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PERCEPTION OF SHOP FLOOR EMPLOYEES REGARDING SENIOR MANAGEMENT SUPPORT IN LEAN PROJECTS AND ITS RELATIONSHIP WITH INITIATIVES SUCCESS

Percepções dos funcionários de chão de fábrica em relação ao suporte de gestores seniores em projetos lean e sua relação com iniciativas de sucesso

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ABSTRACT

Purpose – Over the years, the lean production philosophy has shown satisfactory results for companies from different sectors in different countries. Aiming to contribute to the knowledge base on the mentioned philosophy, this study aims to verify the perception of shop floor employees regarding senior management support in lean projects and its relationship with initiatives success.
Design/methodology/approach – Through a literature review, 18 aspects of a lean journey were identified and divided into four constructs by a panel of specialists. This information was used to compose a questionnaire, and a survey was conducted with 198 shop floor employees of two auto parts companies. Data analysis was done via Structural Equation Modeling.
Findings – As a general result, it was possible to prove that when employees perceive more significant support from senior management in lean projects, the greater is the perception of initiatives success. Therefore, it is interesting that the involvement of senior management occurs at all stages of the project.
Originality/value – The results described here have practical implications, especially for managers interested in implementing lean projects; they must be aware of the importance of senior management support for the success of previous projects.

Keywords - Lean manufacturing; Performance; Automotive Industry; Leadership.

RESUMO

Objetivo - Ao longo dos anos, a filosofia lean tem mostrado resultados satisfatórios empresas de diversos setores em diferentes países. Com o objetivo de contribuir para a base de conhecimento acerca da referida filosofia, este estudo tem como objetivo verificar a percepção dos funcionários do chão de fábrica em relação ao apoio da alta administração nos projetos lean e sua relação com iniciativas de sucesso.
Design/metodologia/abordagem - Por meio de uma revisão da literatura, 18 aspectos de uma jornada lean foram identificados e divididos em quatro construtos via um painel de especialistas. Essas informações foram utilizadas na estruturação de um questionário e uma survey foi realizada com 198 funcionários de duas empresas de autopeças. A análise dos dados foi feita por meio da Modelagem de Equações Estruturais.
Resultados - Como resultado geral, foi possível comprovar que quando os funcionários percebem um apoio mais significativo da alta administração nos projetos lean, maior é a percepção do sucesso das iniciativas. Torna-se interessante, assim, que o envolvimento da alta administração ocorra em todas as etapas do projeto.
Originalidade/valor - Os resultados aqui descritos aqui têm implicações práticas principalmente para gerentes interessados em implementar projetos enxutos; eles devem estar cientes da importância do apoio da alta administração para o sucesso dos projetos mencionados.

Keywords: Lean manufacturing; Performance; Automotive Industry; Leadership.

1 INTRODUÇÃO

Companies continuously try to improve their performance and stay competitive (Laser, 2020; Martins et al., 2019). According to Gamme and Aschehoug (2014), the increase of global competition and production costs prompted a new attitude and critical analysis of concepts associated with the productive system.

In this sense, lean manufacturing has proved to be a successful alternative since it aims to identify and improve activities that add value to the customers while it seeks to eliminate all activities and operations that do not add value (Nascimento et al., 2019; Nunes et al., 2019; I. S. Rampasso et al., 2017; Shahin et al., 2020; Yang et al., 2020). However, as Shi et al. (2019) emphasise, companies need to completely implement lean production to observe more significant benefits from it. These authors also show the moderating role of research and development for lean manufacturing to enhance companies productivity. In addition to the notable contributions of lean manufacturing to operational performance, it was also verified its contribution to companies innovation processes (Möldner et al., 2020; Solaimani et al., 2019) and can contribute to waste management (Vasconcelos et al., 2019).

Despite benefits, Maskell et al. (2007) emphasise that transforming a traditional company into a lean one is not easy. To Jadhav et al. (2014) and Laureani and Antony (2012), it is possible to observe many barriers to lean manufacturing implementation: lack of resources, the resistance of workers, and lack of senior management involvement. Focusing on senior management involvement, it is possible to say that it is crucial and the basis for successful lean implementation (de Oliveira et al., 2019). Nogueira et al. (2018) and Tortorella and Fogliatto (2017) corroborate this argument and emphasise that leadership performs an essential role in lean implementation.

Considering the importance of senior management support for lean success and the automotive industry relevance, this article aims to assess the perception of shop floor employees regarding senior management support in lean projects and its relation with initiatives success.

2 THEORETICAL BACKGROUND

Lean manufacturing is based on several fundamental principles: elimination of waste, minimisation of process variability, continuous process improvement, employee involvement, transfer of

activities such as quality inspections and periodic maintenance to operators and maintenance of synchronised production flow through visual signals (Angelis et al., 2011). The mix of hard and soft practices in lean improves companies cost-saving, products quality and delivery reliability (Signoretti, 2020).

According to Lewis (2000) and Bhasin (2012a), each lean journey is unique for each company. Many aspects need to be considered on a lean journey. Through a literature review process, 18 aspects of a lean journey were identified. They are presented in Table 1. Table 1 also shows the codes used to identify each aspect in data analyses.

Table 1. Lean journey aspects identified in the literature (see references in Table)

Code	Aspect	References
P1	Continuous improvement culture based on innovation.	(Jagoda et al., 2013; Slack et al., 2013)
P2	Active participation of managers throughout the lean journey.	(Jadhav et al., 2014; Laureani & Antony, 2012)
P3	Retention Policy and valuing labour force (recognition, training, among other initiatives).	(Alagaraja & Egan, 2013; Sisson & Elshennawy, 2015; Wong et al., 2009)
P4	Prioritisation of resources by management for implementation and maintenance of lean projects.	(Jadhav et al., 2014; Rahbek Gjerdrum Pedersen & Huniche, 2011; Rich & Bateman, 2003).
P5	Open communication stimulated by senior management towards all hierarchical levels.	(Emiliani, 1998; Jagoda et al., 2013; Wong et al., 2009).
P6	Realistic deadlines for the execution of the proposed projects.	(Mainga, 2017; Wu & Passerini, 2013)
P7	Lean coordination support the development throughout the project.	(Dombrowski & Mielke, 2014; Jadhav et al., 2014).
P8	Process of generating, storage and disseminating lessons learned associated with each lean project.	(Guzzo et al., 2012; Milton, 2010)
P9	Projects contemplate the participation of suppliers in activities to improve processes.	(Jadhav et al., 2014; Kim, 2015; Wong et al., 2009)
P10	A clear and objective definition of activities to be performed by operators, including procedures and working standards according to standards.	(Lantz et al., 2015)
P11	Clarity of lean metrics to be achieved (Overall Equipment Effectiveness, takt time, etc.).	(Braglia et al., 2019).
P12	Operators are apt to work with multiple types of equipment (polyvalence).	(Angelis et al., 2011; Birkie et al., 2017)
P13	Autonomy granted to operators for decision making for working area activities.	(Azambuja, 2011; Lantz et al., 2015)
P14	Application of basic concepts of continuous improvement (e.g. 5S) on the company's everyday routine.	(Ballé & Régnier, 2007; Randhawa & Ahuja, 2017).
P15	Application of the seven basic wastes diffused by lean culture on the company's everyday routine.	(Bevilacqua et al., 2017; Karim & Arif-Uz-Zaman, 2013)
P16	Continuous improvement of processes considering ergonomics, health and well-being of employees.	(Botti et al., 2017; Zhang et al., 2017)
P17	Lean tools application aiming to solve problems and for processes performance improvement.	(Karim & Arif-Uz-Zaman, 2013; Worley & Doolen, 2015)
P18	Identification of barriers for organisational changes towards performance improvement and actions to minimise them.	Bhasin (Bhasin, 2012a) Zhang et al. (Zhang et al., 2017)

A lean journey is long and hard. For Bhasin (2012a), despite the prevalence of lean philosophy for more than three decades, some aspects do not receive enough attention, resulting in a low number of successful lean implementations.

Lean manufacturing, based on the Toyota model, involves a more profound cultural transformation (Bhasin, 2012b). Many barriers to the implementation of the lean philosophy can be noted. Zhang et al. (Zhang et al., 2017) identified, through a literature review, 44 barriers to the implementation of the referred philosophy, which were classified in 10 areas, being the same ones related to knowledge (which includes, among others, lack of training, insufficient understanding of potential benefits, lack of implementation knowledge, lack of management skills to implement the philosophy, lack of methodology, and lack of willingness to learn and see), conflicts, resources, management, technology, employees, financial situation, culture, clients and experiences.

To minimise these barriers, the authors suggest developing a lean culture and in this situation, it is essential the senior management support in all lean projects implementations. (Wong et al., 2009) emphasise de importance of a supportive culture of employees engagement.

For Binti Aminuddin et al. (2016) and Scherrer-Rathje et al. (2009), lack of commitment of senior management is the most critical barrier to lean manufacturing success.

3 METHODOLOGICAL PROCEDURES

This section presents the steps carried out in this study. The first step was the literature review, performed to establish the study's theoretical background. As mentioned, the 18 aspects of a lean journey as identified and presented in Table 1. In the sequence, a panel of specialists composed of five doctors in production engineering and five lean companies managers was performed to divide the 18 aspects into constructs. Table 2 presents the 18 aspects divided into four constructs.

Table 2. Aspects of the lean journey divided into constructs.

Construct	Code	Construct	Code	Construct	Code	Construct	Code
Senior management support	P1	Lean Projects Management	P6	Operational Management	P10	Continuous Improvement Management	P14
	P2		P7		P11		P15
	P3		P8		P12		P16
	P4		P9		P13		P17
	P5						P18

The structure presented was used on questionnaire development. As recommended by Hair et al. (2011), a pre-test was performed on the questionnaire. Researchers on Industrial Engineering analysed the first version of the questionnaire in this pre-test process and proposed improvements regarding corrections and understanding.

Before survey conduction, the study was approved by an ethical committee. The survey was conducted with 198 professionals. Respondents indicated for each aspect, through a scale from 1 to 10, the intensity (1 = aspect unnoticed or minimally perceived observation; 10 = high observation of the aspect)

Data was analysed through Structural Equation Modeling (SEM), using the Partial Least Squares method (PLS), known by its acronym (PLS-SEM). PLS-SEM is a valuable tool to analyse data in exploratory research (Imam & Chambel, 2020). In order to facilitate the analysis, nine steps were defined based on several authors (Henseler et al., 2009; Júnior et al., 2012; Ringle et al., 2014).

The first step was the definition of the model to be tested. The second step consisted of the calculation of the minimum sample required using G*Power software. We considered test power of

80%; error probability of 5%; and median effect size of 15% (Hair et al., 2014).

The third step aimed to start the validation of the proposed model. For this analysis, the PLS algorithm is run using parameters recommended by Ringle et al. (2014).

The fourth step is characterised by convergent validity evaluation through analysis of Average Variances Extracted (AVE). According to Henseler et al. (2009) and Ringle et al. (2014), AVE values should be higher than 0.5 for convergent validity. Ringle et al. (2014) highlight that if AVE values are lower than 0.5, variables with the lowest factorial loads from the construct need to be removed. Since it is a reflective model, this remotion does not change construct meaning (Jarvis et al., 2003).

The fifth step consisted in verifying the internal consistencies through Cronbach's alpha and Composite Reliability. These two parameters are used to confirm if the sample is bias-free and if its data are reliable (Rampasso, Anholon, da Silva, Ordóñez, & Quelhas, 2019; Silva et al., 2018). Values of references are Cronbach's alpha above 0.60 and Composite Reliability above 0.70 (Hair et al., 2014; Ringle et al., 2014). Ringle et al. (2014) argue that Composite Reliability is adequate for the technique applied.

In the sixth step, it was analysed the discriminant validity. Chin criterion was used to this (Ringle et al., 2014). Under this criterion, the factorial loads of each variable should be higher in their constructs than in the others.

In the seventh step, the analysis of the structural model was performed through the Pearson determination coefficients (R^2). According to Ringle et al. (2014), R^2 = 2% is classified as small effect, R^2 = 13% as medium effect and R^2 = 26% as large effect.

In the eighth step, the 'Bootstrapping' function was used to verify if it is possible to use linear regression and correlation in the PLS-SEM. Values above 1.96 correspond to p-values ≤ 0.05, making it clear that in less than 5% of cases' correlations and linear regressions cannot be used (Silva et al., 2018).

In the ninth step, other indicators of adjustment quality for the proposed model were analysed: Redundancy (Q^2) and Cohen's indicator (f^2). Redundancy should have values bigger than zero, and Hair et al. (2014) considers f^2 = 0.02, 0.15 and 0.35 as small, medium and large, respectively. Hair et al. (2017, p. 201) emphasise that "effect size values of less than 0.02 indicate that there is no effect".

It is essential to highlight that authors such as Wetzels et al. (2009) argue that the model quality can be measured through an indicator called Goodness of Fit (GoF). However, Hair et al. (2017) argue that this indicator is not always adequate and that the previously mentioned steps are more reliable to validate the model.

4 RESULTS AND DISCUSSIONS

Through literature review followed by a panel of specialists, it was possible to define the model to be tested, presented in Figure 1. In this theoretical model, Senior Management Support influence other constructs.

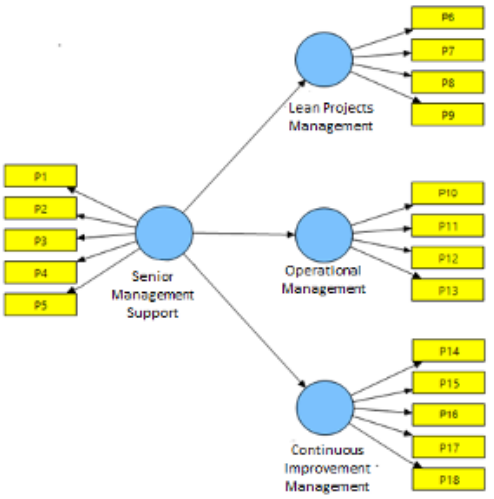

Figure 1. The model used on the SEM

In the sequence (Step 2), using the G*Power software, it was calculated the minimum sample required (55 respondents). The sample used was composed of 198 respondents, higher than that recommended.

In the first validation round, some AVE values did not reach the minimum value (0.5), indicating that it is necessary to eliminate the variables with the lowest factor loadings values (constructs that presented AVE values lower than 0.5). Figure 2 shows the new version of the model after excluding the variables with lower factor load (P1, P6, P10 and P16).

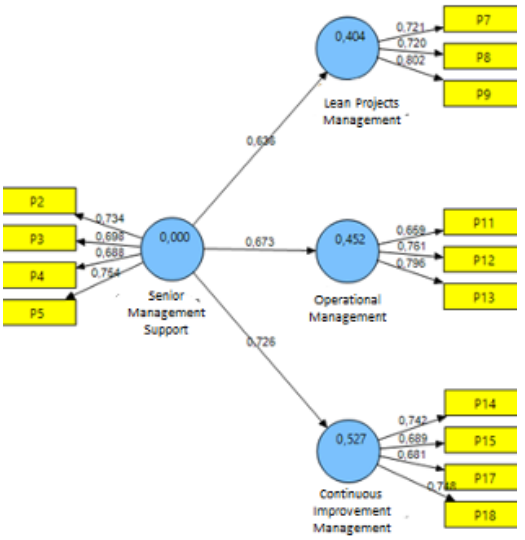

Figure 2. Validated model from PLS-Algorithm

For the model presented, AVE values are ensured for all constructs (step 4). Composite Reliability values were above 0.70, and for Cronbach's alpha, only one construct (Operational Management) did not reach the minimum value of 0.60. Considering that Ringle et al. (2014) argue that Composite Reliability is an adequate to applied technique and the value obtained was close to the reference value, the authors of this study decided to keep this construct. These values are presented in Table 3.

Table 3. Analysed values of the quality of the validated model

Constructs	AVE	Composite Reliability	Cronbach's Alpha
Continuous Improvement Management	0.51191	0.80724	0.68200
Operational Management	0.54891	0.78392	0.58655
Lean Project Management	0.56067	0.79246	0.61308
Senior Management Support	0.51670	0.81027	0.68829

The discriminant validity was analysed (Step 6). The analysis was performed according to Chin criteria, in which the factor load of each variable should be higher in its construct than in the others. All variables presented higher loads in their constructs, showing that their allocation was correct.

Step seven analysed the Pearson determination coefficient (R^2), and all values were above 0.4. According to Cohen (1988), values of this intensity indicate a significant effect. Values of AVE, Composite Reliability and R^2 together indicate that the proposed model is adjusted and presents quality to be interpreted (Júnior et al., 2012), considering only essential variables for the analysis.

The evaluation of the correlations and linear regressions (Step 8) was made by Bootstrapping re-sampling, using parameters recommended by Ringle et al. (2014). Figure 3 show Bootstrapping results with all values above 1.96; then, correlations and linear regressions logics are acceptable.

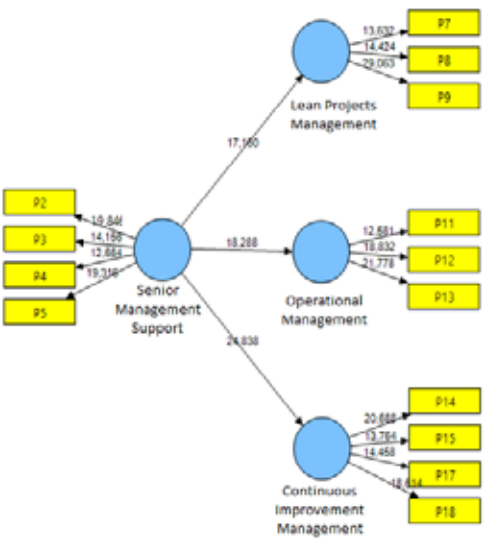

Figure 3. Bootstrapping results

In the sequence (Step 9), other indicators of adjustment quality for the proposed model were analysed: Q^2 and f^2. The results are present in Table 4.

Table 4. Stone-Geisser (Q^2) and Cohen (f^2) values

Constructs	Q^2	f^2
Continuous Improvement Management	0.261562	0.194018
Operational Management	0.244162	0.132093
Lean Project Management	0.219980	0.558264
Senior Management Support	0.516642	0.516642

From Table 4 analysis, it is possible to note that the proposed model presents accuracy and that the constructs are essential for the general adjustment of the model studied. Analysing path coefficients, via Figure 2, the minimum value is 0.636 between construct Senior Management Support - Lean Projects Management (see other values in red in Figure 2).

Through the results presented, it is concluded that the proposed model was validated. Considering the high values for path coefficients, it is possible to confirm the argument that when shop floor employees of auto parts companies perceive the support of senior management, they notice the success of the lean philosophy in their companies. Thus, it is interesting that senior management involvement occurs in all stages of projects. The results described here have practical implications mainly for managers of companies interested in lean projects implementations; they must be aware of the importance of top management support for the success of these projects beforehand. As mencioned previously, lack of commitment of senior management is the most critical barrier to lean manufacturing success (Binti Aminuddin et al., 2016; Scherrer-Rathje et al., 2009).

The success of global manufacturing strategies, such as lean, is not only based on the application of appropriate tools and techniques but also on the development of strategies to overcome implementation barriers. Thus, senior management can play a significant role in developing these strategies (T. & K.P., 2021).

5 CONCLUSION

This research aimed to analyse the perception of shop floor employees regarding senior management support in lean projects and its relation with initiatives success. Considering the results presented, it is possible to affirm that the main objective was achieved.

From the presented findings, it can be concluded that lean implementation success does not depend only on the use of techniques and tools; the support and commitment of senior management are essential; when shop floor employees note this support, the perception of success in initiatives is better.

This research presents some limitations that should be mentioned, such as the sample size and the fact that the respondents act only in two auto part companies. However, we believe that the exploratory character of this research justifies the mentioned limitations. The results presented here can be used for senior management in order to improve its participation in lean activities and academics in futures studies.

As future research, we suggest the development of studies with employees from other sectors, different from the sector analysed here (automotive) and performing comparisons to evidence similarity and differences among results.

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1. Definition of research problem	√	√				
2. Development of hypotheses or research questions (empirical studies)	√	√				
3. Development of theoretical propositions (theoretical work)	√	√				
4. Theoretical foundation / Literature review	√	√				
5. Definition of methodological procedures	√	√				√
6. Data collection	√					
7. Statistical analysis	√	√				√
8. Analysis and interpretation of data	√	√				
9. Critical revision of the manuscript	√	√	√	√	√	√
10. Manuscript writing	√	√	√	√	√	√
11. Other (please specify)						

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The authors have stated that there is no conflict of interest.

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