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Effect of the motivational factor on lean manufacturing performance: the case of a multinational consumer goods company

Impactos do fator motivacional no desempenho da manufatura enxuta: o caso de uma multinacional de bens de consumo

Felipe Castro[1]
Paulo Soares Figueiredo[2]
Camila Pereira-Guizzo[1]
Franscisco Uchoa Passos[1]

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Abstract: The goal of this study was to evaluate the effect of the motivational factor on the results obtained after implementing a lean manufacturing system in a multinational consumer goods manufacturing company. Key performance indicator data were collected from three production lines during periods before and after lean manufacturing implementation. Unstructured interviews were conducted, and the Motivation and Work Meaning Inventory (MWMI) instrument was applied. The motivational factors were then correlated with the performance indicators. The results provide evidence to support the hypothesis, based on the literature, that the motivational factor in work teams in a lean implementation process will affect the degree of success of the process. It was also confirmed that after implementation of the program, there was a significant improvement in the lines' operational performance.

Keywords: Behavioral management operations; Lean manufacturing; Motivation.

Resumo: *Este estudo visou avaliar os impactos do fator motivacional nos resultados obtidos ao final da implementação de um sistema de manufatura enxuta, em uma empresa multinacional fabricante de bens de consumo. Foram coletados dados dos principais indicadores de desempenho de três linhas de produção, em períodos antes e após a implementação da manufatura enxuta. Foram realizadas entrevistas não estruturadas e aplicado o instrumento "Inventário da Motivação e Significado do Trabalho" (IMST). Posteriormente foram correlacionados os fatores motivacionais com os indicadores de desempenho. Os resultados fornecem indícios que apoiam a hipótese, baseada na literatura, de que o papel do fator motivacional nos times de trabalho em um processo de implementação lean teria impacto no grau de sucesso do processo. Também foi confirmado que após a implementação do programa, houve uma melhoria significante no desempenho operacional das linhas.*

Palavras-chave: *Gestão comportamental de operações; Manufatura enxuta; Motivação.*

1 Introduction

Globalization demands that enterprises be more competitive, which leads them to seek tools and adapt to changes and customer demands (Cardon & Bribiescas, 2015). Because of these increasingly challenging goals, a growing number of companies are implementing lean manufacturing systems. Lean manufacturing concepts were developed to maximize the use of resources by reducing waste. The development of increasingly competitive markets and environments has meant that organizations have been forced to face the challenges and complexities imposed on them by these changes. These new demands can be addressed by the concept of lean manufacturing (Sundar et al., 2014), which strengthens production by increasing

[1] Centro Universitário SENAI CIMATEC, Av. Orlando Gomes, 1845, Piatã, CEP 41650-010, Salvador, BA, Brasil, e-mail: felipe.dbojan@gmail.com; camilarsp@hotmail.com; uchoapassos@gmail.com

[2] Escola de Administração, Universidade Federal da Bahia – UFBA, Av. Reitor Miguel Calmon, s/n, Vale do Canela, CEP 40110-903, Salvador, BA, Brasil, e-mail: paulo_s_figueiredo@hotmail.com

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cost efficiency and reducing waste while maintaining quality assurance and on-time delivery.

Although lean manufacturing (LM) is widely recognized for its effectiveness in the continuous improvement of productivity, product quality, and timely delivery to customers, fewer than 10% of companies worldwide have managed to implement it using lean tools, techniques, and technologies to improve operational performance effectively (Vienazindiene & Ciarniene, 2013). The implementation of LM should not merely be based on teaching techniques to employees; focus must also be placed on human factors for its implementation to be successful (Cardon & Bribiescas, 2015).

The application of lean manufacturing involves employees at all levels of a company, and good communication processes are needed to ensure a good process flow (Bendoly et al., 2015). One of the main challenges of communication is to ensure the acceptance and implementation of the changes by all stakeholders at all levels. There are few companies that place the required emphasis on behavioral aspects when implementing lean manufacturing; this oversight can result in process failure. There are several causes for the failure of a project or change, but a common feature is a lack of attention on how to implement the change relative to human beings and their peculiarities. The failure of a new strategy or innovation is often due to the inability or resistance of individual employees to commit to the strategy and adopt the behaviors needed to achieve the strategic objectives. Motivation is a critical factor in this process (Heracleous & Barrett, 2001).

The management of human change should consider human beings with all their complexities. Their reactions, moods, motives, behaviors, and commitment contribute to determining their positive collaboration, or not, with the change. A major challenge of a lean manufacturing program is the change in working culture required from employees for the organization to implement the new methods (Johnson & Wemmerlöv, 2004).

Shah & Ward (2003) found that lean manufacturing practices contribute substantially to improving factories' operational performance. However, these authors state that implementation requires increasingly customized solutions. The success of an LM implementation process and the sustainability of good results depend on the people involved. The relationship between motivation and performance is relatively well studied (e.g., Zameer et al., 2014), but only one study that focuses on the effect of behavioral aspects on the performance of the lean manufacturing implementation process was found (Puvanasvaran et al., 2009), which led to our interest in investigating the following research problem: "What is the effect of the motivational factor on operational performance after implementing a lean manufacturing system in production lines?"

We believe that the contribution of this research lies in its approach to behavioral aspects, specifically in terms of employee motivation, and their effects on lean manufacturing production system implementation. Although there are studies on the effects of the motivational factor in different contexts, behavioral studies in the area of operations, specifically on the topic of lean manufacturing, remain scarce. This study aims to contribute to the operations behavioral management literature, particularly in respect to people management during the implementation of improvement programs. A simple conceptual model is proposed, and the study considers the opportunities and challenges encountered during and after implementation of a lean manufacturing system in a multinational industrial company that has units in Brazil. Key performance indicator data were collected from three production lines prior to and after lean manufacturing implementation. Unstructured interviews were conducted, and the Motivation and Work Meaning Inventory (MWMI) instrument was applied. The motivational factors were then correlated with the performance indicators.

It is hoped that this research can contribute to the literature addressing human factors in LM, in addition to facilitating management practice by introducing guidelines for improving the lean manufacturing system implementation process in companies, focusing on human behavior, especially the motivational factor.

The next section summarizes the literature review and presents the hypotheses posited in this study. The third section addresses the research's methodological procedures. The fourth section analyzes and discusses the results of this investigation, and the fifth section presents the conclusions.

2 Literature review

Lean manufacturing is a management philosophy that was first developed in the Toyota Production System (TPS). The TPS represented a breakthrough in increasing manufacturing efficiency, designing a car manufacturing system as an integrated, cohesive process and not a loose combination of related tasks and emphasizing the human factor in increasing manufacturing efficiency in a conducive working environment and the culture involved in this process.

The culture of lean manufacturing continues to evolve, and it is common in most current studies for authors to address not only the benefits that powerful lean manufacturing program tools can bring but also to focus on the people involved and the human behavior exhibited in the face of the various changes that a lean manufacturing program can promote. One of these aspects is behavioral changes in the workplace. Some of the studies that address this issue are discussed in the following subsection. Implementation of successful lean manufacturing is dependent on the behavior of the employees involved in the program, including those at all levels, both managerial and operational (Sawhney & Chason, 2005).

2.1 Behavioral factors in lean manufacturing

Many of the articles on human behavior related to lean manufacturing focus on the consequences of LM for the worker. In a study with a large sample, Lewchuk & Robertson (1996) concluded that workers in lean production units have a 20% higher probability of reporting increases in stress, are 17% more likely to report being tired after work, and are 25% more likely to have an increased workload compared to a worker in a traditional production unit. Lewchuk & Robertson (1997) showed that workers in "lean" factories reported that it was more difficult to modify their functions, change their workplace, and attend to personal matters than it was for factory workers in less advanced "lean" factories. They also concluded that workers in more advanced units felt more monitored by management. Lewchuk et al. (2001) reached similar conclusions to those in the two studies mentioned above.

However, Womack & Jones (1996) concluded that LM did not increase the likelihood of musculoskeletal problems in factories. Their study indicated that employees in lean factories work at a faster pace, but with less use of force, therefore with a lower total physical demand. Similarly, Saurin & Ferreira (2009) found evidence that in their selected sample, employees felt that their working conditions had improved and strongly preferred the lean system to the previous system, despite noting that their workload, work intensity, and stress had increased.

The contradictions found in the above studies persist. Hasle (2014) argued that lean manufacturing is a concept that has been challenged in a debate with no consensus (Conti et al., 2006; Delbridge, 2005; Genaidy & Karwowski, 2003; Hasle, 2009; Treville & Antonakis, 2006). On one hand, the lean manufacturing model, by empowering employees, is seen as positive; however, it has been criticized for increasing workload and causing deterioration in workers' health and physical and psychological well-being (Babson, 1993; Danford et al., 2008; Harrison, 1994; Parker, 2003; Stewart et al., 2009).

It is important to note that the above studies focus on employees' behavioral aspects and consequences for their physical and psychological state *after* the lean implementation. Studies that focus on these same aspects during the process are rarer and are discussed below.

A lean manufacturing system requires a major shift in the mindset of people as a whole, from the shop floor to senior management, and these changes can be difficult to implement. Another factor is the importance of interpersonal relationships in terms of teamwork, training, team development, social interaction within the team, and respecting workers' opinions. Problems relating to the human factor include how people react to the manner in which they are treated within their organization and how they are involved in the lean manufacturing implementation process (Puvanasvaran et al., 2009). People management is not simply controlling procedures and routines. It implies the involvement of all members of the organization, and the organization must be committed to teaching, motivating, and investing in mechanisms that promote creativity and innovation.

Sawhney & Chason (2005) stated that during the migration to lean manufacturing, a major source of problems is related to people, for example, resistance to change, lack of necessary skills, and low motivation. Such factors can lead to a significant amount of conflict, both during and after implementation. The same authors cited the work of White et al. (1999), in which people's behavior is the metric least favored by the adoption of lean manufacturing systems. This is due to the nonintegration of peoples' behavior with the process, which leads to demotivation on the part of the worker. Success in this area essentially requires that workers are satisfied and have quality in their work life, a point also made by Vidal (2007). A company's productivity is closely related to its people and strategies. Therefore, for a system to be robust, it is crucial to place proper emphasis on people (Tabassi & Bakar, 2009).

2.2 Motivation in the workplace

Studies on the meaning of work in psychology are more recent than those on the motivation to work; they began to emerge in the 1980s. Therefore, differences in theoretical and methodological perspectives are not prominent, although they exist, which has been discussed in the literature (Borges et al., 2001).

Motivation is somewhat difficult to define concisely due to the wide diversity of views on the subject. This study uses Vroom's Expectancy Theory (Vroom, 1995) as a reference. According to Muchinsky (1994), this theory established the concept of expectancy in the field of motivation. It is a cognitive theory that states that in terms of work, there is a relationship between the effort made and the income received. It presupposes the unity of the human mind and action and is popular primarily because of its empirical support (Antoni, 2004; Hertel et al., 2004; Klein et al., 1999; Muchinsky, 1994). It is based on five basic concepts: (1) work outcomes, which are the consequences that an organization offers its employees for performing their functions; (2) valences, or the intensity with which an individual desires or feels aversion to obtaining a work outcome (Borges et al., 2001); (3) expectancy, which is an individual's perception of the probability that the expected results will actually occur; (4) instrumentality, which is the degree of perceived relationship between execution and obtaining outcomes; and (5) motivational force, which is the amount of effort or pressure that a person puts on him- or herself for self-motivation. According to Vroom (1995), the motivational force is a multiplicative function of valences, instrumentalities, and expectancies.

According to Bart (1996), workers feel more motivated when they belong to a team where they are free to make suggestions because the feeling of participating in a group is a basic human need. Nesan & Holt (1999) note that teams are especially motivated when given the opportunity to manage themselves.

Vroom (1995) developed his model of motivation considering five major categories of work outcomes: the provision of salary, the expenditure of physical and mental energy, the production of goods and services, social interactions with others, and social status. This author based the choice of these results on a comprehensive and thorough review of the literature. Borges et al. (2001) used the concepts of the motivation theory known as Expectancy Theory and its empirical categories to develop the MWMI.

Recently, the motivational factor as measured by the MWMI has been studied and related to different aspects or organizational variables. A significant number of recent studies focus only on the meaning of work or a simple measurement of motivation. Some of the most prominent of these recent studies are those by, Magalhães & Rosa (2017), Ruffatto et al. (2017), Biancheto et al. (2017), Arakaki & Leite (2016), and Alves & Borges (2014). However, studies that focus on operational results are rarer; this topic is explored in the next section.

2.2.1 Motivation in the workplace and operational results

Zameer et al. (2014) examined the effect of motivation on performance in industrial beverage companies, including Pepsi and Coca Cola, and concluded that basic needs, such as security, self-esteem, self-realization, interpersonal relationships, and professional growth, increase employee performance and consequently the industries' performance. In this sense, Erez (1997) stated that dissatisfied or unmotivated employees are unwilling to devote knowledge, effort, and personal skills to their work. Therefore, it is vital that an organization promotes the satisfaction of its employees.

Abreu (2011) examined the role of workplace motivation in the car industry, specifically the tooling area of Peugeot in Mangualde, and concluded that the motivational factor contributes to better performance of the employees involved, improving results and increasing productivity in a highly competitive sector.

More recently, Liu et al. (2018) studied how gamification in manufacturing can affect motivation and consequently operational performance. In a meta-analysis, Tzabbar et al. (2017) concluded that motivational practices are associated with operational gains.

However, surprisingly, given the numerous interventions that implement LM in the manufacturing environment, the literature is limited regarding empirical studies that correlate the motivational factor to operational performance in LM. This is the intention of this study.

A simple and intuitive conceptual model is proposed that integrates the variables or constructs considered in this study, as shown in Figure 1. This model is consistent with the previous analysis found in the literature and is one of the study's contributions to the literature. It proposes that the degree of benefit, in terms of operational performance, in the implementation of LM (for the key dimensions of quality, cost, and time) in a production unit or on production lines depends on the motivation of the operators working on the line or lines.

With respect to this model, two hypotheses are formulated for this study:

H1: The degree of operator motivation is positively associated with operational performance after the implementation of lean manufacturing.

H2: There is a statistically significant improvement in operational performance after the implementation of a lean manufacturing program.

3 Research methods and techniques

This research is empirical, exploratory, qualitative, quantitative, and based on a case study (Yin, 2005). Performance data were collected from three production lines of an industrial company, and a portion of the

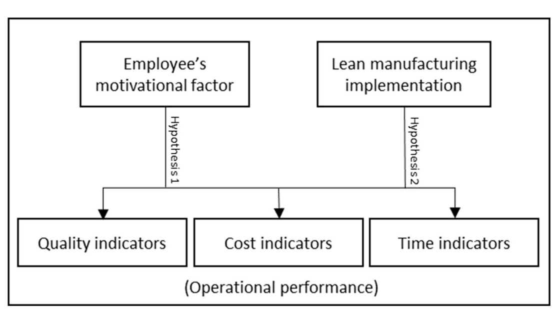

Figure 1. Conceptual model of motivational factor in LM. Source: the authors.

MWMI questionnaire was provided to members of the work teams of these lines. Unstructured interviews were also conducted with those involved in the research during the months of lean manufacturing implementation to evaluate operator motivation during the process.

Although the study's analysis unit is the employee, the study is configured as a case study. Yin (2005) suggests that some case studies can have a general analysis unit and other incorporated units (such as subunits).

The company chosen is an American multinational with operations in 35 countries. Its products are sold in more than 150 countries. It is a manufacturer of personal hygiene, infant care, and feminine protection products. The research occurred in a factory in the municipality of Camaçari, located in the state of Bahia. This unit has approximately 600 direct employees, of which 107 are production line operators.

Each of the three production lines has a work team specific to each shift. There are three shifts per day; the first shift has a working day of 6 am to 2 pm, the second from 2 pm to 10 pm, and the third from 10 pm to 6 am. Therefore, work is continuous with uninterrupted production. The teams of each shift are fixed, and workers are fixed on each line and on each shift. Put differently, the line 1 worker does not work on line 2 or 3, and vice versa, and does not change shift. Each production line is operated by nine employees, three per work shift.

Data were collected regarding the product cost (*proxy* for the cost dimension), waste rate (*proxy* for the quality dimension), and productivity (indirect *proxy* for the time dimension because the inputs in the productivity calculation depend on time) in the ten-month period prior to implementation of lean manufacturing and during the ten months after implementation on each line. This allowed us to measure whether there were significant improvements in these operational performance indicators.

It is noteworthy that the production lines have the same technology and the same nominal production capacity. The only difference between the production lines is the size of the products produced. The first line produces size M diapers, line 2 produces size XL, and line 3 produces size L.

During the final phase of lean manufacturing implementation, the MWMI questionnaire was given to 15 employees from the three production lines, i.e., five employees from each line and from different shifts. This represents 56% of the total number of employees on each line. These employees were chosen because they participated in the entire lean manufacturing implementation process, from start to finish.

It is worth mentioning that although it reduces the external validity, the choice of a case study has the advantage of reducing the effect of other factors on any change in operational performance. Because it was the same company and the same product category, factors such as training, skill building, content, and format of the lean manufacturing implementation plan were the same for all production lines, thus facilitating testing of the hypotheses presented in Section 2.

All employees chosen to complete the MWMI questionnaire had more than five years of experience within the company, with equivalent levels of training; all had completed a technical course, and they were between 30 and 37 years old.

It is important to note that the statistical techniques used in the descriptive statistics and non-parametric test only sought to confirm, in the studied company, the relationships expressed in the conceptual model shown in Figure 1. The MWMI instrument has been previously validated in several studies and was not changed or reformulated.

3.1 Data collection techniques and procedures

The data collection techniques used will be described in the following section.

3.1.1 Operational performance

The operational performance variables (waste or loss, unit product cost, and productivity) were collected from the company's system and management reports using software that measures these performance indicators. After data collection, the nonparametric Mann-Whitney test was used to establish whether there were significant gains in operational performance in the period following lean manufacturing implementation.

The loss rate (waste) is measured as a percentage by dividing the total number of products discarded during the month due to manufacturing defects by the total number of products produced during the month and multiplying this number by 100. The unit product cost is obtained by dividing the monthly costs (fixed and variable) by the total volume produced during the month. The productivity variable is the main indicator for measuring the efficiency of equipment, represented by the overall equipment effectiveness (OEE), and is measured as a percentage. The OEE measures how well a production line works relative to its expected capacity during the time that it is scheduled to operate. The OEE considers efficiency across three dimensions: availability, performance, and quality. The three components are multiplied to calculate the OEE index (Hansen, 2005).

It is important to note that the OEE variable is not totally independent of the other performance variables used, in particular waste.

3.1.2 MWMI questionnaire

During the final phase of lean manufacturing implementation in the company, a study was conducted that attempted to measure the motivation of each line's work team using the MWMI instrument. More specifically, questions measuring motivational force were posed (Borges et al., 2001).

The MWMI (Borges et al., 2001) questionnaire has a factorial structure and is divided into four major blocks. Within each of these blocks are themes, which in turn are composed of a series of questions (items), where each item has an assigned weight that, once placed in its factorial structure, allows calculation of the constructs to be measured. The themes of each MWMI block are represented by the following concepts: justice in the workplace, self-expression and personal fulfillment, involvement, wear and dehumanization, economic independence, responsibility, and working conditions. These constructs are derived from exploratory factor analysis, as shown in Borges et al. (2001). For the sake of brevity, we will not explore here the analysis performed by the aforementioned authors, but it should be emphasized that the instrument has satisfactory psychometric properties (Borges et al., 2001).

The questionnaire was administered as recommended by the MWMI instrument's author (Borges et al., 2001). In the MWMI, motivational force (MF) is the amount of effort or pressure a person applies to motivate him- or herself. MF is a measure of the "motivation" construct and is obtained from the product of the sums of scores of the instrumentality factors, subtracting the product of the scores of the expectancy and instrumentality factors relating to undesirable (or unattractive) work results, for which, hypothetically, negative valence is attributed. Only factors relating to wear and dehumanization are included in the formula, as shown in Equation 1 (Borges et al., 2001).

$$MF = \begin{bmatrix} \Sigma(Fe1, Fe3, Fe4, Fe5)^{*} \\ \Sigma(Fi1, Fi2, Fi4, Fi5) \end{bmatrix} - (Fe2^{*} Fi3) \quad (1)$$

Equation 1 translates as follows: Fe2 and Fi3 measure the valence; Fe1, Fe3, Fe4, and Fe5 measure the expectancy; and Fi1, Fi2, Fi4, and Fi5 measure the instrumentality.

After application of the questionnaire, the data were compiled, and the motivational force of each operator was measured. Subsequently, the mean motivational indices of the MWMI scale of each line and team were compared with the mean operational performance (for a total period of ten months beginning after lean manufacturing implementation).

3.1.3 Interviews

During the period of lean system implementation in the company, the researchers conducted unstructured and informal interviews with 15 employees from the sample to obtain additional evidence that could explain the results obtained and discrepancies in the teams' motivational factors.

4 Analysis and discussion of the results

The results are presented and discussed based on the following topics: (1) analysis of the MWMI and operational performance; (2) relationship between motivation and operational performance; and (3) motivation in teams.

4.1 Analysis of the MWMI and operational performance

Table 1 shows the expectancy factor scores, which comprise the individual's perception of the likelihood that a certain result will actually occur.

Table 2 shows the instrumentality scores, which comprise the perceived degree of relationship between execution and outcomes. These indicators are used to later calculate the motivational factor.

Table 3 shows the scores of the motivational force of each operator. The most motivated operator is on line 3, with a factor of 225.74. The least motivated is on line 2, with a result of 92.87. The table presents the mean motivational factor for each line. It may be noted that line 2 obtained a score of 106.44, which is nearly half as low as the results of lines 1 and 3, which were 200.14 and 207.49, respectively. This offers evidence that the line 2 team is struggling with regard to employee motivation, evidence that had already been provided in the interviews. Note also that the standard deviation of line 2 is higher (19.03) than those of lines 1 and 3, which were 6.71 and 11.11, respectively. It may be inferred that the degree of disagreement or variation between line 2 employees is much greater.

Additionally, the nonparametric Mann-Whitney test confirmed that there is a significant difference between the mean motivational factors on lines 1 and 2 (*p-value* of 0.01208). Similarly, there is a significant difference between the mean motivational factors of lines 3 and 2 (*p-value* of 0.01208). There is no significant difference between the mean motivational factors of lines 1 and 3 (*p-value* of 0.4009).

Conversations with the two operators of line 2, who had the lowest motivational factor results, revealed their high levels of emotional and physical wear. Both proved to be working extremely hard and said that they did not see that the results of their work were in proportion to the effort exerted. There are clear indications, according to both the MWMI and the interviews, that the line 2 employees have problems in terms of motivational factor.

Table 1. Mean expectancy factors.

Machines	Employees	Fe1 Self-expression	Fe2 Wear and dehumanization	Fe3 Responsibility	Fe4 Economic independence	Fe5 Safety and dignity
Line 1	**Operator 1**	3.53	1.33	3.66	3.87	3.64
	Operator 2	3.36	1.77	3.27	3.75	3.25
	Operator 3	3.08	1.83	3.34	3.20	3.83
	Operator 4	3.93	1.69	3.75	3.34	3.75
	Operator 5	3.78	1.71	3.64	3.55	3.63
Line 2	**Operator 6**	3.30	1.59	2.40	2.26	3.06
	Operator 7	3.46	1.97	3.26	3.32	3.21
	Operator 8	3.30	1.34	2.40	2.26	3.06
	Operator 9	3.04	2.18	2.99	2.80	2.82
	Operator 10	3.07	2.20	2.51	2.62	3.39
Line 3	**Operator 11**	3.62	1.51	3.50	3.46	3.83
	Operator 12	3.73	1.88	3.54	3.60	3.13
	Operator 13	3.47	1.87	3.77	3.61	3.81
	Operator 14	3.85	1.52	3.90	3.88	3.83
	Operator 15	3.65	1.53	3.34	3.29	3.75

Source: the authors.

Table 2. Mean instrumentality factors.

Machines	Employees	Fi1 Involvement and recognition	Fi2 Work material conditions	Fi3 Wear and dehumanization	Fi4 Reward and economic independence	Fi5 Responsibility
Line 1	**Operator 1**	3.42	3.39	0.94	3.23	3.48
	Operator 2	3.69	3.64	1.21	3.87	3.69
	Operator 3	3.44	3.76	1.44	3.82	3.32
	Operator 4	3.33	3.65	1.13	3.55	3.63
	Operator 5	3.54	3.54	1.67	3.51	3.66
Line 2	**Operator 6**	2.33	2.57	2.05	2.52	2.09
	Operator 7	2.27	3.18	2.31	3.12	2.34
	Operator 8	2.10	2.32	2.81	2.75	2.23
	Operator 9	2.06	2.12	2.51	2.50	2.20
	Operator 10	1.46	2.31	2.49	2.73	1.99
Line 3	**Operator 11**	3.56	3.79	1.16	3.85	3.40
	Operator 12	3.59	3.79	1.82	3.88	3.43
	Operator 13	3.62	3.77	2.48	3.81	3.04
	Operator 14	3.86	3.87	2.62	3.98	3.14
	Operator 15	3.30	3.78	2.10	3.96	3.18

Source: the authors.

For the production line results analysis, data were collected regarding the operational performance indicators over two periods: prior to implementation and after implementation, as shown in Tables 4, 5, and 6.

Table 4 shows data relating to each month's product cost for the three production lines. The product cost is calculated as the total cost divided by the total volume produced. The lines have different costs, as they produce different sized diapers. Variations in cost are therefore expressed in terms of percentages. It is possible to see that line 2's product cost did not reduce after lean implementation; this result differs from those for lines 1 and 3, which showed significant reductions in product cost of -12.26% and -23.39%, respectively. The results of the statistical tests shown in Table 5 confirm that line 2 did not obtain a significant change (*p-value* of 0.42858).

It is important to note that according to the company's management, line 2's product cost levels were not low before the LM implementation process, so it

Table 3. Results of motivational forces.

Machines	Employees	MF		
		Motivational Force (0 to 256)	Mean Motivational Force (0 to 256)	Motivational Force Standard Deviation
Line 1	**Operator 1**	197.41	200.14	6.71
	Operator 2	200.81		
	Operator 3	190.25		
	Operator 4	207.30		
	Operator 5	204.96		
Line 2	**Operator 6**	101.49	106.44	19.03
	Operator 7	139.99		
	Operator 8	99.86		
	Operator 9	97.97		
	Operator 10	92.87		
Line 3	**Operator 11**	208.76	207.49	11.11
	Operator 12	202.25		
	Operator 13	204.22		
	Operator 14	225.74		
	Operator 15	196.48		

Source: the authors.

Table 4. Product cost.

PRODUCT COST - BRL/1000									
Machines	Ten months prior to implementation			Ten months after implementation					
Line 1	**July/13**	327.67	**Mean**	**Sept/14**	247.74	**Mean**	**Gain %**	**U-Value**	**p-Value (p <0.05)**
	Aug/13	315.43	303.32	**Oct/14**	254.34	266.14	-12.26%	161.5	0.03005
	Sept/13	302.73		**Nov/14**	277.13				
	Oct/13	286.86		**Dec/14**	253.20				
	Nov/13	295.40		**Jan/15**	265.80				
	Dec/13	298.90		**Feb/15**	288.50				
	Jan/14	285.24		**Mar/15**	278.15				
	Feb/14	314.20		**Apr/15**	268.01				
	Mar/14	321.60		**May/15**	258.04				
	Apr/14	285.14		**June/15**	270.52				
Line 2	**Nov/14**	288.50	**Mean**	**Jan/16**	384.14	**Mean**	**Gain %**	**U-Value**	**p-Value (p <0.05)**
	Dec/14	341.02	349.87	**Feb/16**	397.71	349.91	0.01%	234	0.42858
	Jan/15	368.39		**Mar/16**	332.98				
	Feb/15	360.30		**Apr/16**	345.55				
	Mar/15	339.81		**May/16**	328.78				
	Apr/15	347.99		**June/16**	332.28				
	May/15	354.27		**July/16**	329.48				
	June/15	373.83		**Aug/16**	323.92				
	July/15	332.58		**Sept/16**	394.03				
	Aug/15	391.97		**Oct/16**	330.24				
Line 3	**July/14**	283.45	**Mean**	**Sept/15**	272.40	**Mean**	**Gain %**	**U-Value**	**p-Value (p <0.05)**
	Aug/14	291.80	355.25	**Oct/15**	252.40	272.14	-23.39%	128	0.0268
	Sept/14	305.79		**Nov/15**	267.70				
	Oct/14	298.51		**Dec/15**	245.20				
	Nov/14	293.92		**Jan/16**	283.50				
	Dec/14	333.90		**Feb/16**	247.20				
	Jan/15	736.60		**Mar/16**	292.40				
	Feb/15	363.25		**Apr/16**	274.70				
	Mar/15	323.61		**May/16**	298.41				
	Apr/15	321.63		**June/16**	287.50				

Source: the authors

Table 5. Waste.

WASTE - %									
Machines	**Ten months prior to implementation**			**Ten months after implementation**					
Line 1	**July/13**	19.58	**Mean**	**Sept/14**	7.25	**Mean**	**Gain %**	**U-Value**	**p-Value (p <0.05)**
	Aug/13	16.12	14.12	**Oct/14**	7.92	8.83	-37.43%	156.5	0.12302
	Sept/13	14.25		**Nov/14**	10.51				
	Oct/13	16.19		**Dec/14**	9.48				
	Nov/13	10.90		**Jan/15**	12.07				
	Dec/13	14.46		**Feb/15**	11.52				
	Jan/14	15.63		**Mar/15**	8.66				
	Feb/14	10.13		**Apr/15**	8.15				
	Mar/14	12.93		**May/15**	6.18				
	Apr/14	11.00		**June/15**	6.60				
Line 2	**Nov/14**	8.13	**Mean**	**Jan/16**	9.37	**Mean**	**Gain %**	**U-Value**	**p-Value (p <0.05)**
	Dec/14	10.97	10.45	**Feb/16**	8.64	9.41	-10.03%	160	0.14231
	Jan/15	13.98		**Mar/16**	9.06				
	Feb/15	13.38		**Apr/16**	10.40				
	Mar/15	11.26		**May/16**	8.95				
	Apr/15	10.69		**June/16**	11.70				
	May/15	9.48		**July/16**	8.04				
	June/15	11.18		**Aug/16**	9.87				
	July/15	7.94		**Sept/16**	9.20				
	Aug/15	7.53		**Oct/16**	8.82				
Line 3	**July/14**	9.47	**Mean**	**Sept/15**	6.43	**Mean**	**Gain %**	**U-Value**	**p-Value (p <0.05)**
	Aug/14	10.82	11.68	**Oct/15**	6.54	5.62	-51.91%	128	0.03216
	Sept/14	13.75		**Nov/15**	7.00				
	Oct/14	12.05		**Dec/15**	6.00				
	Nov/14	10.78		**Jan/16**	5.24				
	Dec/14	10.26		**Feb/16**	4.90				
	Jan/15	10.95		**Mar/16**	4.83				
	Feb/15	14.59		**Apr/16**	5.89				
	Mar/15	11.84		**May/16**	4.53				
	Apr/15	12.30		**June/16**	4.83				

Source: the authors.

Table 6. Productivity.

PRODUCTIVITY - %									
Machines	**Ten months prior to implementation**			**Ten months after implementation**					
Line 1	**July/13**	43.53	**Mean**	**Sept/14**	62.42	**Mean**	**Gain %**	**U-Value**	**p-Value (p <0.10)**
	Aug/13	45.91	46.01	**Oct/14**	60.63	60.46	31.41%	175	0.05938
	Sept/13	45.50		**Nov/14**	59.85				
	Oct/13	40.97		**Dec/14**	57.28				
	Nov/13	48.96		**Jan/15**	60.70				
	Dec/13	40.72		**Feb/15**	62.80				
	Jan/14	41.57		**Mar/15**	58.74				
	Feb/14	51.11		**Apr/15**	54.96				
	Mar/14	48.87		**May/15**	68.99				
	Apr/14	52.98		**June/15**	58.27				

Source: the authors.

Table 6. Continued...

PRODUCTIVITY - %									
Machines	**Ten months prior to implementation**			**Ten months after implementation**					
Line 2	**Nov/14**	54.93	**Mean**	**Jan/16**	71.11	**Mean**	**Gain %**	**U-Value**	**p-Value (p <0.05)**
	Dec/14	59.51	55.86	**Feb/16**	61.41	66.01	18.17%	186.5	0.36317
	Jan/15	50.45		**Mar/16**	66.71				
	Feb/15	55.70		**Apr/16**	59.28				
	Mar/15	49.72		**May/16**	69.06				
	Apr/15	59.87		**June/16**	72.44				
	May/15	60.14		**July/16**	69.54				
	June/15	52.98		**Aug/16**	64.14				
	July/15	55.16		**Sept/16**	65.60				
	Aug/15	60.17		**Oct/16**	60.83				
Line 3	**July/14**	50.10	**Mean**	**Sept/15**	62.74	**Mean**	**Gain %**	**U-Value**	**p-Value (p <0.05)**
	Aug/14	45.27	44.88	**Oct/15**	63.05	64.50	43.73%	193	0.42858
	Sept/14	41.76		**Nov/15**	60.39				
	Oct/14	45.77		**Dec/15**	61.71				
	Nov/14	46.93		**Jan/16**	65.60				
	Dec/14	45.74		**Feb/16**	67.64				
	Jan/15	51.74		**Mar/16**	68.05				
	Feb/15	35.91		**Apr/16**	58.87				
	Mar/15	43.72		**May/16**	68.75				
	Apr/15	41.81		**June/16**	68.19				

Source: the authors.

cannot be said that subsequent marginal reductions would be difficult to achieve.

Table 5 shows the waste percentage values for each month and each line, before and after lean manufacturing implementation, i.e., the percentage of products lost due to some type of manufacturing defect (product not according to specification). It can be seen that line 2 obtained a very small reduction after implementation, of only -10.03%; line 3 obtained excellent results, reducing their losses by more than half (-51.91%), and line 1 also improved greatly, obtaining a reduction of -37.43%. The only line with a significant result in the statistical tests was line 3 (*p-value* of 0.03216).

Table 6 shows the percentage data relating to productivity gains. The results demonstrate once again that line 2 was unable to obtain very significant gains, with only an 18.17% increase in productivity. Lines 1 and 3 obtained gains of 31.41% and 43.73%, respectively. The only line with a significant result for productivity, i.e., with a *p-value* <0.10, was line 1, which had a *p-value* of 0.05938.

It is important to note that line 2's productivity levels were slightly higher than the other lines prior to the LM implementation process, so it is possible that improvements in that line's productivity would have been more difficult to achieve.

There is, therefore, evidence to support the central hypothesis of the study, i.e., that the greater the employees' motivation is, the greater the operational performance after implementation of a lean manufacturing program. In the work presented, when there was a greater motivational factor, there was less waste, greater productivity, and lower costs. Lines 1 and 3 had the best motivational factors, and this was reflected in the better operational performance indicator results. These findings are consistent with studies by Abreu (2011), Erez (1997), and Zameer et al. (2014), which found a relationship between motivation and performance.

In view of these results, one can infer that the lines for which lean manufacturing implementation was successful were lines 1 and 3. This supports hypothesis 2. Line 2 failed to achieve the satisfactory results expected by the company. An alignment meeting held with all line 2 operators involved in the study revealed that they were unable to perform problem solving when changing shifts, i.e., this is a team that does not show unity towards a common goal; members focus on identifying colleagues' mistakes rather than resolving problems. This shows a clear misalignment between members. As mentioned above, Tabassi & Bakar (2009) and White et al. (1999) have indicated the negative consequences of this very problem.

4.2 Relationship between motivation and operational performance

To ascertain the relationship between the motivational factors found and operational performance, a combination of two graphs with main (scale referring to motivation) and secondary (scale referring to operational results) axes were extracted from Table 7.

Line 2 has the lowest mean motivational factor in Figure 2 (motivational factor x product cost ratio).

Table 7. Relationship between motivational factors and operational performance.

Machines	ẋ Motivational factor	ẋ Postimplementation product cost	ẋ Postimplementation waste	ẋ Postimplementation productivity
Line 1	200.14	-12.26%	-37.43%	31.41%
Line 2	106.44	0.01%	-10.03%	18.17%
Line 3	207.49	-23.39%	-51.91%	43.73%

Source: the authors.

Virtually no reductions were achieved relative to product cost, with a result of 0.01%. Lines 1 and 3 exhibited significant reductions in mean product cost of -12.26% and -23.39%, respectively, and one can see that when the mean motivational factor was highest, as in the case of line 3, the reduction was the most significant.

Figure 3 (motivational factor x waste) shows a result somewhat similar to that of the previous indicator. Line 2 had the lowest reduction in waste at -10.03%, which was well behind those for lines 1 and 3, with reductions of -37.43% and 51.91%, respectively. Line 3 produced the greatest reduction and had the highest mean motivational factor of 207.49, in keeping with study hypothesis 1.

Figure 4 (motivational factor x productivity ratio) shows that line 2 had the lowest productivity increase of only 18.17%, behind line 1 with 31.41%. Line 3 had the greatest growth in productivity, with an increase of 43.73%.

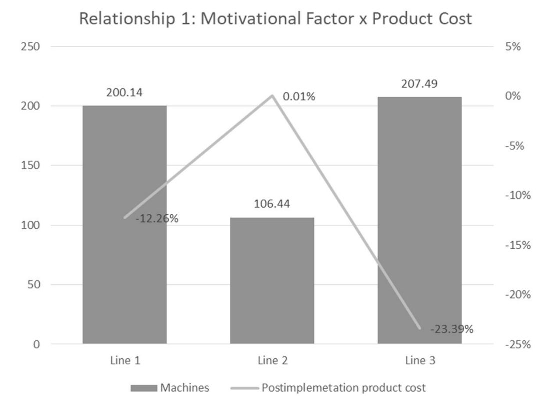

Figure 2. Relationship between motivational factor and product cost. Source: the authors.

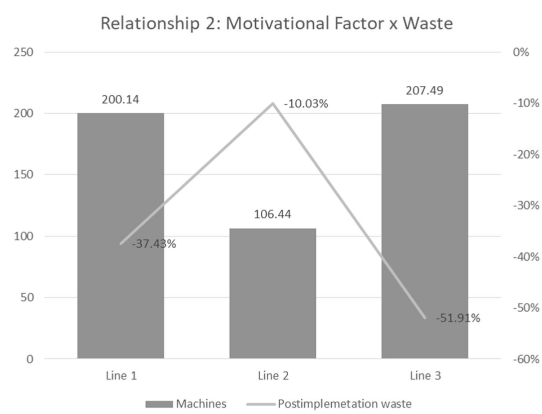

Figure 3. Relationship between motivational factor and waste. Source: the authors.

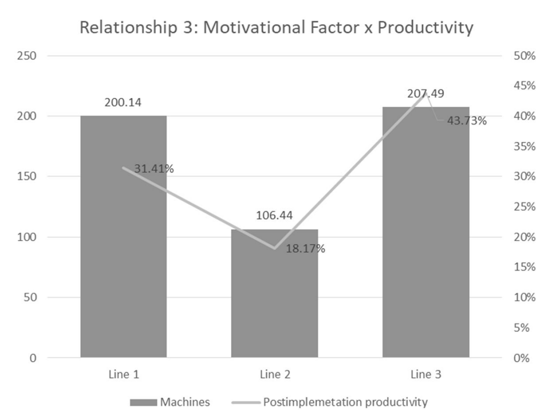

Figure 4. Relationship between motivational factor and productivity. Source: the authors.

4.3 Motivation in teams

It is important to stress that during the implementation of lean manufacturing on the lines, there were several unstructured interviews on the *Gemba*. One of the reports revealed that the line 2 team wanted and made efforts to achieve the goals; however, these efforts were not collective but were individual efforts within the same work shift. At the end of each month, they did not produce significant results. This result is consistent with Vroom's (Vroom, 1995) conclusions, which stated that an individual who believes that his or her effort will not produce any significant variation in the outcomes will tend to not work hard and will have low motivation.

An important aspect of employee motivation is finding appropriate ways to meet the employee's needs. Each individual has different needs, and these may be associated with participation in his or her day-to-day work, recognition, and feedback, among other factors. The line 1 team reported on the *Gemba* that they consider themselves open to both positive feedback and to feedback detailing opportunities for improvement. Many employees are motivated when they are "empowered" and feel that their participation is important in making the company successful. This appears to have occurred on that line. When employees feel empowered in this manner, they work to meet not only their own needs but also the needs of the company as a whole (Tabassi & Bakar, 2009; Vidal, 2007).

The reports of five outstanding employees, three members of line 3 and two of line 1, suggest that they are confident that financial rewards are adequate when the proposed objectives are achieved. In the reports of two employees, who are the A and B shift operators of line 2, they admit to having poor motivation, as they did not obtain financial rewards after the management evaluation. In this sense, Olomolaiye et al. (1998) stated that money is a powerful motivator and that a well-designed reward system will lead to greater productivity for the employer in exchange for the additional wages awarded to employees for their efforts.

In the interviews, it was clear that the selected operators in line 2 had no confidence in each other and that there were not good relationships among them. Each was working without considering the following shift. In addition, their interpersonal relationships were unsatisfactory, which differs from the relationships observed between the line 1 and 3 operators, who often extended their working hours to help the next shift to achieve good results. These outcomes are in accordance with Zameer et al. (2014) view that basic needs, such as interpersonal relationships and professional growth, increase employee performance and, consequently, company performance. It is therefore crucial that responsible sectors study techniques that help to build good relationships in their work teams so that they can obtain better results, thus ensuring greater market competitiveness.

Another practice adopted by the company studied is recognition of any team that exceeds previous records at the end of each month. These teams are given a picture of the entire team to be placed on the factory's entrance panel. These teams also win baskets of products that they themselves manufactured. The recognition of good work, even if not financial, is also considered a powerful method to inspire and enthuse employees. Nesan & Holt (1999) note that positive feedback is especially effective when applied to teams and recommend that this type of recognition be given to the best employees each month.

In the reports of the line 3 team, during the interviews, the employees reported feeling safe when giving suggestions and opinions on the day's work and did not fear retaliation. In addition, line 3 employees reported that they felt they were the "managers" of their own working day, that is, that they were responsible for their actions. This is in accordance with the proposals of Bart (1996) and Nesan & Holt (1999), cited above.

5 Conclusions

In general, studies into the behavioral aspects of lean manufacturing focus on consequences to the physical and psychological states of employees after lean implementation, that is, how LM affects the employee in his or her role and regarding his or her well-being. However, there are few studies from the opposite perspective, i.e., that focus on how the workers' behavior during lean implementation affects the operational performance achieved. This is an important gap in the literature, one that this research attempts to partially fill.

The work presented sought to understand and show how the motivational factor can affect the gains in operational performance obtained after implementation of a lean program, in terms of productivity, waste, and product cost. The results provide evidence to support the hypothesis, based on the literature, that the role of the motivational factor in work teams in a lean implementation process will affect the degree of success of the process. Furthermore, they also corroborate the hypothesis that after implementation of a lean program, there will be a significant improvement in the operational performance of the lines.

People management is not just about controlling procedures and routines. It implies the involvement and motivation of all members of an organization. This work can contribute to the leaders' practices in that it shows the importance of the motivational factor to operational performance and explores methods by which both individual and work team motivation can be improved.

The study's main limitation is that it measures motivation at just one point in time, i.e., during the final phase of the lean manufacturing program implementation. The MWMI motivational factor could have also been measured during earlier stages. However, the quantitative MWMI results were fully compatible with and confirmed the evidence accumulated during the participant interviews that occurred during the lean implementation. Moreover, when the interviews occurred, the effective operational gains achieved by the program remained unclear. Therefore, the alternative explanation that poor performance had demotivated employees is implausible.

It is important to note that the study of a single company does not allow us to generalize the results. It is understood that the study allowed the hypothesis to be tested only in this specific case. Furthermore, similar hypotheses have already been tested in previous studies with larger samples and may be generalized, although, as mentioned in the literature review, these were not focused on the effect of behavioral factors specifically on operating results resulting from implementation of lean manufacturing. The present study is innovative in this regard. The studies mentioned above, with their greater external validity and power of generalization, demonstrate the importance of motivation on work performance in a broad sense. In general, employees with higher motivation produce superior performance in their work. This study adds additional empirical evidence that, in the specific process of lean manufacturing implementation, this factor is also important.

Methods or situations in which workplace motivation can be fostered or improved were addressed, albeit in an ad hoc manner. The literature on this topic is extensive, and this study helps to confirm the importance of this goal, not only in terms of achieving greater employee satisfaction but also in terms of the effectiveness, quality, and productivity resulting from the employee's work.

Finally, from an academic point of view, this brief study attempts to partially fill the gap in the literature concerning the association between the behavioral aspects of lean implementation and company results. From an empirical point of view, this study, despite being limited to a very particular case, offers a contribution to lean intervention practitioners and encourages similar research, particularly in the current context, in which a great deal of effort is being made to improve manufacturing operations by means of lean practices.

Future work could include a longitudinal study to evaluate the effects of implementation of a lean manufacturing program on long-term motivation and operational performance. In addition, new research could test the effectiveness of management practices that aim to motivate LM teams.

References

Abreu, V. D. F. (2011). *A influência da motivação na produtividade do posto de trabalho: aplicação à indústria automóvel* (Tese de doutorado). Escola Superior de Tecnologia e Gestão de Viseu, Viseu.

Alves, A., Fo., & Borges, L. D. O. (2014). The health professional's motivation in the basic health units. *Psicologia (Conselho Federal de Psicologia)*, 34(4), 984-1001.

Antoni, C. H. (2004). Research note: a motivational perspective on change processes and outcomes. *European Journal of Work and Organizational Psychology*, 13(2), 197-216. http://dx.doi.org/10.1080/13594320444000065.

Arakaki, S. C., & Leite, U. R. (2016). Aspectos motivacionais e o significado do trabalho em concessionárias de carros e motos. *Revista Interamericana de Psicología Ocupacional*, 31(2), 85-100.

Babson, S. (1993). Lean or mean: the MIT model and lean production at Mazda. *Labor Studies Journal*, 18, 3-24.

Bart, J. (1996). *McGraw-hill's best practices for housing construction*. São Paulo: McGraw Hill.

Bendoly, E., Van Wezel, W., & Bachrach, D. (2015). *The handbook of behavioral operations management: Social and psychological dynamics in production and service settings*. Oxford: Oxford University Press. http://dx.doi.org/10.1093/acprof:oso/9780199357215.001.0001.

Biancheto, J. M., Coltre, S. M., & Mello, G. R. (2017). Fator valorativo do trabalho: estudo em uma indústria moveleira do sudoeste do Paraná. *Revista Capital Científico-Eletrônica*, *15*(3), 1-13. http://dx.doi.org/35/2177-4153.20170021.

Borges, L., Tamayo, A. O., & Alves, A., Fo. (2001). A mensuração da motivação e do significado do trabalho. *Estudos de Psicologia*, 6(2), 177-194. http://dx.doi.org/10.1590/S1413-294X2001000200006.

Cardon, N., & Bribiescas, F. (2015). Respect for people: the forgotten principle in lean manufacturing implementation. *European Scientific Journal*, 11(13), 45-61.

Conti, R., Angelis, J., Cooper, C., Faragher, B., & Gill, C. (2006). The effects of lean production on worker job stress. *International Journal of Operations & Production Management*, 26(9), 1013-1038. http://dx.doi.org/10.1108/01443570610682616.

Danford, A., Richardson, M., Stewart, P., Tailby, S., & Upchurch, M. (2008). Partnership, high performance work systems and quality of working life. *New Technology, Work and Employment*, 23(3), 151-166. http://dx.doi.org/10.1111/j.1468-005X.2008.00210.x.

Delbridge, R. (2005). Workers under lean manufacturing. In D. Holman, T. D. Wall, C. W. Clegg, P. Sparrow, & A. Howard (Eds.), *The essentials of the new workplace - A guide to the human impact of modern working practices* (pp. 15-32). Chichester: JohnWiley & Sons.

Erez, M. (1997). A culture based model of work motivation. In P. C. Earley, & M. Erez (Eds.), *New perspectives on international industrial/organizational psychology* (pp. 193-242). San Francisco: Jossey-Bass.

Genaidy, A. M., & Karwowski, W. (2003). Human performance in lean production environment: critical assessment and research framework. *Human Factors and Ergonomics in Manufacturing*, 13(4), 317-330. http://dx.doi.org/10.1002/hfm.10047.

Hansen, R. C. (2005). *Overall equipment effectiveness: a powerful production/maintenance tool for increased profits*. Norwalk: Industrial Press.

Harrison, B. (1994). *Lean and mean. The changing landscape of corporate power in the age of flexibility*. New York: The Guilford Press.

Hasle, P. (2009). Lean and the psychosocialwork environment. In P. O. Saksvik (Ed.), *Prerequisites for healthy organizational change* (pp. 1-9). Oak Park: Bentham Science Publishers.

Hasle, P. (2014). Lean production: an evaluation of the possibilities for an employee supportive lean practice. *Human Factors and Ergonomics in Manufacturing*, 24(1), 40-53. http://dx.doi.org/10.1002/hfm.20350.

Heracleous, L., & Barrett, M. (2001). Organizational change as discourse: communicative actions and deep structures in the context of information technology implementation. *Academy of Management Journal*, 44(4), 755-778.

Hertel, G., Konradt, U., & Orlikowski, B. (2004). Managing distance by interdependence: goal setting, task interdependence, and team-based rewards in virtual teams. *European Journal of Work and Organizational Psychology*, 13(1), 1-28. http://dx.doi.org/10.1080/13594320344000228.

Johnson, D. J., & Wemmerlöv, U. (2004). Why does cell implementation stop? Factors influencing cell penetration in manufacturing factories. *Production and Operations Management*, 13(3), 272-289. http://dx.doi.org/10.1111/j.1937-5956.2004.tb00512.x.

Klein, H. J., Wesson, M. J., Hollenbeck, J. R., & Alge, B. J. (1999). Goal commitment and the goal-setting process: conceptual clarification and empirical synthesis. *The Journal of Applied Psychology*, 84(6), 885-896. http://dx.doi.org/10.1037/0021-9010.84.6.885. PMid:10639908.

Lewchuk, W., & Robertson, D. (1996).Working conditions under lean production: a worker-based benchmarking study. In P. Stewart (Ed.), *Beyond Japanese management. The end of modern times?* (pp. 60-81). London: Frank Cass. http://dx.doi.org/10.1080/13602389600000020.

Lewchuk, W., & Robertson, D. (1997). Production without empowerment: work re-organisation from the perspective of motor vehicle workers. *Capital and Class*, 21(3), 37-64. http://dx.doi.org/10.1177/030981689706300104.

Lewchuk, W., Stewart, P., & Yates, C. (2001). Quality of working life in the automobile industry: a Canada-UK comparative study. *New Technology, Work and Employment*, 16(2), 72-87. http://dx.doi.org/10.1111/1468-005X.00078.

Liu, M., Huang, Y., & Zhang, D. (2018). Gamification's impact on manufacturing: enhancing job motivation, satisfaction and operational performance with smartphone-based gamified job design. *Human Factors and Ergonomics in Manufacturing & Service Industries*, 28(1), 38-51. http://dx.doi.org/10.1002/hfm.20723.

Magalhães, L. S., & Rosa, F. H. M. (2017). O fator humano na organização: características motivacionais da equipe de enfermagem de um hospital público do interior de Rondônia. *Revista de Administração em Saúde*, *17*(68), 1-15. http://dx.doi.org/10.23973/ras.68.38.

Muchinsky, P. M. (1994). *Psicologia aplicada al trabajo: una introduccion a la psicología industrial y organizacional* (pp. 367-412). Bilbao: Desclée de Brouwer.

Nesan, L. J., & Holt, G. D. (1999). *Empowerment in construction: the way forward for performance improvement*. Research Studies Press.

Olomolaiye, P. O., Jayawardane, A. K. W., & Harris, F. C. (1998). *Construction productivity management*. England: Longman.

Parker, S. K. (2003). Longitudinal effects of lean production on employee outcomes and the mediating role of work characteristics. *The Journal of Applied Psychology*, 88(4), 620-634. http://dx.doi.org/10.1037/0021-9010.88.4.620. PMid:12940403.

Puvanasvaran, P., Megat, H., Sai Hong, T., & Mohd.Razali, M. (2009). The roles of communication process for an effective lean manufacturing implementation. *Journal of Industrial Engineering and Management*, 2(1), 128-152. http://dx.doi.org/10.3926/jiem.2009.v2n1.p128-152.

Ruffatto, J., Pauli, J., & Ferrão, A. R. (2017). Influência do estilo de liderança na motivação e conflitos interpessoais em empresas familiares. *Revista de Administração FACES Journal*, 16(1), 29-44. http://dx.doi.org/10.21714/1984-6975FACES2017V16N1ART3616.

Saurin, T. A., & Ferreira, C. F. (2009). The impacts of lean production on working conditions: a case study of a harvester assembly line in Brazil. *International Journal of Industrial Ergonomics*, 39(2), 403-412. http://dx.doi.org/10.1016/j.ergon.2008.08.003.

Sawhney, R., & Chason, S. (2005). Human behavior based exploratory model for successful implementation of lean enterprise in industry. *Performance Improvement Quarterly*, 18(2), 76-96. http://dx.doi.org/10.1111/j.1937-8327.2005.tb00334.x.

Shah, R., & Ward, P. T. (2003). Lean manufacturing: context, practice bundles, and performance. *Journal of Operations Management*, 21(2), 129-149. http://dx.doi.org/10.1016/S0272-6963(02)00108-0.

Stewart, P., Richardson, M., Danford, A., Murphy, K., Richardson, T., & Wass, V. (2009). *We sell our time no more-Workers' struggle against lean production in the British car Industr*y. London: Pluto Press.

Sundar, R., Balaji, A. N., & Kumar, R. M. S. (2014). A review on lean manufacturing implementation techniques. *Procedia Engineering*, 97, 1875-1885. http://dx.doi.org/10.1016/j.proeng.2014.12.341.

Tabassi, A. A., & Bakar, A. A. (2009). Training, motivation, and performance: the case of human resource management in construction projects in Mashhad, Iran. *International Journal of Project Management*, 27(5), 471-480. http://dx.doi.org/10.1016/j.ijproman.2008.08.002.

Treville, S., & Antonakis, J. (2006). Could lean production job design be intrinsically motivating? Contextual, configurational, and levels-of-analysis issues. *Journal of Operations Management*, 24(2), 99-123. http://dx.doi.org/10.1016/j.jom.2005.04.001.

Tzabbar, D., Tzafrir, S., & Baruch, Y. (2017). A bridge over troubled water: replication, integration and extension of the relationship between HRM practices and organizational performance using moderating meta-analysis. *Human Resource Management Review*, 27(1), 134-148. http://dx.doi.org/10.1016/j.hrmr.2016.08.002.

Vidal, M. (2007). Lean production, worker empowerment, and job satisfaction: a qualitative analysis and critique. *Critical Sociology*, 33(1-2), 247-278. http://dx.doi.org/10.1163/156916307X168656.

Vienazindiene, M., & Ciarniene, R. (2013). Lean manufacturing implementation and progress measurement. *Economics and Management*, *18*(2), 366-373.

Vroom, V. H. (1995). *Work and motivation*. New York: Wiley. Obra originalmente publicada em 1964.

White, R. E., Pearson, J. N., & Wilson, J. R. (1999). JIT manufacturing: a survey of implementations in small and large US manufacturers. *Management Science*, 45(1), 1-15. http://dx.doi.org/10.1287/mnsc.45.1.1.

Womack, J. P., & Jones, D. T. (1996). Beyond Toyota: how to root out waste and pursue perfection. *Harvard Business Review*, 74(5), 140-158.

Yin, R. K. (2005). *Estudo de caso: planejamento e métodos* (3. ed.). Porto Alegre: Bookman.

Zameer, H., Alireza, S., Nisar, W., & Amir, M. (2014). The impact of the motivation on the employee's performance in beverage industry of Pakistan. *International Journal of Academic Research in Accounting. Finance and Management Sciences*, 4(1), 293-298. http://dx.doi.org/10.6007/IJARAFMS/v4-i1/630.