at the moment; and (ii) the style of its current leaderships at each hierarchical level. Information in (i) is obtained through semi-structured interviews with the company's

executives; information in (ii) is gathered applying the situational leadership (SL) questionnaire proposed by Blanchard (2010) to the company's leaders. Finally, we combine information from previous steps to diagnose the suitability of company's leaderships to its lean implementation needs. Our method thus integrates elements from the SL model to LM implementation roadmaps, bridging a gap observed in the literature. Our propositions are illustrated in a case study from the automotive parts manufacturing sector. We investigate a large-sized company that has been continuously implementing LM practices for the past 15 years, although not adopting an integrated and sustainable lean change approach, particularly regarding the development of leadership styles.

The identification of leaderships' attributes and behaviors in companies at different phases of the lean implementation roadmap contributes to the existing body of knowledge on LM. Our method is intended as a supporting tool for lean implementation, as it enables the assessment of gaps in leadership behaviors in the organization, and directs to improvements according to the phase of lean implementation. Our goal is to complement existing lean roadmaps by driving improvements in leadership-related aspects of the implementation process. We are not aware of any other method that is comparable to ours regarding its objectives.

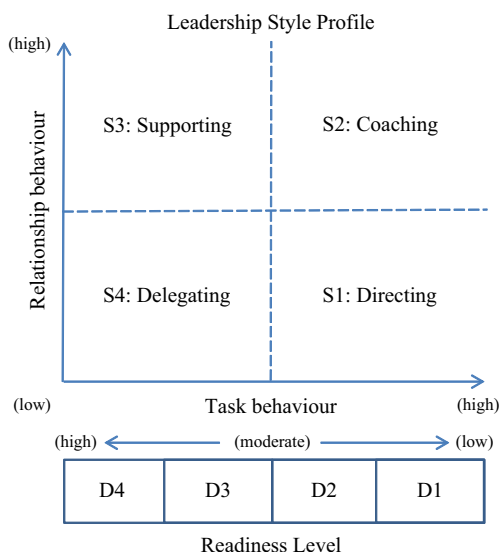
This rest of this paper is structured as follows. Section 2 gives a brief overview of the literature on SL and lean implementation roadmaps. Section 3 describes the proposed method, with results of its application in a large-sized auto parts manufacturer presented in Section 4. Section 5 closes the paper presenting conclusions and future research opportunities.

2. Background

2.1 Leadership style

Although the subject of leadership has been extensively studied, researchers still struggle to provide a clear definition of leadership or to develop a concise set of behaviors and styles that all successful leaders should follow (Northouse, 2010). Leaders present different views, values, visions and methods guiding their perception of individual success, and the actions they should pursue to make their teams succeed. In view of that, many different leadership theories have emerged; examples are the trait theory, behavioral theories, contingency theories, leader-member exchange theories, and others. Each one is based on the leaders' ability to influence a team toward a common goal (Robbins and Judge, 2011). van Eeden *et al.* (2008), for instance, argue that the most effective leaders display a balanced combination of different styles. Avolio (2011), following a similar rationale, emphasizes the importance of balancing three leadership styles; namely: laissez-faire, transactional, and transformational. Such styles may be positioned on a continuum where the least people-concerned style is laissez-faire, transactional leadership comprises the logic of exchanging promises of rewards and benefits to subordinates, to promote their fulfillment of agreements, and transformational leadership is designed to help employees achieve their goals by building commitment.

Further, Hersey and Blanchard's (1969; Hersey *et al.*, 2001) SL model is one of the best-known leadership characterization models (Yukl, 2006). The SL model provides a means to effectively change individuals' working habits through cooperation and communication to enhance productivity (Hartnell and Walumbwa, 2011; Pasaribu, 2015). SL is grounded on three leadership dimensions, two of them associated with leadership style: relationship behavior (*R*), and task behavior (*T*). The model considers two levels for these dimensions, high and low; when combined, the dimensions lead to four categories: S1 (low *R*, high *T*) – guiding, telling or directing; S2 (high *R*, high *T*) – explaining, selling or persuading; S3 (high *R*, low *T*) – encouraging, participating or problem-solving; and S4 (low *R*, low *T*) – observing, delegating or monitoring; see Figure 1. Further, the SL model indicates that the most effective leadership style is determined by the individual's "performance readiness level" (Papworth *et al.*, 2009). There are four levels of readiness; they are: D1 – individuals lack both ability and commitment, or competence; D2 – individuals lack ability, but are motivated or confident; D3 – individuals



Source: adapted from Hersey and Blanchard (1969)

Figure 1.
Leadership
style profile and
performance readiness

have ability, but are not willing to use it; and D4 – individuals have the competence to perform, and are committed or confident.

Effectiveness is maximized by matching the leadership style category to individuals' readiness level (Maj, 2011). For example, a D1 individual would perform better under a "directing" leader (S1). As individuals become more mature, their readiness increases and the ideal leadership style changes accordingly (Aric, 2007). A key assumption of the SL model is that it is possible to determine the appropriate leadership style in response to individuals' readiness level. While leadership styles seem well understood, assessing individuals' readiness with respect to a specific leadership style tends to be more challenging (Graeff, 1997; Thompson and Glaso, 2015). Individuals may accept or reject a leader, whose style flexibility seems to deliver greater performance (Avery and Ryan, 2002).

Complementing the SL model, Fiedler's contingency theory (Yukl, 2006; Thompson and Vecchio, 2009) states that leadership effectiveness is a function of the relationship between a leader's style, which varies according her personality and working environment (Leskiw and Singh, 2007), which is affected by situational aspects that enable a leader to influence her followers (Shaun, 2007; Maj, 2011). Sethuraman and Suresh (2014) propose the use of Myers Briggs Type Indicator (a psychological instrument) to map leaders' personality and interests, and identify the influence on leadership styles. The authors argue that self-awareness is essential for enhancing leadership skills.

The Leadership Effectiveness and Adaptability Description (LEAD) survey, developed by Hersey and Blanchard (1969), exposes respondents to different workplace situations and asks for answers that describe how respondents would react to them. The objective is to determine how leaders behave on the job and the propensity to adapt the leadership style. Several references (Blanchard *et al.*, 1985; Hersey and Blanchard, 1996; Chen and Silverthorne, 2005; Blanchard, 2010; Bates, 2014) report the application of LEAD as a supporting tool to assess leadership style and adaptability. However, some authors (Thompson and Glaso, 2015) do not advocate the use of LEAD since the instrument's reliability cannot to be established. Alternatively, some researchers (Kao, 2005; Liu, 2005; Littrell *et al.*, 2012) have adopted Stogdill's (1974) Leader Behavior Description Questionnaire-XII due to its desirable

psychometric properties. Criticism of the SL model among scholars (Vecchio *et al.*, 2006; Vroom and Jago, 2007; Thompson and Vecchio, 2009) contrast with the model's popularity among practitioners (Avery and Ryan, 2002; Bates, 2014; Jain and Chaudhary, 2014). The continued applicability of the model is reinforced by the recent appearance of a revised version of its main data collection instrument, the leadership style questionnaire (Blanchard, 2010), which is used in our propositions.

The forerunner of LM implementation is Toyota Motor Corporation, which is commonly viewed as benchmark in terms of lean leadership (Liker and Convis, 2011). The culture of leadership at Toyota was shaped by the personalities, values and experiences of the company's founders, which provided the features that distinguish the Toyota leadership style; namely, the readiness to face seemingly unattainable objectives and the requirement for leaders to thoroughly become familiar with the company's operation, being personally involved with it (Trenkner, 2016). Behaviors and styles of lean leaders are viewed as paradoxical: on one hand, they must encompass technical knowledge (e.g. management based on facts, and analysis and adherence to standard operating procedures for efficiency and effectiveness); on the other hand, social aspects such as empowerment and collaboration to boost creativity and stimulate innovation must also be contemplated (Assen, 2016). That produces leaders who tend to act meticulously and manage consistently, while being able to stand back and empower employees in order to foment creativity and improvements (Lam *et al.*, 2015).

Table I consolidates findings from studies exploring the integration of leadership behaviors and styles, and LM implementation. Those studies present complementary approaches aimed at providing a better understanding on the relationship between LM and leadership styles. Although providing evidence of a growing body of literature on that

Author(s)	Findings
Emiliani and Stec (2005)	Present common leadership obstacles and identify common implementation errors that must be avoided to realize the full benefits of an LM system
Emiliani (2008)	A practical framework for implementing standardized work may be created in relation to strategic (long term) and daily (short term) tasks of executive leaderships by providing a new definition of leadership, a precise description of business principles, and a standard set of skills and behaviors for executives
Found <i>et al.</i> (2009)	Both top and middle management need to adopt double-loop learning to improve their management and leadership skills over time, to sustain LM
Marksberry (2010)	The roles of team leader and group leader share many rights and obligations. Such insight provides increased understanding of the training and development needs of team leaders in socio-technical LM environments
Marksberry <i>et al.</i> (2010)	Jishukens may be extremely effective to develop in managers the ability to conduct and teach others to conduct daily kaizen and problem solving activities. That may support managers to communicate, coach and teach problem solving to their followers
Marksberry and Hughes (2011)	Toyota promotes a fair distribution of time between office and shop floor for executives and managers, vertically oriented training relationships with followers, and an emphasis on the culture mindset behind the Toyota Production System
Steed (2012)	Identified the need to have a strong combination of personal characteristics, learned behaviors, strategies, tools, and tactics that evolved into a starting adaptable framework for health care leaders to leverage when starting their own transformational change journeys using the lean system
Dombrowski and Mielke (2014)	Based on previous studies, 15 practice-oriented requirements were theoretically identified in leadership during LM implementations
Gelei <i>et al.</i> (2015)	Five leadership behaviors were identified. None of them were inhibitors. Surprisingly, a theoretical inhibitor type of behavior, denoted as micromanagement, proved to be a contributor
van Dun <i>et al.</i> (2017)	Effective LM middle managers engage more in positive relation-oriented than task-, change- and counterproductive behaviors

Table I.
 Studies integrating
 LM and leadership
 behaviors and styles

relationship, they do not cover the research gap on leadership styles prescribed to achieve successful and sustainable widespread mobilization in companies, in different phases of LM implementation.

2.2 *Lean implementation roadmaps*

The literature on LM is prolific (Marodin and Saurin, 2013), and several lean implementation roadmaps have been proposed, some of which are discussed here. Liker and Meier (2007) recommend that LM implementation processes should start by addressing the 4P's (philosophy, process, people, and problem solving). Following the recommendation, the Lean Enterprise Institute (LEI) (2010) proposes a roadmap in which the first step is the establishment of a training program to develop the principles of lean thinking in individuals. The first goal is to develop expertise on Value Stream Mapping, in order to avoid the common mistake of applying single techniques instead of creating a system that builds a lean value stream. Although not emphasizing the importance of assessing the LM implementation level, the roadmap in LEI (2010) is flexible and allows customization according to the application environment and stage of change in which the organization is positioned.

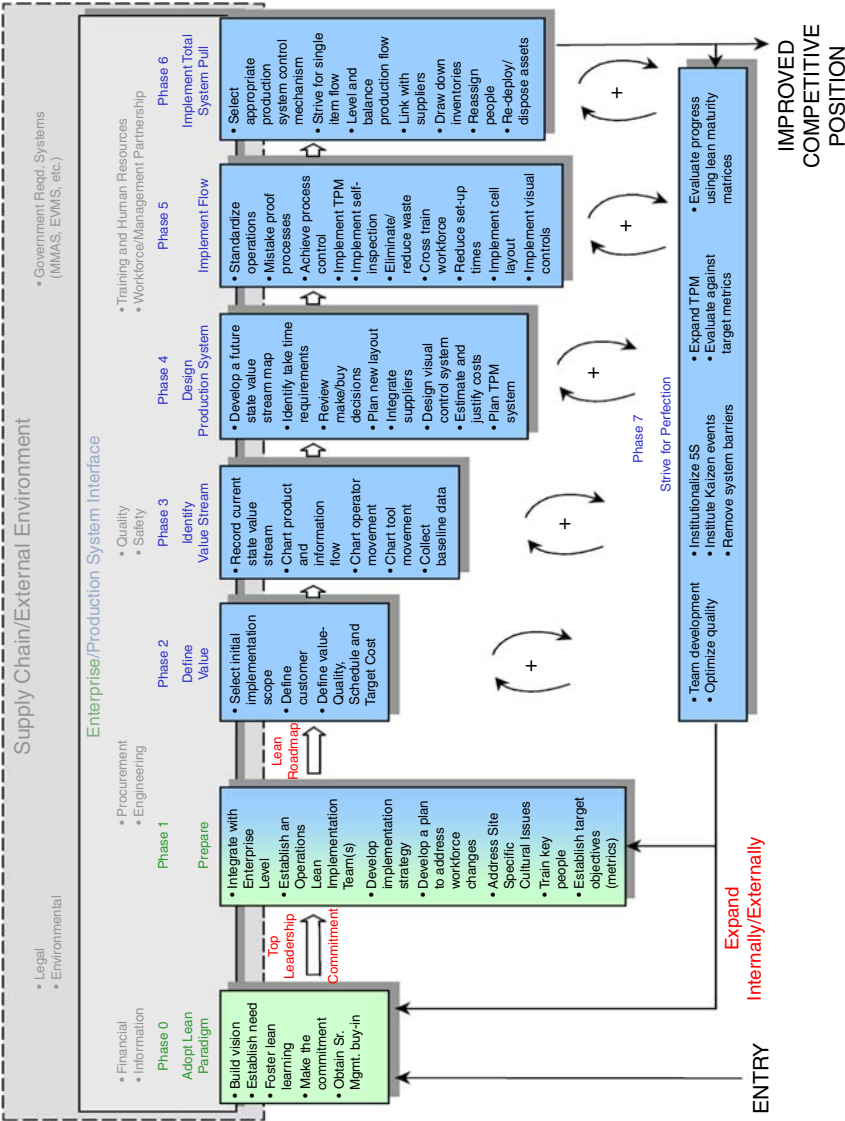
Productivity Inc. (2010) presents a model comprised of five phases to guide the LM implementation. The model provides a sequence of steps which emphasize the importance of teamwork as a basis for lean implementation; however, it does not motivate a sense of "need for change," which should be strongly linked to the decision of adopting LM.

Crabill *et al.* (2000/2010) describe the Lean Enterprise Model (LEM), which aims at establishing a systematic implementation of lean principles and practices, and therefore integrates perspectives from engineering, human resources and the business itself. The LEM, comprised of eight implementation phases (see Figure 2), was based on six already tested transition models, providing a guide for transforming an existing production operation to one that fully implements LM. Each LEM phase ensures that tasks prescribed in prior phases are finished or are being addressed, before proceeding to the next phase. However, the LEM model does not provide a means to identify leadership style needs in the organization at each roadmap phase; that is addressed in the method presented in the next section.

3. Proposed method

The proposed method identifies desirable leadership attributes and behaviors at different phases of the lean implementation roadmap (step (i)). For that, it uses a relationship matrix based on expert opinion that correlates leadership styles at different hierarchical levels with phases of the LEM roadmap (Crabill *et al.*, 2000/2010). The application of relationship matrices based on expert opinion collected through semi-structured interviews is a common method, and has been reported in recent studies on LM (e.g. Marodin and Saurin, 2013; Tortorella and Fogliatto, 2014; van Dun *et al.*, 2017). Next, focusing on a company under lean implementation, it maps the current leadership styles (step (ii)) using the LEAD instrument proposed by Hersey and Blanchard (1969) and reviewed by Blanchard (2010), which is acknowledged for its ease of application and interpretation (Avery and Ryan, 2002; Bates, 2014). Finally, current and prescribed leadership styles are compared, and managerial improvements are proposed (step (iii)). The steps outlined here are detailed in the following paragraphs.

In step (i), the objective is to establish ideal leadership styles for each phase of the LEM roadmap (aligned with previous studies in the literature; e.g. Nightingale and Mize, 2002; Tortorella and Fogliatto, 2014), providing a more integrated view of the organization undergoing lean implementation. To accomplish that, we propose using a relationship matrix **M** with entries giving the adequacy of having a leader with a given style coordinating the activities demanded in a given LEM roadmap phase. The general structure of the proposed matrix is depicted in Figure 3. In matrix **M**, a leadership style S_i ($i = 1, \dots, 4$)



Source: Adapted from Crabill *et al.* (2010)

Figure 2.
Lean implementation
roadmap

Hierarchic level	Leadership style	LEM implementation roadmap phases							Importance of leadership style for lean implementation
		Phase 0: Adoption of Lean Paradigm	Phase 1: Prepare implementation	Phase 2: Define value	Phase 3: Identify flow of value	Phase 4: Design production system	Phase 5: Implement flow	Phase 6: Implement pull system	Phase 7: Look for perfection
h_1 : TL	S1: Directing	m_{ij}							l_{11}
	S2: Coaching								l_{12}
	S3: Supporting								l_{13}
	S4: Delegating								l_{14}
h_2 : GL	S1: Directing	m_{ij}							l_{21}
	S2: Coaching								l_{22}
	S3: Supporting								l_{23}
	S4: Delegating								l_{24}
h_3 : AM	S1: Directing	m_{ij}							l_{31}
	S2: Coaching								l_{32}
	S3: Supporting								l_{33}
	S4: Delegating								l_{34}
h_4 : GM	S1: Directing	m_{ij}							l_{41}
	S2: Coaching								l_{42}
	S3: Supporting								l_{43}
	S4: Delegating								l_{44}

Figure 3.
Matrix M

at each hierarchical level h_k ($k = 1, \dots, 4$) is evaluated, regarding its adequacy, in implementation phase p_j ($j = 1, \dots, 8$) of the LEM roadmap. The intensity of the relationship (meaning adequacy) between each style and phase is given by m_{ij} , and written in the intersection between row i and column j . Intensities are expressed using a 12-point continuous scale, where 0 indicates no relationship and 12 indicates maximum intensity of relationship, as suggested by Blanchard (2010).

Relationships in **M** were gathered through interviews with eight experts. Expert selection was guided by individuals' experience in lean implementation. Individuals selected had at least 15 years of experience in LM implementation in large automotive companies. The experts provided answers to the following question: "for hierarchical level h_k , how adequate is a leader with style S_i in lean implementation phase p_j ?" To adhere to the metrics proposed in the LEAD instrument, we normalized the scores assigned by experts to a certain phase for each leadership style within each hierarchical level, such that the sum of scores is always 12. Thus, experts assign scores using a 12 point-scale, and the sum for the four styles within each hierarchical level and in the same phase will also yield 12. Expert's responses were consolidated in matrix **M** using the average of responses, weighted by each expert's years of experience; see Table II.

M is the theoretical basis for determining the ideal leadership style for the LEM phases. We recommend using **M** when assessing leadership styles in companies from the automotive sector, or sectors with similar characteristics. In general, the overall importance l_{hi} of style i and level h over all LEM phases is given as follows:

$$l_{hi} = \frac{\sum_{j=1}^8 m_{ij}}{8}, \quad h = 1, \dots, 4; \quad i = 1, \dots, 4 \tag{1}$$

In step (ii) the objective is to identify predominant leadership styles in the company under study, at different hierarchical levels. For that, we adapted the LEAD, originally developed by Hersey and Blanchard (1969), to be used in an organizational environment undergoing lean implementation. The new questionnaire, comprised of 12 questions related to leadership behaviors, is aimed at four hierarchical levels within the company, as proposed by Mann (2009) and Liker (2004); they are: team leader (TL), group leader (GL), assistant manager (AM), and general manager (GM). At each level, the primary (adopted most frequently) and secondary (adopted as backup) leadership styles are identified, as well as the leader's adaptability level. The adapted questionnaire is presented in the Appendix. Respondents were selected according to their roles and functions within the studied company, in order to illustrate the preferred behaviors and styles from leaders of the four levels aforementioned.

In step (iii) the objective is to identify which LEM roadmap phase the company is currently implementing. For that, we propose the use of semi-structured interviews (Ribeiro and Newmann, 2012) with senior managers. Finally, comparing the existing leadership

Table II.
 Experts'
 experience profile

Expert	Years of experience in lean implementation	Relative importance weight (%)
E1	21	11
E2	15	8
E3	34	18
E4	25	13
E5	27	14
E6	18	10
E7	29	15
E8	19	10
Total	188	100

styles in the company with the ideal styles prescribed for the LEM phase the company is in, it is possible to address gaps in leadership style within each hierarchical level through improvement projects.

4. Case study

We now illustrate the application of our propositions in a case study. The multinational company under analysis is an automotive parts manufacturer located in the south of Brazil. Level of product customization is medium, and manufacturing processes are organized in assembly lines and cells. A total of 1,600 employees work at the company, and the total annual revenue is around US\$360 million.

In order to address continuous improvement formally, the company promoted in 2003 a new project named Lean Enterprise. The objectives were: set a standard approach to continuous improvement in the company; create an environment where individuals were encouraged to identify improvement opportunities; and enable them to solve problems through the use of lean practices (Tortorella and Fogliatto, 2014).

Since 2003 company employees displayed an evolution in the level of knowledge related to lean practices. That was due to the promotion of workshops and training offered to employees, as well as the practice of kaizen activities throughout the company. In those initiatives, technical factors of lean implementation were addressed and discussed. Despite the company's support to continuous improvement, the lean implementation committee and senior management still perceived that the lean implementation was mainly practice-oriented, disregarding leadership development or not emphasizing it. That was undermining attempts to implement new lean practices and hindering the evolvement in lean implementation. In interviews with the lean implementation committee, most of its members attributed the difficulty in sustaining lean practices to the lack of a complementary approach aimed at promoting leadership behavior consistent with the process of lean implementation. To address that problem the proposition in Section 3 was applied in the company, with results presented next (Tortorella and Fogliatto, 2014).

The LEAD (Hersey and Blanchard, 1996) was applied to leaders of one of the six manufacturing units of the company. According to senior management, that unit presents the highest level of lean implementation. The sample of respondents had 18 TLs, nine GLs, three AMs and one GM, all from the same manufacturing unit. Their leadership experience and roles are described in Table III.

Figure 4 shows the existing leadership styles' preferences of each respondent, according to her hierarchical level. At TL level, S2: coaching seems to be the preferred leadership style, while S4: delegating appears to be the least favored. For GLs, the S3: supporting style tends to be used more frequently, while S4: delegating is the least frequent. At AM level, both S2: coaching and S3: supporting styles seem to be equally preferred by leaders, while S1: directing and S4: coaching are less applied. Finally, at GM level, S3: supporting is significantly more used than the other styles.

Table IV gives the final results of the ideal leadership styles for each LEM roadmap phase (matrix **M**), after opinions from all experts are combined. In matrix **M**, it is possible to identify a changing trend on leadership styles as phases of the implementation roadmap progress. For instance, in the initial phases (0-2), higher hierarchical levels (GMs and AMs) should display guiding and explaining behaviors in order to prepare the environment, and correctly orientate the first lean implementation steps. On the other hand, TLs and GLs are expected to be more involved in operational matters, presenting encouraging and problem-solving behaviors. It is worth noticing that style S4: delegating displays low importance scores in these initial phases; however, as implementation progresses, this style becomes more desirable, especially at GM and AM levels. Such trend

Hierarchical level	Number of respondents	Leadership experience	Role description
TL	18	From 2 to 6 years	Each TL is responsible for 5 to 10 employees Start and control processes Support to achieve production targets Respond to <i>Andon</i> alarms Confirm quality procedures Train employees Perform small repairs Assure standardized work is being followed Facilitate incremental and continuous improvements activities Substitute absent employees
GL	9	From 7 to 12 years	Schedule labor and vacation Boost team's morale Confirm quality procedures Coordinate shift changes Develop and train team leaders Coordinate work-in-process inventory Ensure team's safety Support when team leaders are absent Coordinate greater process changes and improvement activities Report and map daily production results
AM	3	From 10 to 16 years	Responsible for 3 Group Leaders Direct responsibility over production activities Spend most of their time on shop floor Coordinate major problem solving, such as failures or shortage to customers Develop and train GL Approve time/labor, expense reports Perform other duties as required Develop group <i>Hoshin</i> plan, including monitoring and reporting process Ensure team follows policies, standards and that process procedures are documented Plan resources (labor, machine, etc.) according to demand needs
GM	1	19 years	Plan and facilitate major continuous improvements activities Increase management's effectiveness by recruiting, selecting, orienting, training, coaching, counseling, and disciplining managers Communicate values, strategies, and objectives Assign accountabilities Plan, monitor, and appraise job results Develop incentives Develop a climate for offering information and opinions Providing educational opportunities Develop <i>Hoshin</i> plan by studying technological and financial opportunities, presenting assumptions and recommending objectives Accomplish subsidiary objectives by establishing plans, budgets, and results measurements Allocate resources Review progress and make mid-course corrections Coordinate efforts by establishing procurement, production, marketing, field, and technical services policies and practices Coordinate actions with corporate staff Build company image by collaborating with customers, government, community organizations, and employees Enforce ethical business practices Maintain quality service by establishing and enforcing organization standards Contribute to team effort by accomplishing related results as needed

Table III.
Sample of leaders

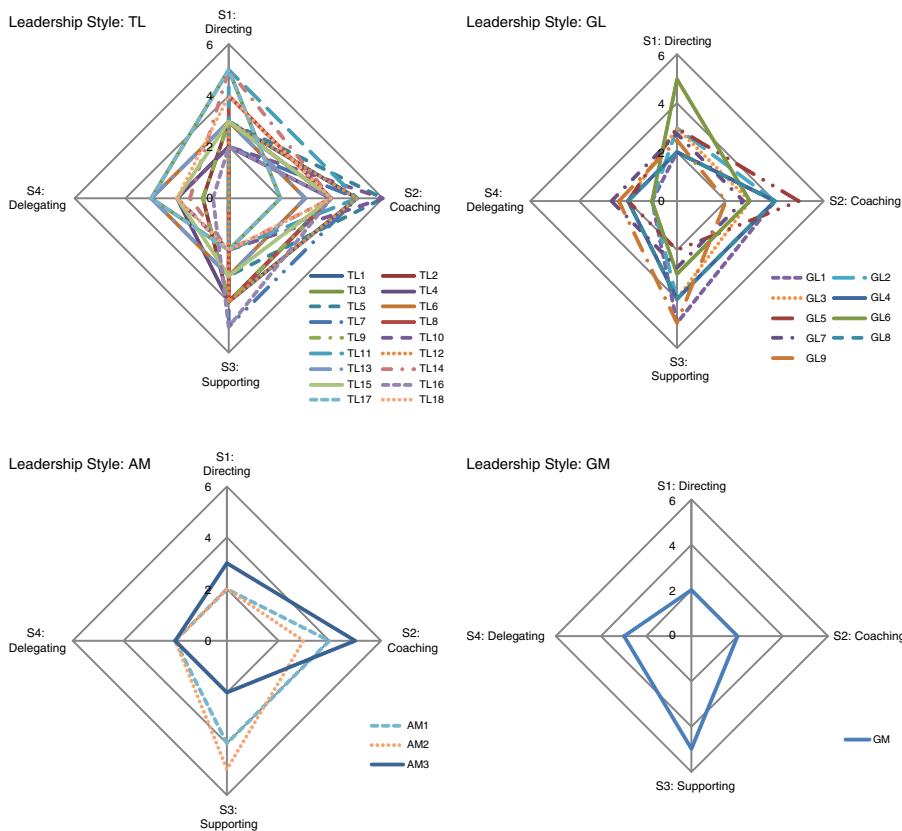


Figure 4.
Current preferred
leadership styles
at each company
hierarchical level

marks that, as lean implementation evolves and the correct mind-sets and knowledge are put in place, GMs and AMs may distance themselves from the implementation process and assume encouraging and monitoring postures. This outcome is somewhat consistent with findings in Marksberry and Hughes (2011) and Angelis *et al.* (2011), which suggest that leaders from higher hierarchical levels should focus on developing vision and strategy and, subsequently, ensuring that middle and frontline leaders align their actions with the company's objectives. At the same time, GLs and TLs should have increased their skills, and become "owners" of the implementation process, adopting for that telling and persuading behaviors, converging to conclusions in Scherrer-Rathje *et al.* (2009) and van Dun *et al.* (2017), which state that in most organizations the responsibility for lean initiatives often fall upon leaders from these hierarchical levels the last column of matrix **M** in Table IV gives a measure of the overall importance of leadership styles for lean implementation at each hierarchical level. Ideal styles move from S1 to S3 as hierarchical levels goes from lower to higher. Style S4 (delegating) becomes more desirable at higher hierarchical levels, although never appearing as ideal; that points to the hands-on nature of lean as an improvement method, as remarked by Joosten *et al.* (2009).

In interviews conducted with senior management, it was identified that the manufacturing unit was currently implementing Phase 5 (implement flow) of the LEM roadmap. With that information, it was possible to compare the existing leadership styles in each hierarchical level with the ideal styles proposed by experts in Table IV.

Table IV.
Ideal leadership
styles at each LEM
roadmap phase

Lean implementation roadmap phases											
Hierarchic level	Leadership style	Phase 0: adoption of lean paradigm	Phase 1: prepare implementation	Phase 2: define value	Phase 3: identify flow of value	Phase 4:			Phase 6: implement pull system	Phase 7: look for perfection	Importance of leadership style for lean implementation
						design production system	implement flow				
h_1 : TL	S1: directing	2.6	2.8	3.1	3.5	4.0	4.6	5.4	5.6	3.9	
	S2: coaching	3.5	3.5	3.8	4.4	4.3	4.3	4.0	3.7	3.9	
	S3: supporting	3.7	4.3	4.3	3.7	3.4	3.0	2.5	2.6	3.4	
	S4: delegating	2.3	1.5	0.8	0.4	0.3	0.1	0.1	0.1	0.7	
h_2 : GL	S1: directing	2.5	2.5	2.5	2.9	3.3	4.0	4.4	5.0	3.4	
	S2: coaching	3.2	3.2	3.8	4.3	4.6	4.5	4.4	4.3	4.0	
	S3: supporting	3.8	4.5	4.5	3.7	3.6	3.1	3.0	2.7	3.6	
	S4: delegating	2.5	1.8	1.2	1.1	0.6	0.3	0.1	0.0	1.0	
h_3 : AM	S1: directing	4.1	3.3	2.8	2.1	2.0	1.8	1.7	1.4	2.4	
	S2: coaching	4.2	4.4	4.2	3.9	3.4	2.8	2.2	2.0	3.4	
	S3: supporting	2.7	2.9	3.1	3.8	4.2	4.9	5.3	4.7	3.9	
	S4: delegating	1.0	1.4	2.0	2.1	2.4	2.5	2.9	3.9	2.3	
h_4 : GM	S1: directing	5.0	4.0	3.3	2.8	2.5	2.0	1.6	0.7	2.7	
	S2: doaching	3.6	4.1	3.9	3.4	3.1	2.9	2.2	1.6	3.1	
	S3: supporting	2.4	2.4	2.8	3.4	4.1	4.6	4.8	4.8	3.7	
	S4: delegating	1.0	1.5	2.0	2.4	2.3	2.6	3.4	4.8	2.5	

Table V presents the distribution of primary and secondary leadership styles in the studied manufacturing unit, resultant from the application of the LEAD questionnaire to the sample of respondents presented in Table II. Analyzing results for level h_1 we note that only 25 percent of the TLs display the ideal primary style S1: directing, recommended by experts for phase 5; most of h_1 individuals were adherent to style S2, which is the ideal secondary style for phase 5.

Results for level h_2 inform that the preferred styles of GLs are S3: supporting (47 percent) and S2: coaching (41 percent), although experts point styles S2: coaching and S1: directing as primary and backup ideal styles, respectively. As observed for level h_1 , GLs' preferred style is the one prescribed as backup by experts. Results for level h_3 indicate styles S3: supporting and S2: coaching as first and second preferences of AMs; these results are aligned with the styles viewed as ideal by experts. Results for level h_4 reveal that S3: supporting and S4: delegating are the preferred styles by GMs. S3 also appears as ideal style in the view of experts, but the backup ideal style is S2: coaching, rather than S4.

In general, Table V reveals that leaderships at operational levels are less prepared to meet the requirements of the current lean implementation phase, while leaders at strategic levels demonstrate more frequently the ideal behaviors expected for that phase. These results may be explained by a fact taking place in the company, in the past few years. As leaders reach higher hierarchical levels (GM and AM), they are offered more training and leadership development programs by the human resources department. By opposition, leaders at operational levels are qualified through informal and less structured manners, revealing a gap in knowledge and leadership skills transfer in the company. Further, operators are commonly promoted to TLs according to their technical expertise, while interpersonal and leadership skills are usually neglected. That explains part of the behavioral gap related to lean implementation observed in Table V.

In view of the results and facts presented above, it is recommended that the company continues providing training and development for high level leaders; however, its human resources department should also focus on the development of middle management and frontline leaders, orientating and capacitating them to present proper leadership behaviors and better support lean implementation. Such recommendations are aligned with those in previous studies (e.g. Found *et al.*, 2009; Marksberry, 2010; Manville *et al.*, 2012) that highlight the importance of developing learning capabilities in the middle management and frontline leaders, in order to empower them to sustain lean initiatives.

5. Conclusions

In this paper we assessed leadership styles in companies undergoing a LM implementation process. The proposed method was illustrated through a case study from a parts manufacturer for the automotive industry (Tortorella and Fogliatto, 2014).

Hierarchical level		S1: directing (%)	S2: coaching (%)	S3: supporting (%)	S4: delegating (%)
h_1 : TL	Primary style	25*	44	25	6
	Secondary style	22	31**	33	14
h_2 : GL	Primary style	13	33*	47	7
	Secondary style	24**	41	29	6
h_3 : AM	Primary style	0	50	50*	0
	Secondary style	25	50**	25	0
h_4 : GM	Primary style	0	0	100*	0
	Secondary style	0	0**	0	100

Notes: *Ideal primary style for phase 5 of the LEM roadmap; **Ideal secondary style for phase 5 of the LEM roadmap

Table V.
Distribution of
primary and
secondary styles
preferred by the
unit's leaders

Two contributions of the proposed method become evident from its practical implementation. First, we propose a new approach to identify the relationships between multi-level leadership styles and the implementation phases of the LM roadmap. The specialized literature on LM frequently states that managers are likely to adopt one single leadership style, regardless of their hierarchical positioning and the maturity of LM implementation in their companies. Our approach provides evidence to the contrary, prescribing leadership styles that may contribute the most to each implementation phase of the LM roadmap, according to the hierarchical positioning of the leadership. Although not providing an optimal solution, the method points at improvement alternatives that may be developed simultaneously at different leadership hierarchical levels in companies. The method also provides a means to measure the alignment of leadership styles along the lean implementation process, contributing to build a leadership behavior that supports the change process, and helps sustaining it in the long run. Such improvement opportunities must be sponsored by the senior management and operationally addressed by the human resources department, in order to provide leaders from various levels the proper interpersonal skills to facilitate lean implementation. The reinforcement of proper leadership behaviors should enhance the socio-cultural aspects of lean implementation, which corroborates to attain more sustainable results.

Second, using the matrix of ideal leadership styles (a theoretical contribution of this paper) obtained from experienced experts, companies may be able to identify implementation phases in the lean process that are poorly served by current leadership styles, anticipating problems and developing HRM practices to mitigate them. Further, this study outlines behavioral parameters for leaders in different hierarchical levels of companies undergoing lean implementation. The establishment and utilization of such parameters allow companies to longitudinally verify and compare changes on leaders' styles, fomenting the development of leaders to foster subsequent phases of LM implementation. That is quite relevant, since changes in leadership behaviors and expectations take time to be implemented; therefore, it is important to understand opportunities and have a clear vision of current gaps within the company. It is worth noting that, despite being infeasible to simultaneously tailor leadership styles at all hierarchical levels according to LM maturity of each department or manufacturing unit within an organization, it is also not correct to assume that a single leadership style will support all phases of LM implementation. Thus, envisioning the expected leadership styles along the implementation roadmaps may help companies to design their lean transformation taking into account a more holistic perspective, which approaches the behavioral change of leaders as an evolutionary process toward a lean enterprise.

Some limitations in the proposed method should be mentioned, and viewed as improvement opportunities. Technical aspects of lean adoption are not covered in this paper, but should be taken into account by companies willing to undergo lean change. Lean systems tend to operate with minimum resources becoming exposed to sudden changes in the demand pattern or in the system's availability, which may compromise the desired service level to clients. This important point however is beyond the scope of this paper (Tortorella and Fogliatto, 2014). Another limitation is related to contextual variables involved within the leaders' scope, such as the number of followers per leader. In large groups, leaders may find opportunities for "partnering for performance" less likely, because they have more constraints on their time than do leaders of smaller groups. Opportunities for interaction between leader and individual followers are thus less likely to occur, and leaders may experience difficulty adjusting their style to the needed and expected behavior. That may limit the leader's ability to provide different kinds of support, such as emotional and instrumental.

Leadership typically involves a more complex mix of behavioral, cognitive, and social skills that may develop at different rates, and require different learning experiences. The proposed method does not cover such aspects, which leaves room for further

developments and improvements. Further, the proposed method assesses the leadership development opportunities at each hierarchical level, but does not suggest actions to be taken in order to mitigate such gaps. We envision the development of a method that integrates other aspects of leadership and also guides the adoption of HRM practices as a valuable addition to the current research.

In order to measure and verify any effects of our proposition on key performance indicators it would be necessary to perform a longitudinal analysis, i.e. to apply the method at different moments and monitor its performance indicators. We present a single application of the method in this paper, which is used as diagnosis tool to drive improvements on leadership behaviors within the organization. Another opportunity for further research is to apply the method longitudinally and crosscheck it with the evolution of technical aspects of lean implementation (Tortorella and Fogliatto, 2014). Based on the data collected one could verify the impact of the evolution of leaders' behaviors across phases of lean implementation.

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Appendix. Leadership style questionnaire (Adapted from Blanchard, 2010)

LM and SL
styles

Hierarchical Level: _____ Leadership Experience: _____

Imagine you are involved in each of the following situations. Read the description carefully and think about how you would respond, then circle the answer which comes closest to describing what you would do in practice. You can only choose one option for each situation. Think of how you would behave in your current job with your immediate subordinates in each case.

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1) Your subordinates have not been responding well to your friendly conversations and concern for their welfare, their performance is poor and getting worse but you do not understand why.

- a) Emphasize the rules regarding their conduct and the need to follow standard procedures and to achieve targets.
- b) Make yourself available for discussion of their problems without pushing.
- c) Talk to them, find out what problems they are facing and set goals.
- d) Be careful to stand back for a while until you can see their problem clearly.

2) The performance of the group is improving. You have been making sure they are all aware of their responsibilities and standards.

- a) Be friendly but stress responsibilities and standards.
- b) Take no particular action just carry on as you have been.
- c) Try to make the group feel important and involved.
- d) Emphasize the importance of deadlines and tasks.

3) Members of the group have been unable to solve a problem over the past two weeks, though they have been trying to address it. You have normally let them get on with things by themselves. Group performance and team spirit are good.

- a) Involve the group and together try to solve the problem.
- b) Let them work it out as they have been successful in the past.

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38,7

- c) Act quickly to give them the direction before their failure to solve the problem affects their performance.
- d) Encourage the group to work on the problem and be available for discussion.

966

- 4) You are considering a major change. Your subordinates are performing well but respect the need for change, though as yet they disagree on the details of change.
 - a) Allow group involvement in developing the change without pushing them.
 - b) Announce the change vision and implement in a tightly controlled plan.
 - c) Allow the group to develop and implement their own plan for change.
 - d) Consult the team but direct the change to your plan.
- 5) The performance of the team has been falling during recent months. They have not been concerned to meet objectives and have continually needed reminding to finish their tasks, in the past it has helped to redefine people's goals.
 - a) Ask the group to rethink their direction and goals.
 - b) Ask for and incorporate their suggestions but formulate your own plan for meeting objectives.
 - c) Redefine goals and supervise the change closely.
 - d) Allow group freedom to set their own goals without pushing them.
- 6) You stepped into an efficient set up. Your predecessor exercised detailed but rather impersonal supervision, you would like to begin humanizing the situation.
 - a) Do what you can to make the group feel important and involved.
 - b) Follow the lead of your predecessor by emphasizing deadlines and tasks but in your own friendly style.
 - c) Be careful not to change things too much too soon.
 - d) Get the group involved in decision-making but watch performance carefully.

7) You are considering changes to the organization structure. Members of the group have made suggestions about the changes needed. The group is quite flexible in its way of working.

- a) Define the new structure yourself and monitor its introduction because you have the most objective view.
- b) Ask for group approval to changes you suggest and let them organize implementation.
- c) Make changes requested by group members but control implementation yourself as the leader.
- d) Leave the group to resolve its problems flexibly without imposing organizational changes.

8) Group performance and morale are good. You feel you are not exercising much direction or control.

- a) Leave the group to continue working well.
- b) Discuss the situation with the group ask for their views and introduce changes.
- c) Take steps to improve your direction and control of the group.
- d) Be careful not to upset relationships by giving direction when it is probably not needed.

9) Your superior has appointed you to take over direction of a task force that is far overdue in recommending changes. The group is not clear of its goals attendance at group meetings has been poor and have tended to be used as social gatherings rather than solving problems.

- a) Ask the group to set their own goals and wait for their report.
- b) Set goals for the group as a whole ask them to pull together continue group meetings
- c) Set clear targets for each member of the group and reduce meetings.
- d) Use informal group meetings to determine the issues felt by the group.

10) Your subordinates, who are usually able to take responsibility, are not responding to your recent redefinition of standards of work.

- a) Allow the group to redefine standards of work without pushing them.
- b) Redefine standards and supervise carefully.

- c) Avoid confrontation on this issue since their work is in any case good.
- d) Incorporate group recommendations on new standards but see that these standards are met.

11) You have been promoted to a new position. Your predecessor had left the group to get on with their work without much personal involvement over a period of years. The group worked reasonably well and morale is good.

- a) Take steps to introduce clearer instructions, job descriptions and instructions.
- b) Involve the group in decision-making and recognize the best performers.
- c) Discuss past performance of the group and examine the need for change.
- d) Continue as your predecessor as they are working reasonably well and you have other priorities.

12) Recent information indicates some problems between members of the group over the last month. They have been a remarkably effective team in the past with a good record of working together toward long term goals and good team morale; they are a very well qualified team.

- a) Discuss your ideas to resolve the problem and examine the need for changes.
- b) Allow the group to resolve the problem.
- c) Act quickly and firmly to get the team back on track.
- d) Make yourself available for discussion to support the group in resolving the problem.

Corresponding author

Guilherme Tortorella can be contacted at: gtortorella@bol.com.br

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