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# Impact Assessment on the Economic and Financial Indicators of the Implementation of Lean Management Model

**ABSTRACT**

**Objective:** Understand how the increased competitiveness encourages industries to seek solutions in order to maintain or increase their market share, promoting the manufacturing of quality products at reduced costs.

**Methodology:** In this study, an in-company analysis regarding the Lean performance evaluation methods present in the literature as well as already implemented in the industry was performed, focusing on the gaps of present models and needs for future.

**Findings:** New philosophies arise such as the Lean Manufacturing, which is based on continuous improvement, aiming at optimizing the production system, eliminating waste and using fewer resources.

**Value Added:** Based on the results, and with the objective of allowing comprehensive assessment of Lean performance independently by the companies, and the determination of improvement actions, a Lean performance evaluation method was developed in order to understand the impact in financial and economic figures of the case study.

**Recommendations:** Take into account the main concepts of the social sciences, such as Organizational Culture, Leadership Style and Strategic Approach, considering the link with the financial economic performance.

**Key words:** Organizational Change; Organizational culture; Leadership; LEAN management; Application and performance model

**JEL codes:** L11, L21, G31

## Introduction

Nowadays, a modern, competitive context is pressuring companies to achieve higher productivity with the lowest possible cost impact (Kokubu & Tachikawa, 2013).

Thus, few alternative methods have emerged to support management decisions in terms of economic performances and, simultaneously, considering the product quality impact and production volumes (Kokubu & Tachikawa, 2013; Sygulla, Bierer & Götze, 2011).

Under the current circumstances, a robust report supported in KPI's is considered as one of the main tools for management and results improvement (Kokubu & Tachikawa, 2013).

Deployment of Economic performance indicators is a management tool fostering the transparency of results reporting for process flows and Time Driven Activity Based Costing (Kaplan & Anderson, 2007).

This method has been developed to support industrial companies to increase the efficiency of Business Processes and to support management decisions by presenting the effective value of the company's waste.

Lean Management is recognised as a solution for waste elimination. Its main goal is the identification and elimination of several types of waste allowing companies to achieve an efficient customer demand (Spear, 2019).

Firstly, the deployment methodology is applied to an industrial system in a Portuguese company.

Then, to support the hypothesis of integration, the Economic and Financial Indicators and Lean management complementarities and gaps are primarily observed to identify improvement opportunities in manufacturing system during the Process Flow Cost Recording.

Further, to support the hypothesis of integrating the indicators and Lean tools, their complementarities aspects and gaps of knowledge are studied based on scientific literature. Thereafter, a methodology to integrate the KPI's reporting and Lean management, is presented and preliminarily validated with a case study.

## Literature Review and Methodology Model

The Process Flow Cost Recording is characterized by being a flow-orientated accounting method that traces and quantifies in physical and monetary units all the material and added value cost flows. Furthermore, it compares the costs associated to the products and the material losses (Kokubu & Tachikawa, 2013). Once the cost of waste is visible, it can drive managers to re-plan their strategy, understanding the impact on the economic and financial indicators.

As soon as their strategy is implemented, the resources reduction can be achieved and, consequently, a reduction of the overall production cost and economic impact as well (Guenther et al., 2015). Thus, the deployment of indicators aims to support companies to enhance its financial and economic performance through the reduction of resources usage (Christ & Burritt, 2016).

The original concept of the strategy and management indicators linkage was developed in 2004 at Harvard Business School, USA. Posterior few pilot

projects were initialised in the world industry. Nevertheless, the first breakthrough of the method was accomplished in Japan by Toyota.

Due to the successful results of the first implementations the methodology was enhanced and published in September 2011 as ISO14051 included in Cost Accounting procedures (Sygulla, Bierer, & Götze, 2011; Guenther et al., 2015).

## Principles and Fundamentals of Indicators Deployment

The Process of deploying indicators method divides the entire production system into responsibility levels. The  $m$  levels are parts or sub-divisions of the management system where the inputs and outputs must be quantified in physical and further in monetary units.

Usually, these areas correspond to places where materials are transformed or stocked (Kaplan & Anderson, 2007).

The management levels are the starting point for data collection in physical units in terms of resources measurements.

Considering this principle and to guarantee that all the flows are accounted, a mass balance should be performed to the production system per each area individually.

The system of indicators management considers the production of goods as a system of integrated report, based on the mass balance. It distinguishes the movements of materials in (Sygulla, Götze, & Bierer, 2011.: (i) Desired material flow – Movement of material that intend to become part of the final product; (ii) Undesired material flow – movement of unintended materials output.

The Process application method must be considered as a step-by-step procedure. Its implementation in a production system can be performed based on the following steps (Kaplan & Anderson, 2007):

- 1) Selection of the indicators to analyse;
- 2) Definition of boundaries and time period of analysis;
- 3) Determination of the measured items;
- 4) Quantification of material and added value flow in physical units;

- 5) Quantification of the previous flows in monetary units;
- 6) Identification of Inputs and Outputs;
- 7) Development of a calculation model which compiles the collected information;
- 8) Communicating the results to the company's managers;
- 9) Process Flow Cost Recording summary and interpretation.

Since any production process requires several types of inputs, the analysis should consider all the costs involved on it. Consequently, the flow cost which have to be assigned to the material's flow (physical units) include all costs which can be related or are caused by the material flow (Kaplan & Anderson, 2007).

The process of economic report divides the several types of cost into: (i) Material cost, (ii) Energy cost, (iii) System cost, (iv) Waste management Cost.

The system cost includes the cost of all expenses incurred in the course of in-house handling of the material flows, except the material, energy and waste management cost (Kaplan & Anderson, 2007).

Thereafter, a calculation model should be developed to compile all the information required resulting in a Process flow map. Further, the flow map should be presented and analysed by the company's managers to seek for improvements (Kaplan & Anderson, 2007).

The flow map is the final output of the Process Flow Cost Recording analysis. It presents the economic flow based on the resources consumed in each area of reporting. It is divided in indicators and then each indicator is sub-divided in Input cost, Energy and System cost, and outputs which in turns differentiate the product and material waste cost, which can allow the management to obtain the best KPI's value.

## Organizational Development and Change Project

The program called "Organizational Development and Change Project" (Reeves, Haanaes, & Sinja, 2015) was the model chosen by top manage-

ment as a way of ensuring the necessary change process, as well as complying with the activities.

The model to be developed is supported by three fundamental pillars, which allow its development in phases, considering the permanent monitoring and evolution: (i) Management System – Consolidation and Sustainability; (ii) Themes: Context, stakeholders, leadership and strategy; (iii) Global Philosophy of Lean Management (Womack, 2007; Lopes, 2016).

### Management System – Consolidation and Sustainability (context)

Considering that we intend to be an innovative organization that is continuously learning, we intend to develop the EFQM model from a theoretical point of view and then apply improvement and management actions in each of its aspects in order to promote and evaluate permanent and continuous improvement.

Then we intend to describe the model from a generic point of view, then highlight the improvement actions chosen by the company's top management, considering the connection of the functional areas to the points dealt with in the respective activity plans described in 2.1.

In the specific case study, top management conducted its action and follow-up priorities in the same intervention logic, highlighting actions in terms of direct intervention in (i) leadership training (moving to intermediate levels) (ii) policy definition and strategy (unfold and continue with functional areas) (iii) redefinition and management of business processes (LEAN implementation work) (iv) performance indicators (follow-up and performance using the ScoreCard).

Lean Manufacturing is based on the principles of the Toyota Production System which focus on the need to manufacture a product whenever the customer needs in the quantities he needs, allowing the disposal of finished products. Womack & Jones (2003) outline the five concepts of Lean Man-

ufacturing that make their application easier and more intuitive in different industry types: Specify the Value, Identify the Value Stream, define a Continuous Flow, Implement Pull Production and Seek Perfection. There are several Lean fundamentals and tools, such as Kaizen and Muda, Mura and Muri.

## Continuous Improvement (Kaizen)

The word Kaizen is divided into two Japanese terms: Kai – meaning change and Zen – which means to do better (Womack & Jones, 2012). The concept of continuous improvement should encompass all employees of the organization, from operator to leadership. According to Imai, the Kaizen philosophy consists in a continuous process with small low risk changes which will translate into great results on the long term. The PDCA cycle, also called the Deming Wheel, represents the successive stages of continuous improvement process (Womack & Jones, 2003): Plan (identification and analysis of the problem), Do (development and implementation), Check (analysis of results) and Act (standardization of the successful process).

## TPS House

Lean Manufacturing is based on the TPS model, visually represented by the TPS House. The fundamentals of the house are the Standardization, which is the process of developing and regularly implementing uniform and easily repeated concepts, methods and operations, adapted to the design of different products, also related to Heijunka, and the Stability, which is related to the operational consistency of the equipment, the organization of the space, the permanent alignment with objectives, and the purpose and mission disseminated in the company. The pillars are Just-in-Time (JIT) and Jidoka. JIT consists of Pull Production which is “pulled” according to customer demand, related to continuous flow on the production line. Jidoka focuses on the causes of the problems and their resolution, on the quality

of the process, on the minimization of variability and rapid response to non-conformities. In the centre there is the Involvement which consists in the existence of flexible and motivated teams that work with the common goal of continuous improvement. The main focus of TPS House is to maximize quality while minimizing cost and production time as well as eliminating waste in order to meet Customer needs. In addition to the product, the Customer considers the safety at work and the motivation of the employees (Womack & Jones, 2003; 2012).

### Muda, Mura and Muri

One of TPS's principles is the reduction of wastes ("Muda" in Japanese). All activities that do not contribute to the value of the product are considered waste. According to Womack and Jones, the Muda is associated with activities such as waiting and delays, product defects, poor processing, excessive production and inventory, poorly optimized transport and operator movement, and the inadequate use of employees' talent. Taiichi Ohno divided the Muda into seven distinct categories: Transport, Movement, Waiting, Defects or Rework, Processing, Overproduction, and Inventory. Later, another type of Muda was added: Talent, which involves the optimized use of the collaborators' capabilities (Womack & Jones, 2003; 2012).

In addition to these eight types of Muda, there is also the waste whose elimination does not involve benefit for the company: Unevenness (Mura) and Overburden (Muri). Mura represents the unequal distribution of labour due to, for example, delays in previous production steps and poor planning of production. Muri represents the overburden of equipment and operators (Womack & Jones, 2003; 2012).

## Lean Methods and Vocabulary

In order to implement the Lean Manufacturing philosophy, it is necessary to use several tools and methods to identify and reduce waste. Some of the most common methods and vocabulary used in Lean philosophy are:

- Kanban system: a visual production control system that facilitates JIT implementation;
- 5S: focusing on keeping the workplace clean and organized, it is divided into five concepts:
  - Seiri (Selection),
  - Seiton (Organization),
  - Seiso (Cleansing),
  - Seiketsu (Systematization),
  - Shitsuke (Discipline);
- Poka-Yoke: a system to prevent errors and defects;
- SMED (Single Minute Exchange of Die): a setup time reduction technique;
- Work in Process (WIP): work that was started and has not yet been completed;
- Lead Time: time spent from the beginning to the end of the process including processing time and waits;
- Takt Time: time available to manufacture a product based on customer demands;
- Overall Equipment Effectiveness (OEE): indicator of equipment efficiency;
- Total Productive Maintenance (TPM): process which ensures the correct maintenance of the equipment, assigning responsibility to operators;
- Go to Gemba: Gemba is a Japanese term meaning "the real place", which represents the space where the production work is carried out;
- Kaizen Events: small group reunions to discuss the areas which need improvement actions;
- Value Stream Mapping (VSM): detailed map with the materials' flow and information at all stages from the beginning to the end of the manufacturing process.

Although it is known which tools are necessary to obtain a competitive

advantage on the market, it is necessary to clarify how to classify a company according to its performance in Lean. It is important to understand what the current state is and what the desired Lean level is. In addition, it is necessary to understand which key dimensions should be evaluated and how to evaluate them (Womack & Jones, 2003; 2012).

## Results

According to Cameron et al. (2014), the implementation of a management model will lead management to a leadership style conducive to creating value and obtaining results in terms of quality, human and financial capital, based on effective organizational performance.

Development and implementation of the strategic plan: Strategic Map, Strategic Actions and Objectives, hitherto non-existent.

Activity Plan: Annual objective, strategy implementation maps, breakdown by functional areas and documents related to the strategic plan, which allow the common orientation of management units, such as (i) Market Studies, (ii) Business Plans and (iii) Quality Plans.

Change and organizational development project according to Reeves, Hannaes, & Sinja, 2015 was the model chosen by top management as a way to guarantee systemic implementation, based on the following pillars of action: (i) Top management actions; (ii) Definition of Objectives; and (iii) Implementation Practices, supported by the change in the Company's Culture (Values and Behaviour).

In terms of results of the study, we analyse the evolution of the economic and financial indicators (the first table), but mainly the link between the operational indicators and the economic and financial indicators that translate into a consequence of the good performance of the previous ones. This is the basis for the main research hypothesis in the case study.

The evolution of the treated economic and financial indicators is clearly the consequence of the operational indicators as we can see in the com-

pany reports, in which the evolution of values is located in the stock rotation (3.2%), Working Capital (4.65%) EBITDA margin (15.6%), and Net Cash Flow (46.7%) (table 1 and 2).

**Table 1. Macro Key Performance Indicators**

<b>KPI</b>	<b>Value</b>
Stocks Turnover	3.2%
Working Capital	4.65%
EBITDA Margin	15.6%
Net Cash Flow	46.7%

Source: Company reports data.

**Table 2. Operational effect on Macro indicators**

<b>Macro KPI</b>	<b>Operational</b>
Stocks Turnover (Production & Logistics)	Inventory Reduction
Working Capital (Controlling)	Stocks, Collection and Debt
Customer Service (Business, Quality and Marketing Directions)	Complaints, Delivery Time, Brand Image, New Solutions, Visiting and Listening.
EBITDA Margin (All areas)	Efficiency, Working Times, Standards and Rework.
Net Cash Flow (All areas)	Sales, ideas instead of investments and all cost savings.

Source: Company information reports.

Table 1 explains the improvement in results during the period under analysis, using the management indicators considered adequate for the development of the business and evaluation of the company’s performance.

Thus, it refers in the first column to the designation of the indicator in question and in the second the value relative to the percentage of the obtained improvement.

The management indicators are described in the results and were listed according to the following:

- Stocks turnover;
- Working Capital;
- EBITDA Margin;
- Net Cash Flow.

As we will be able to understand these indicators, they are the consequence of operating at the operational level. For this purpose, table 2 was elaborated, which allows us to understand the unfolding of the indicators, from the macro to the operational level, given that the macro is considered the strategic level (Kaplan & Anderson, 2007).

Thus, in table 2 we report the macro indicators in the first column, also referring to the responsible areas and in the second column the activities related to each indicator that allow results to be obtained at the operational level and which will then have an economic and financial consequence.

In the operational column, activities and indicators related to the LEAN Management philosophy are considered. In the left column reported are economic and financial indicators, which will be the consequence of the actions mentioned above, in order to assess the impact of Lean implementation on company results (Rother & Shook, 1999).

## Discussion

The phased implementation, with the creation and development of pilot areas, is particularly beneficial for the organization's culture, also interesting for the involvement of people and the cascading communication process.

The company's entry into "way of life" when defining long, medium- and short-term improvement cycles, in which the use of the DMAIC and PDCA cycles is important in an integrated and complementary way through the Lean tools (Basu, 2011).

According to (Kaplan & Norton, 2019) the use of the Balanced ScoreCard allows the organization the correct allocation of management indicators, thus ensuring their correct and effective follow-up against the objectives.

The improvement of the global EFQM index by 35%, going from 540 to 730 points in one year was noted.

Implementation of the corporate risk management model was based on five pillars: (i) Market risk, (ii) Credit risk, (iii) Operational Risk, (iv) Legal risk, and (v) Information Systems Risk (Kendall, 1998).

According to Cameron et al. (2014) the strength of value creation comes from the performance model and the achievement of objectives, through LEAN transformation (Rother & Shook, 1999).

Strongly active behavioural performance of top and middle management, according to (Quinn, 2011), transition from normal state to the fundamental state of leadership.

Management of skills, knowledge and talent, provides the success of teams (Cascão, 2014).

Strategy and Deployment is always associated with the business chain supported by the axes of diversity and segmentation, in marketing policies and in the established criteria, such as the distribution network in geographic terms (Kotler & Keller 2006).

Company competitiveness is supported by cost optimization of internal business processes considering the categories of: (i) Excess stocks, (ii) Rework operations, (iii) Waiting Times, in addition to the budget deviations that represented (27.9%) of the deviations in costs, this is one of the opportunities for rationalization.

Implementation of quality cost analysis is divided into four categories: (i) Prevention (35%), (ii) Evaluation (25%), (iii) Internal failures (30%), (iv) External Failures (10%).

Leadership Behaviour, according to Shook (2019), should be focused on management by example, having all people involved and committed, putting knowledge ahead of "I think that", instilling the principles of continuous

improvement, conducting tests before opting for solution to the problems or needs of the markets, creating trust in teams and people, developing mutual trust, developing people before products, as well as dealing with the day to day functions.

Analysis of the data and results of the management indicators, according to Hejazi (2015), were divided into categories: (i) Competitiveness (with changes between 40% and 80%), whether qualitative or quantitative; (ii) Operational, Economic and Financial (with changes between 3.2% and 46.7%), supported in table 3 by the competitiveness key performance indicators.

**Table 3. Competitiveness Key Performance Indicators**

<b>Indicador</b>	<b>Valor</b>
Processes Cost Reduction	45%
Reduced product and project development times	60%
Engineering capacity increase – new projects	40%
Improved customer satisfaction – NPS – Net Promoter Score	80%

Source: Company Data.

The capacity to create value and develop new management methodologies, based on the LEAN philosophy, allowed the evolution of the organization's results according to the one expected and defended in the literature, considering the implementation of a strategic and operational plan (Grant, 2019); the clear and negotiated definition of objectives is transversal to all functional areas and behavioural changes in terms of the state of leadership, with the transition from the normal state to the fundamental state of leadership (Quinn, 2004). Thus, we are able to understand the qualitative evolution provided by the results of the evolutionary evaluations of the EFQM model and the quantitative evolution understood by the evolution of the economic and financial indicators, which we were able to summarize in the improvement of the EBITDA margin to (15.6%).

## Conclusion and Future Research Lines

### Conclusion

The initial process of implementing the LEAN management philosophy in the company allowed us to understand that the main objective of the performance, in this context, would be the creation, development and application of a management model adapted and appropriate to the organization, which should be based on the LEAN system, integrating several tools and concepts that would allow it to be present at the forefront of current management (Romana, 2014).

Given the growing demand of the markets, the it would be the introduction of new and more demanding customers and the most effective approach in terms of quality.

The stronger penetration in the international area of the business, agricultural and transport units, and of course the acquisition of customers in the current business, connected with the automotive industry and markets, also created the need to evolve at all levels of activity.

With the implementation of the Management Model, which at the beginning of the journey, we had no idea that we could move forward in this direction, we concluded that the modular and systemic logic allows us to verify that:

All organizations, their teams and all people need a defined path to be motivated in the pursuit of common goals (Shook, 2019; Womack & Jones, 2012).

The fundamental tools or elements for the definition of common objectives are the definition of the strategy through the creation and development of strategic, coherent and participatory maps.

The consolidation of the strategic maps must be carried out in a management medium that is the strategic plan, based on valuation and rationality in the budget and business plans (Kaplan & Norton, 2016).

According to Grant (2019), it is essential that the strategies supported by the motivation of people and in the definition and follow-up of objectives, be

implemented by appealing to what is called successful strategies through the capacity for execution, by the functional areas.

Areas in which the priorities for action are defined, the strategies to be developed, the target areas of action, indicators for measuring progress and objectives allow the success of the implementations (Grant, 2012).

Risk Analysis and Initial Diagnosis – the involvement of the most experienced teams in this phase was crucial to define the main problems and opportunities for improvement (Rother & Shook 1999; Womack, Jones, & Roos 1991).

Organizational Change and Development Project was developed and implemented based on the following aspects: Management System – Consolidation and Sustainability (context); Implementation methodology in phases, designating pilot areas and then expanding to the entire organization; Moving forward with improvement cycles, as a form of common action across the company, allowing us to instil the spirit of continuous and permanent improvement, throughout the entire value chain; Follow-up Model – based on the “Balanced ScoreCard” tool and highlighting the four perspectives of management indicators (financial, customers, internal processes and learning and growth), allowing to raise the level of management performance, the integration between areas and the improvement of reference values; and Evolution according to the EFQM model, which allows us to measure and monitor qualitative and quantitative improvements over time, in addition to technical and behavioural aspects;

We arrived here at the Lean Model (MGG) through the program called “LEAN Transformation”, based on the implementation of the PDCA and focused on the basic triangle of performance (Purpose, Processes and People), improving management indicators by values between 25% and 50%, from productivity, material flows and information flows.

We carry out the assessment of LEAN implementation levels according to the MIT Model (LAI – LEAN Advancement Initiative), through the six parameters of the defined scale: (i) Involvement of People, (ii) Value Creation, (iii) Value Chain, (iv) Process Flow, (v) Notion of “PULL”, (vi) Perfection Index,

obtaining (66%) the level of implementation, considering the scale we will have more (34%), opportunity for improvement.

The Behavioural Performance was and is being supported in the development of the leadership capacities of all the coordinators and directors of the company and in the management of competences, knowledge and talent of all people, through "Coaching" actions that are methodologically based on the cycles of experimentation, training and the practice of processes. The "KATA Coaching" Improvement cycles, according to Rother (2009), are based on the Production Management System quadrants created for the company and on the process flow optimization tools.

Leadership – it is a subject of particular importance in this transformation process and in the specific case, through changes in the shareholder body, in the generation change, mainly by the inclusion of the professional management team. In fact, the transition from leadership status in most functional and operational teams was also promoted, as mentioned by Quinn (2011), from the normal state to the fundamental state, seeking a focus on teamwork, joint coordination and cohesion, centred on others and not on the leaders, being more oriented towards customers and flexibility to the detriment of internal focus and only in control activities. The leadership approach is considered in a value chain as a model for the management and monitoring of the evolution of the company's processes, supported by the leadership's action plan that concretely acts in the strategic, tactical and operational variants, always managing the flow of creation of value: (i) productive; (ii) materials; (iii) information.

As far as Strategy and Deployment is concerned, we believe that the best solution would be to address the topic according to three fundamental points of action and implementation: (i) The business chain, based on the concepts of diversity and segmentation of markets and Ansoff products described by Kotler & Keller (2006), including a geographical criterion; (ii) Competitiveness of the company, through good management of inventories, costs and waste of activities; (iii) Quality, improving Prevention and Evaluation procedures,

managing and following internal and external failures, naturally centred on customer complaints and non-conformities of processes.

Management Indicators naturally allow us to follow the evolution of results and simultaneously stimulate the setting of objectives, indicators for measuring competitiveness, both quantitative and qualitative, as well as operational, economic, and financial indicators were developed. We also changed the company's management posture here at all levels, considering the contribution of people and areas to the overall results. It reflects the strategy unfolding, embodied in its valuation and follow-up, through the integrated monitoring elements, supported by the ScoreCard model (Basu, 2008) integration of management tools.

We definitely concluded that modern management systems can adapt to century-old organizations and work in perfect co-existence with the experience demonstrated over time, considering that the critical success factors are based on the formation and transformation of leadership styles, in implementation in phases and the good communication of the programs (Mann, 2016).

## Future Research Lines

Naturally, we understand some limitations in the study, as it is a specific case in which there was a strong capacity and opportunity for improvement. Thus, we defined as future lines of research two fundamental and converging options, which would be the possibility to compare the results over time with other industrial organizations (Romana, 2016a) and apply the study methodologies to companies in non-industrial sectors, such as logistics and services (Romana, 2016b).

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