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**Measuring performance and Lean Production: a review of literature and a proposal for
a Performance Measurement System**

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Abstract

The survival of companies in a globalized market, where there are no more frontiers for competition and any bad move can offer significant risk to any organization, associated with the pressure from competition and the search for a competitive advantage, has forced companies to rethink strategies and how to manage their businesses.

Literature shows that companies have perceived that the management model adopted is not appropriate for their reality. This has given rise to the need to analyze new managerial practices and to implement a model that provides, among other objectives, cost reductions, increased quality in products and greater flexibility to quickly meet market demands.

In this scenario, an increase can be verified in the number of companies adopting the management model developed by Toyota Motor Company called the Toyota Production System (TPS), also known in the west as Lean Production. This model has provided Toyota and those companies that have adopted it increased efficiency and effectiveness in their production systems; however, many companies have encountered difficulties in implementing and maintaining this management model. Among the main difficulties encountered, it is possible to point out the need to develop a Performance Measurement System – PMS with indicators that can support this management model and consequently help in making the most appropriate decisions for Lean Production principles.

The purpose of this study is to revise literature identifying Lean Production's main characteristics and a Performance Measurement System that has adherence to this management model, aimed at providing organizations with conditions to understand that this management model needs appropriate performance indicators where the focus is not only directed towards production volume, but rather on only producing what is needed, eliminating waste throughout the production process.

The paper explores literature and reviews studies carried out in the performance measurement area and Lean Production, thus finding critical factors for developing an appropriate PMS for this management philosophy.

Although much has been discussed regarding the importance of developing PMS with financial and non-financial performance indicators over the past two decades, it is clear that few researchers examine this field in-depth, making it difficult to find references in the literature. Something specific found in the bibliographic review is the Lean Accounting concept, which has the objective of providing some financial and non-financial indicators that can support decisions in organizations that try to practice Lean Production. This study shows there are critical factors that require a study of the appropriate performance indicators and it indicates the development of a PMS that can sustain the principles of Lean Production as well as provide important aspects of this management model that seeks the simplification of processes, continuous improvement and mainly the elimination of waste. The study also explores the importance of visual management, which attempts to associate the A3 report and identification of the organization's goals with indicators that will support Lean Production management practices.

We conclude that it is necessary to evolve in this knowledge area that involves production management and operations with the support of a PMS and indicators that adhere to the principles of Lean Production, avoiding distortions in the information obtained by performance indicators that are inappropriate for this model.

Keywords: Lean Production; performance indicator; performance measurement.

1. Introduction

It's well know that over the last decades, lean production and the search for measuring

performance in organizations has been in the agenda academics and market professionals.

The search for competitiveness is forcing companies to review old industry paradigms, promoting a clear transition from traditional mass production to lean production. These methods have significant differences within specific operations management area literature. On one side we have mass production, based principles of economies of scale, while lean production aims to produce only what the client requests, simplifying processes and maximum waste elimination.

Therefore, with these different perspectives, it is clear that each method has specific requirements to measure performance, but little is found in the operations management area about performance indicators aligned with lean production, building a performance measuring system to help boost management model practices and guide decision makers in the best possible way.

According to Katayama and Bennet (1999), when a company chooses to adopt a lean philosophy, the main objective must be adopting a strategy that allows for cost reductions and increase in market share.

Nonetheless, if the company does not develop a set of financial and non-financial metrics to support this cost reduction strategy, the result will be frustration for not achieving good results and the erroneous feeling of increased costs.

According to Moreira (1996), any performance measurement system will have to demonstrate to the organization if it is going in the right direction, continuously monitoring its movements.

Therefore, a company wishing to be lean must have - like any other organization - a performance measurement system to show if their goals are being met.

In the realm of performance management knowledge, it is important to observe the huge academic effort to develop performance measurement system models to help companies

manage internal conflicts related to strategy planning within the organization, and to measure them. The highlights are: Performance Pyramid by Cross and Lynch (1990), Balanced Scorecard (BSC), Kaplan and Norton (1992), Integrated Performance Measurement Systems, Bititci et al.(1997), and Performance Prism , Neely and Adams (2000).

Amongst these models, literature contains several implemented success cases, especially using BSC, but great effort must be done by organizations to successfully implement this option and the results may not be immediate.

This work is not aimed at advocating a developed model, since each model has its particularities and may be modified for each organization type, depending on its needs. The article's main goal is to identify key factors in the lean production management model to contribute to the development of a set of metrics useful for this management model.

The work is divided in four main chapters. The first and the second contain relevant aspects in the literature about lean production and performance management. The third chapter brings a discussion about identifying key aspects considered in performance measurement on lean production, also aimed at facilitating visual management using A3 reports in all organization levels, creating a simple proposal to follow-up of strategic goals and also its metrics. The last chapter presents final considerations.

2. Bibliographic review

2.1 Lean Production Principles

Toyota has advanced as a global leader in the automotive market. Toyota's achievements were first noticed in 1980, when it was clear that there was something special in terms of quality and efficiency in Japanese manufacturing (LIKER, 2005).

Toyota's characteristics resulted from several scars from the Second World War,

forcing the search of innovative alternatives for growth amidst chaos in post-war times. That is why Toyota became the biggest automotive manufacturer of the 21st century and one of the most profitable companies in the world.

In this context, two questions stand out: What is Toyota's secret of success that other companies try to duplicate? What is lean production after all?

For Liker (2005), Toyota's success is, essentially, based on its aptitude to cultivate leadership, teams and culture to create strategies, build relationships with suppliers and foster a learning organization.

Beyond Liker's (2005) observations, Toyota continuously seeks perfection – *nothing is so good that can't be improved* – therefore, one of the main focuses is the process of continuous improvement.

Ohno (1997) states that total waste elimination or reduction is the top Lean Production goal. This involves changes in quality and operations management practices, used to improve or manage production processes. To him, the *Toyota Production System* (TPS) is supported by two pillars – Just in Time (JIT) and autonomation.

Womack, Jones and Ross (1990) were responsible for translating TPS to the western world, naming this model *Lean Production*. For them, Lean Production uses half the human efforts in factory, half the space to manufacture, half the investments in tools, half the engineering hours to develop a new product in half the time, in addition to keep half the required inventory, resulting in less defects and increasing variety of products.

For Womack and Jones (2004) there are five Lean principles:

- Precisely determining the value of each specific product in the eyes of the end client;
- Identifying the value flow of each product;
- Making the value flow continuously

- Letting the customer pull value from the manufacturer;
- Seeking perfection.

Womack and Jones (2004) state that it is necessary to keep focus in eliminating waste. This focus requires actions taken by process managers, since every human activity absorbs resources but some do not create value.

There are two types of waste described in Lean Production: type 1 does not create value to the end customer, but it is necessary, and type 2, which is an activity group that does not create value and is not necessary, then must be removed.

To Ohno (1997), the main wastes are: overproduction, delays, transport, overprocessing, inventory, motion and production of defective products.

For a company to be lean, it is necessary to reconsider all processes, allowing for the flow of material and information, and also adding value aimed at unit flow and client (internal and external) restock only when required.

According to Hines et al. (2000), lean production principles are linked to material handling. However, it is possible to link these principles to activities aimed at the information flow, that is, to the non-manufacturing activities, known as Lean Office, since manufacturing activities allow for material flow and if companies have issues with information flow, the manufacturing effort would be not be rewarded.

The methodology adopted by the Lean philosophy is clear: decreasing lead time from the time of the order until the order is delivered to the client. It allows the increase of financial flow and the use of less capital in inventory for processes and finished materials.

After material and information are secured in terms of continuous flow and waste, that is, activities that do add value are being eliminated during the production process, lean companies will be more flexible than companies focusing in mass production, because this lean production process allow companies to act faster in face of customers requirements,

achieve better product quality, higher productivity and better equipment and usage of productive space.

One of the methods used to increase company performance and identify lean production issues is to allow problems to emerge, especially via inventory reduction in processes. It leads to another lean production principle, which is the use of visual controls so no problems are hidden.

Visual control, to Liker (2005), represents any communication device used in the workplace to quickly indicate how work must be performed and if there are deviations from the standard. The idea is not to leave hidden problems unattended.

There are many visual tools that can make bring any deviations to surface. The andon indicates deviations from manufacturing processes, which need to be solved quickly to prevent delays in the production line and the waste of excess wait; the kanban is aimed at managing and starting production of material in predetermined quantities and any deviation in the cards may represent underproduction or overproduction of a specific item; the heijunka box is a board to balance the production mix and organize kanban cards following production processes restrictions; and the standard work indicates the best flow method for a specific workstation and each operator.

All aspects addressed here are important to know critical factors before developing metrics for performance measurement and the amount of metrics to support and control processes for companies aiming to be lean, because it must be clear that performance measurement must work together with principles, always seeking processes improvement and waste elimination.

2.2 Performance Measurement System

According to Neely et al. (1995) a **Performance Measurement System (PMS)** is a

set of metrics used to quantify the efficiency and effectiveness of actions.

PMS is a set of measures referring to the organization as a whole (divisions, departments, sections, etc.), to their processes and activities organized in well-defined blocks, reflecting specific performance characteristics for each concerned management level (MOREIRA, 1996).

Performance measurement is still a debated topic in several areas of human knowledge, such as financial resources management and accounting, continuous improvement management in operations and strategic management of human resources; however, there is no general consensus about the meaning of the concept of “performance measurement” to researchers or consultants and professionals alike (NEELY, 1999).

Initially, managerial accounting became the performance measurement basis in organizations and this model was used by most organizations during the 20th century. However, over the last decades, with multiple changes in the global panorama, managerial accounting practices became unsuitable for measuring performance in organizations.

According to Neely (1999), the primary deficiencies of traditional managerial accounting as PMS are:

- Short-term vision and stimuli to local optimizations;
- Lack of strategic focus and not taking into account other performance dimensions;
- Search for control, instead of continuous improvement and innovations;
- Lack of information about customers and competitors;
- Focus in past historical measures not proven informative for planning the organization's future;
- Lack of integration between individual measures and other organization's processes.

From the moment researchers noticed the need to use performance indicators different

from accounting indicators, several works emerged addressing the need of reviewing performance measurement systems inside organizations using a different approach.

Cross and Lynch (1990), Keenerly and Neely (2002), and Gomes et al. (2004), state some characteristics that PMS's must have to help organizations identify appropriate performance indicators. For example:

- Promoting strategic implementation analysis and verifying its validity over time;
- Having financial and non-financial multi-dimensional performance indicators;
- Having performance indicators that are easily adaptable to changes in strategic planning;
- Being capable to produce a brief and objective overview of organizational performance with a few critical business indicators;
- Having indicators that are simple and easy to understand and managing them in all organizational levels;
- Being capable of stimulating individual behavior to meet desired organizational changes.

In this sense, as previously mentioned, some PMS models have emerged to meet these characteristics, such as Performance Pyramid, Balanced Scorecard, Integrated Performance Measurement Systems, and Performance Prism. Although they have different features in terms of design, they all try to align the PMS with organization strategies.

Kaplan and Norton (1997) emphasize the relationship between performance and strategy, provided that a good performance measurement system must be consistent with the established strategy, being essential to strategy communication, propagation and implementation.

Strategy is nothing more than a set of goals established by the organization and known by their strategic objectives, derived from a future vision set by the organization, that is, a

point in the future where the company wants to be or remain (MOREIRA, 1996).

Therefore, the PMS must have a set of different nature indicators to support organization's strategic goals – financial and non-financial indicators.

For Moreira (1996), in the nature of financial indicators, costs maybe the most monitored aspect, on the other hand, in the nature of non-financial indicators are the ones used to measure productive efficiency. In this dimension, the indicator seen as most important in organizations is labor productivity, at least for two reasons. First, it is relatively easy to measure labor productivity, since production and labor series (hours worked or number of employees) are easily available. In second place, historically, the focus of manufacturing organizations is to decrease labor costs, since it is possible to link those productivity costs directly to profits per employee.

Another important aspect that needs to be highlighted on performance indicators is the need to be simple to understand and have objective metrics. A clear way to communicate indicators is required, since all managers need to know what are the goals of the organization.

Lea and Parker (1989) suggest that performance indicators must:

- Be easy to understand;
- Have visual impact;
- Focus on improvements more than on variance;
- Be visible to everybody.

As such, a well structured PMS brings together the main performance metrics, which must be aligned with strategic objectives, thus becoming the main mechanism of corporate management, providing immediate *feedback* on company's status and decision making.

Fortuin (1988) suggests that indicators must:

- Provide quick feedback;
- Provide information;

- Be precise – represent exactly what is being measured;
- Be objective – not based on opinions.

It is important to highlight that PMS must not only be focused on defining metrics, but its benefits must follow the performance of the company and facilitate quick adoption of actions, providing benefits to the organization and allowing it to keep on the path to its objectives. For that, the PMS needs to be structured as having a purpose, clear goals, defined metrics and a reliable source of data,

According to Neely et al. (1997) if performance indicators are not well designed, it can result in dysfunctional behaviors, encouraging individuals to make the wrong decisions.

3. Proposing a Performance Measurement System model

3.1 Measuring Performance in Lean Production

For Hronec (1994), the best performance indicators are the ones that promote the balance in company's operations and must be used in the entire organizational structure so as to interlink business strategy from a to operational processes.

Since Lean Production aims to eliminate or reduce waste, implementing an automated system for managerial control usually represents a high financial cost and demand a significant work load. Therefore, using the *Lean* philosophy, these efforts can be considered as waste, since they do not create product value for the customer, but are necessary for organizations. As such, these efforts must be reduced and processes must be simplified.

It is known that using a performance measurement system is crucial for organizations, for companies producing under the principles of traditional mass production, as well as for companies adopting Lean Production principles.

However, companies wishing to adapt their processes to Lean Production principles

need to have indicators supporting this new strategy that contribute for value flow management, that is, indicators that help in continuous flow, preventing process variables to stop the flow and, in case this happens, such indicators must show improvement points, allowing for *kaizen* (continuous improvement).

Thus, if one business strategy is to become a lean company, there is a need to review performance indicators and simplify metrics so that only fundamental metrics exist to measure an organization's performance.

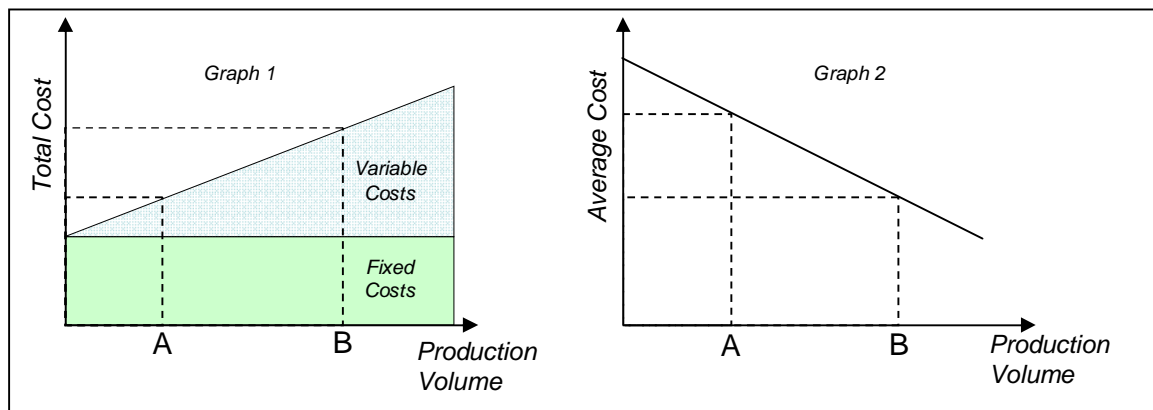
Lean organizations, as any other organization, require information about its performance, reflecting the operating reality and providing *feedback* capable of driving required actions and decisions.

The issue is the majority of this information obtained via performance indicators make sense only when linked to volume and production rhythm, so they are no longer useful when the mass production logic is abandoned, based on economies of scale.

Moreira (1996) states that product cost, except for certain conditions, is still a powerful aspect in competitiveness, even if other variables can be as important as or even more important than cost – such as delivery deadline, product quality, the company's innovation capacity and others.

Yet, since the cost logic is based on principles of economies of scale, as presented in Figure 1 by Battaglia (2008), when an organization abandons the logic of producing more equals costing less and starts producing with pull production, that is, producing only what the client needs, in the amount needed and with the required quality, one can experience an “increase” in unit costs resulting from the decrease in production volume, and this information can be misinterpreted and lead to decisions that do not support Lean Production initiatives.

In Figure 1, Graph 1 illustrates the relationship between total cost and production volume and Graph 2 illustrates the average unit cost variance resulting from changes in volume. In the first graph, since total cost is the sum of fixed and variable costs, increasing the production volume decreases the cost proportion, since fixed costs are diluted, as shown in the second graph, so the bigger the production, the lower the cost.



Source: Bataglia (2008).

Figure 1 – Cost Logic.

Still following the logic of economies of scale, and as already mentioned by Moreira (1996), in the nature of non-financial indicators, the ones used to measure efficiency parameters, since they are interfere with costs directly, because the more a resource can produce, the more costs are going to be diluted. However, seeking maximum efficiency of a specific isolated resource might not be adequate for the organization as a whole, since this isolated efficiency can lead to overproduction – one of the wastes according to Ohno (1997).

Because of this indicator perspective, in the context of Lean Production, it is necessary to rethink the nature of indicators and the use they will have.

Some authors have developed works on performance indicators for Lean Production. Among them, Karlsson and Ahlström (1996), and Sánchez and Péres (2001) suggest indicator models aimed to evaluate if the Lean Production principles contribute to improving productivity and quality, while Maskell (1991) suggests a model that works with the

relationship between the financial system and Lean Production, known as *Lean Accounting*.

Based on the premise that a PMS needs a set of metrics to reach balance between financial and non-financial indicators, Maskell's (1991) proposal is demonstrated in Table 1.

Table 1 – Summary with indicators suggested as the initial set by Maskell.

Strategic Measures	Value Stream Measures	Cell /Process Measures
<ul style="list-style-type: none"> • Sales Growth • EBITDA • Inventory Days • On-Time Delivery • Customer-satisfaction • Sales per employee 	<ul style="list-style-type: none"> • Sales per person • On-Time Delivery • Dock-to-Dock • Time First Time Through • Average Cost per Unit • Accounts Receivable Outstanding 	<ul style="list-style-type: none"> • Day-by-the-hour Production • WIP-to-SWIP • First Time Through • Overall Equipment Effectiveness

Source: Maskell (1991).

According to Maskell (1991), Lean Production cannot be measured by traditional measurement systems, since it is not focused on mass production.

Therefore, the main objectives of this model proposed by Maskell (1991) are:

- Measuring an organization's performance based on Lean Production concepts;
- Eliminating unnecessary accounting transactions;
- Replacing traditional costing with value flow costing.

It is important to remember that this process brings benefits with the implementation of manufacturing cells within the organization, because since processes are organized this way, it is easier to establish the flow of materials and information, providing required information and accelerating the decision making process, differently of when there is an organization divided in departments, since this type of organizations tends to act in parts and often this action goes against goals defined by the organization.

Not all indicators proposed by Maskell (1991) will be discussed, but it is important to

highlight the following indicators to eliminate any doubts regarding principles of lean production and principles of mass production:

- *Average Cost per Unit*: This indicator measures the total cost of the value flow regarding the number of products delivered to the client, aiming at reducing the resources used to produce any given product;
- *Day-by-the-hour Production*: This is the main indicator for measuring performance within the cells and its objective is to measure production regarding *Takt Time*, which is determined by dividing total available production time in each shift by the demand by production shift. For Womack (2004), *Takt Time* precisely synchronizes production speed compared to client sales speed and it is the production rhythm defined, comparing actual production and planned production. Benefits of this indicator include being able to keep the operator focused on cell goals only and providing a quick response for any issues that may arise;
- *Overall Equipment Effectiveness (OEE)*: This indicator must be applied only to bottleneck resources and its objective is to measure production capacity to produce in the right time and with quality. To calculate this indicator, three pieces of information are required – machine availability, efficiency and quality.

Other indicators, such as: Client satisfaction, delivery performance, inventory levels, quality and profit generation are the one that will show the organization if it has been competitive against its competitors and *stakeholders*.

The most important thing when using performance indicators for *Lean* companies is to allow for the simplification of processes, always looking for improvements in value flow and allowing *Lead Time* to be shorter and shorter so that organizations have less capital invested in raw materials and materials in process, often being paid by the client quickly.

3.2 The proposed model

The Visual Management of the performance measurement system is a very important aspect for Lean Production. It is important that information regarding short, medium and long-term objectives are visible to everybody within the organization.

For Ohno (1997), one of the biggest problems of factories is that sectors create different views of the company as a whole. This way, decision making becomes much more complex, along with the identification of restrictions that need to be improved and the worst – seeing the integration among all areas in an organization.

It is then required that the company has an information system that is precise and helps all people within the organization, facilitating the information communication and interpretation.

Liker (2005) mentioned in his works that one of Toyota's principles is *full consideration in decision making*, meaning spending time and efforts with details to make things right.

In TPS full consideration in decision making includes five main elements:

1. Finding out what is really happening, including *genchi genbutsu* (the translation would be: to go to the place and see the actual situation to understand it);
2. Understanding the underlying causes explaining surface impressions – asking “Why?” five times;
3. Broadly consider solution alternatives and developing a detailed rationale for the preferred solution;
4. Building consensus in the team, including employees and external partners;
5. Using very efficient and concise communication vehicles, preferably in a single side of a paper sheet.

It is mandatory that communication is transparent and that the company has a set of metrics supporting its objectives. The information system needs to create ways so that improvements happen easily resulting from actions coming from signals provided by performance indicators, therefore indicators must provide simple signals for those involved and also an immediate *feedback* about the results of actions.

A way of facilitating this communication is using report A3, where it is possible to report how the company performs its operations and the results intended, entering visually all required information so that the goals of the organization can be met, also containing required metrics in addition to results achieved in a time line. These metrics can be financial or non-financial, depending on the objective to be achieved.

Therefore, an organization that wants to be lean does not need to deploy a management model described in specific literature as mentioned, because in addition to having a PMS aimed at meeting the organization's strategies from a view of the future, another objective is to form a consensus on goals and facilitate their communication and propagation.

Thus, this work wishes to use a simplified model using a set of A3 reports that support visual management and that can present organization's strategies, performance critical areas that need more attention and indicators supporting the follow-up of the organization performance in strategic, tactical and operating areas, in addition to providing consensus between involved parties and facilitation communication on organization's goals.

If problems arise, A3 is a management instrument that can help identifying the causes and possible solutions, registering actions to be adopted and people responsible so that the objective is reached.

A3 also helps with the progress of projects, immediately demonstrating project status because it visually provides information required to better understand them.

The focus of A3 is to provide information in a single side of an A3-size sheet, highlighting complex questions and issues for the decision making process. A3 includes the Deming Cycle, known as PDCA – plan, do, check and action (LIKER, 2005).

PDCA is very important when defining long-term strategic goals for the organization and follow-up of fulfillment according to adequate metrics. A3 must use the maximum possible in terms of figures and graphics. Lean Enterprise Institute© (2008) presents a model of A3, as shown in Figure 2.

The A3 Report

THEME: "What are we trying to do?"

Background

- Background of the problem
- Context required for full understanding
- Importance of the problem

Current Condition

- Diagram of current situation (or process).
- Highlight problem(s) with storm bursts.
- What about the system is not IDEAL.
- Extent of the problem(s), i.e., measures.

Cause Analysis

- List problem(s)
- Most likely direct (or root) cause:

Why?	Why?	Why?
Why?	Why?	Why?

To: _____
By: _____
Date: _____

Target Condition

- Diagram of proposed new process
- Countermeasures noted as fluffy clouds
- Measurable targets (quantity, time)

Implementation Plan

What?	Who?	When?	Where?
Actions to be taken	Responsible person	Times, Dates	

Cost: _____

Follow-Up

Plan	Actual Results
<ul style="list-style-type: none"> How will you check the effects? When will you check them? 	<ul style="list-style-type: none"> In red ink/pencil. Date check done. Results, compare to predicted.

Source: Lean Institute Enterprise© (2008).

Figure2 – Model of A3 Report.

According to Figure 2, it is possible to see the steps in identifying a problem and how to solve it. Steps of an A3 are: defining a title and a theme, current conditions, root cause analysis, target condition, implementation plan, follow-up and result report.

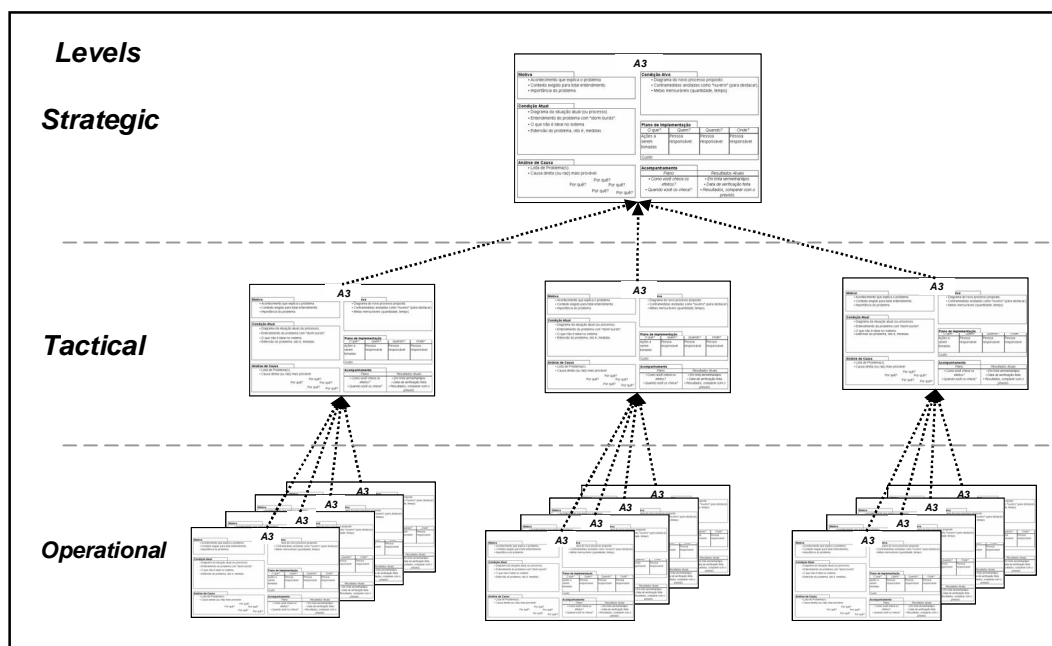
- *Defining a title and theme:* A3 starts with the definition of a title and context, essential for understanding the extent and importance of the problem;

- *Current condition:* Step showing how the identified problem is operating currently and this step it is important that it is described clearly for a good understanding of the current situation;
- *Root cause analysis:* Step in which the author of A3 tries to identify the root of the problems and what must be fought to eliminate the problem;
- *Target condition:* After going through previous steps and having a good understanding of the root cause of the problem, now comes the time to try to find a way to have the system improved, with countermeasures and goals that can be measured;
- *Implementation plan:* Shows the steps that must be contemplated to reach the target condition and who is responsible for the actions;
- *Follow-up:* Is the step in which performance indicators are inserted so that the organization can see if what was proposed is bringing improvements, and these indicators must show how and when to measure improvements;
- *Result report:* It is the step in which results are demonstrated and one can know if the goal was reached or if there are still problems to reach it.

A3 tries to clarify all information regarding an issue and the discussions required to design an A3 with all restrictions interfering with decisions of several individuals within the organization, what strengthens teamwork and, most importantly, brings consensus among all involved areas regarding the set of actions to be taken, that will reflect on organization's benefits.

Therefore, this work aims to offer a methodology to facilitate organizations to design processes aiming at supporting organization's strategies, developing a simple methodology to develop A3 reports following an alignment logic between strategic, tactic and operational levels.

Figure 3 shows that, with a designed strategy and having common agreement among all people involved, organization's goals have to be defined, together with responsible areas.



Source: Lean Institute Enterprise© (2008).

Figure 3 – Proposal of a set of A3 reports aligned with strategic objectives.

From an established goal, an A3 is chosen, contemplating the long-term actions that need to be adopted. These actions must trigger medium and short-term actions in tactic and operational levels, always aligned with the organization's strategic objectives.

As such, there must have set of A3 reports contemplating a strategy, describing the vision and desired results in the long term. It also contains the current conditions of the company, the objectives to be fulfilled, supported by metrics that support those decisions, always focusing on the principles of lean production. This way, a plan is established, with well defined roles and responsibilities, as well as people responsible for feeding and following performance indicators.

4. Final Considerations

In today's corporate world, several paradigms are being broken and changes are happening quickly. The traditional mass production model is being replaced by the lean production model in several organizations.

Performance measurement has been in the agenda of manager and academics alike over the last decades. If management philosophy is to be changed, it is important that the way in which the organization measures its performance is also adequate.

Therefore, this work aims to show that if an organization chooses to go with lean production, it needs to understand its principles and so that the performance can be measured, there is a need to have performance indicators reviewed so they can support the new competitive strategy.

The proposed model provides a clear and objective communication model on the vision and strategic objectives of the organization, facilitated by the visual management provided by A3 report and also to have consensus on the objectives among all involved.

To develop a PMS adequate to lean production, metrics must allow for the identification of waste that must be eliminated and also the practice of continuous improvement.

In the context of the highlighted environment, it is evident that a PMS needs to be adequate to the organization aiming to implement principles of lean production, because if an organization has inaccurate metrics to support and follow-up this production model, results will be inaccurate in showing that one of the most important indicators, cost, is increasing, because the economies of scale have been abandoned.

It is easy to see that the subject needs to evolve in operations management, because lean production model still needs to be studied and developed. This model has been implemented in several ways and in different organizations in different economic segments.

Therefore, it serves as stimuli so that new studies are performed to enrich the area of Lean Production philosophy.

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