

Sustainable control of industrial production systems: A hybrid model “lean /project management”

Salima Hammadi¹, Brahim Herrou²

¹ Laboratory of Industrial Technologies, Faculty of Sciences and Technologies, Sidi Mohamed Ben Abdellah University, Fez, Morocco.

² Superior School of Technology, Laboratory of Industrial Technologies, Faculty of Sciences and Technologies Sidi Mohamed Ben Abdellah University, Fez, Morocco.

Abstract - In a competitive environment, the most successful companies are those that well manage their projects defining the right map to achieve their goals and optimizing the triptych “cost-quality-time limit” without ignoring the actual sustainability requirements. A lot of studies and production system’s experiences are introducing lean production as the direct implementation of lean tools or some of them. However considering a new product manufacturing a new project will summarize many processes and make its management easier especially when the project management becomes lean. In this paper we try to come up with a sustainable hybrid model optimizing and controlling all processes, defining essential values and steps to well manage a manufacturing project generally and draw lean project chart for both conception and production methods to optimize a new product manufacturing based on a case study for steel parts production system. This major project cannot be lean without the integration of lean culture in project management including maintenance projects. Finally a detailed chart of lean maintenance project is proposed which can be generalized for any other industrial production system.

Key Words: Lean, maintenance, project management, processes, control, Human-Machine Interaction, conception, production method,

1. INTRODUCTION

The current dynamic industrial context is developing new project concepts and constraints continuously, what makes management and production flexibility a big competition challenge.

Producing “what is needed when it’s needed” [1] is the lean philosophy that every production system is trying to explore. However any process or system cannot be called lean without a lean project management approach that aligns all project resources and efforts on value creation and waste elimination.

Maintenance and conception are large disciplines that promise a real lean production affording better equipment availability and performance when maintenance processes, conception and production methods become lean and

especially when maintenance or conception and production method project management is lean as well to cover all the production system’s projects making them and their management lean.

2. LEAN IN PROJECT MANAGEMENT

1.1 Definitions

Lean management can be defined as : “ Lean management is an approach to running an organization that supports the concept of continuous improvement, a long-term approach to work that systematically seeks to achieve small, incremental changes in processes in order to improve efficiency and quality ”[2].

Lean management is also “ a set of techniques aiming at eliminating any activity without a value creation.. lean management is a way of management basically centered around waste reduction ”[3].

In order to well define a lean project management it is necessary to know what is meant by “project” and “project management”:

A project is a “unique process, consisting of a set of coordinated and controlled activities with start and finish dates, undertaken to achieve an objective conforming to specific requirements, including the constraints of time, cost and resources”[4].

“Project management is the application of methods, tools, techniques and competences to a project .Project management includes the integration of various phases of the project life cycle. Project management is accomplished through processes” [5]. It is also defined a “planning, organizing, monitoring, controlling and reporting of all aspects of a project and the motivation of all those involved in it to achieve the project objectives” [4].The most frequent question that comes to a project manager’s mind is: how can project management become lean? or briefly what is “lean project management”? to sum up all ideas, Lean project management is the wise vision and adaptation of the lean philosophy, including the different fields’ lean concepts, to fit project management context [6].

1.2 Lean Thinking Extensions

Lean culture is growing from day to day to be recognized and practiced in every field or structure looking for higher performance and quality levels reducing extra-costs as much as possible. In fact lean thinking as Womack and Joes defined in the title of their book: “Banish Waste and Create Wealth in Your Corporation”[7].

The projection of lean thinking concepts in various domains is leading to a lean development connecting various domains to each other making one ‘process lean (lean conception) to deliver a product or service for another (lean production) till achieving a lean development reflecting waste elimination (no defaults, no waiting time...) and value creation in all fields (conception, production,...) as shown in “Fig -1”.

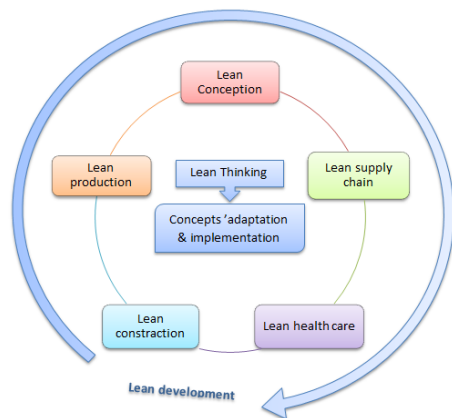


Fig -1: Lean development wheel.

3. A NEW LEAN PRODUCT MANUFACTURING PROJECT

When a production system intends to start producing a new product, it is useful to consider this a new project especially if the new product is totally different from the others or requiring big processes, tools or methods’ changes. The new product manufacturing project can be substituted into several projects converging all to the global project aim in a lean vision: producing the needed quantity of the new product with required quality, the lowest costs and the without any delay.

The manufacturing project can summarize many processes witch must be controlled continuously in sustainable way. The lean context allows companies to remain competitive in developing market targets and constraints [8] without neglecting environmental challenges.

Our lean manufacturing control model (see “Fig -2”) describes the different control processes that can be converted into lean projects to start up a new product manufacturing and achieve a sustainable controlled production system as a long-term vision.

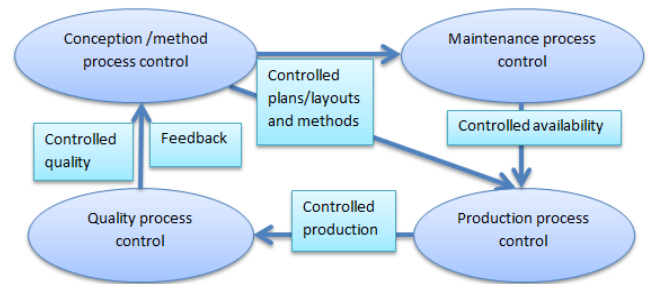


Fig -2: Manufacturing control model: process approach.

The main manufacturing processes ,shown below , can be controlled via lean projects to be managed in a lean framework as well.

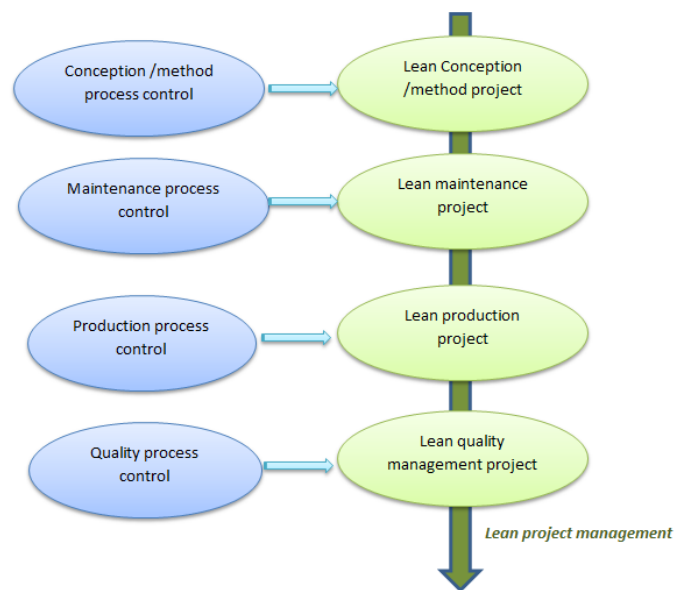


Fig -3: Manufacturing processes’ control through lean project management.

3.1 Case study: problem definition for a new steel parts manufacturing project

A steel parts production system faced several low performance problems due to three factors having different impact level on off-cuts and scrap amounts as reflected in “Table -1” which shows that main problems are due to the current cutting method and equipment state.

Table -1: Influencing parameters on off-cuts and scrap amounts with impact levels.

	Cutting method	Equipment & tools	Human errors
Off-cuts	++++	++++	+++
scrap	+++	+	+

++++: very high impact level.

+++ : high impact level.

++ : medium impact level.

+ : low impact level.

3.1 Proposed solutions

To insure a lean way to the main project (a new product manufacturing project), waste sources should be eliminated as possible implementing the lean solutions in “Table -2”.

Table -2: Lean solutions

Influencing problem	Cutting method	Equipment and tools	Human errors
Proposed solution	Lean conception and method	Lean maintenance project	Training to control new production methods and equipment or tools
Engaged functions, services or people	Conception/method services	Maintenance logistics	Maintenance logistics + conception /method/production services

In order to optimize cutting method the following chart proposes practical steps to reduce off-cuts and scrap (waste) gathering steel parts into kits and choosing the appropriate equipment or tool for cutting operations as well as for the next ones .

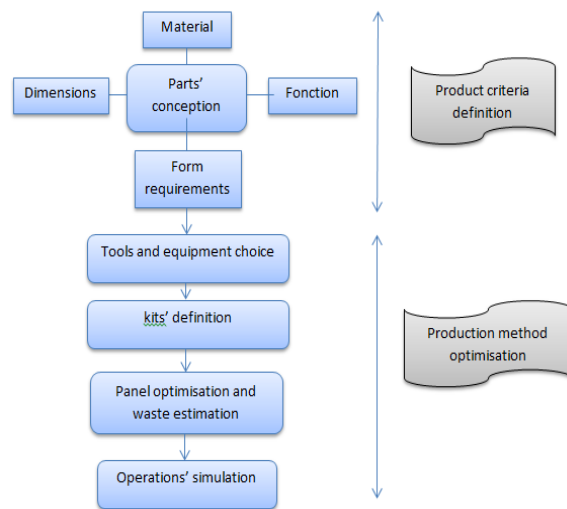


Chart -1: Lean conception/method project: a systemic view.

4. MANAGING MAINTENANCE PROJECTS

In order to improve equipment availability and performance it is essential to have a lean maintenance project management.

4.1 The Lean maintenance project

The actual maintenance context points out the main guideline objectives of a maintenance project:

- Insuring equipment availability continuously to avoid production shutdown.
- Minimizing costs and looking for fast, sustainable benefits.
- Improving product quality as defined by the customer.
- Respecting time limits to win the costumer's confidence.
- Maintenance optimization, in other words achieving goals with a minimum of costs.

Lean maintenance stands for the same previous objectives to import lean's culture to the maintenance field the wish of many companies that has experienced lean manufacturing, in fact “Lean , combined with other initiatives, such as TPM, has allowed these companies to focus on the efficiency of their production processes; efficiency as being “productive without waste.” Recently, we have seen many consultancies and companies starting to talk about terms such as “Lean Maintenance,” an attempt to bring the same efficiency improvement approach into the world of physical asset management”[9].

It is true that Lean tools can be also used to “slimdown” a major maintenance process—scheduling or throughput. JIT

and Pull are really facilitators of continuous flow in production term" [10]. Indeed "many companies have been able to benefit greatly from the waste elimination focus that Lean fosters. The problem is that the same fundamental principles have been brought directly from the production environment into the asset maintenance environment" [9].

4.2 Lean maintenance project management

A lean project could not be qualified so unless its management is also lean.

To draw a short and reliable path towards a lean maintenance project it is important to work on three important values to build a strong practical plan [11]:

- Be collaborative : a project manager should have a wide team vision "using document sharing technology to ensure that the parts of the project that could use input are available to review; lay out a timeline that takes into account potential (small) delays, but also sets reasonable and relatively firm deadlines for completing set goals within the project".[11]
- Be communicative: a lean project communication is necessary to maintain a team spirit and remember the project objectives and strategies at all stages.
- Be flexible: that is the safest way to deal with changes and make them meet the maintenance project goals.

This flexibility cannot be reached without a lean resources' interaction in fact when TPM tries to make the operator more autonomous to involve him in the lean maintenance project ,that may not deliver the main aims of insuring equipment availability since the human-machine interaction is not lean .To make it so two main pillars should be verified:

- Human engagement that can be obtained via motivation, integration, training and participatory management to involve everyone in the maintenance project progress.
- Lean ergonomic equipment choice by affording lean machine conception integrating an easy communication interface design .in fact "the emphasis is on designing an item so that a failure can be corrected as quickly as possible" [12].

A lean maintenance project has to be managed in a lean, well-structured vision through the lean project management, to avoid waste, not only, in maintenance project management efforts, time and costs but also while its implementation. The model proposed below represents the different stages of a lean maintenance project management (see) representing :

- Maintenance needs and purposes

The first stage of a lean maintenance project management is to define accurately in a detailed design brief maintenance needs and requirements by maintenance logistics' team after collecting the necessary maintenance data from the related services (quality or production service), that can give helpful feedback (including the Human-machine interaction feedback) about equipment state through production capacity, the quality of the product reflecting maintenance problems. The team should analyze this feedback (the collected data) responding to four Why questions: What (what is needed?), Why (why it is needed?), Who (who is in need? the operator, maintenance stuff..).

- Lean Maintenance project and objectives definition

In this stage, the project manager and his team should answer the question How (how to feed maintenance needs and solve its problem/problems) defining all project technical (materials, tools...etc.) and administrative aspects, collaborators (other external or internal parts or services working with the maintenance logistics' team and the project's manager) and sponsors (internal or external financial support sources of the lean maintenance project). It is also recommended to define all project goals and perspectives and highlight main ones to set as clear guiding objectives.

- Project feasibility and decision making

It is the most important and crucial phase in the project's management .It stands for a link between the project's theoretical plan and realization studying: "what we have" (maintenance project available resources: human resources, material, spare parts, tools..) ,what we can have (affordable maintenance resources) and what we cannot have (unaffordable maintenance project resources).After answering the three questions important decisions are taken leading to the next project steps or rejecting it to define another feasible project .

- Project lean steps and maintenance strategy definition

Three essential steps should be set up: defining the eventual risks to manage in a lean way (to avoid the wasted time, costs and efforts caused by sudden maintenance risks or general maintenance project threats) via risk prediction and project saving alternatives' definition, value extraction means and lean tools freeing any maintenance method or operation from extra inventory and squandering ways. All that should be considered while defining the project strategy aiming at a multi-level optimization.

- Lean maintenance processes' definition and implementation:

A lean maintenance process definition must dispose of any unnecessary maintenance task, activity or material and keep value adding ones. This phase is finished by a correct execution of the project plan and a sustained project improvement after controlling its results.

The proposed model gives practical maintenance project management steps to follow avoiding resources and effort waste and guiding the project team to value extracting in a short time this is what makes it lean and especially accustomed to a lean maintenance project.

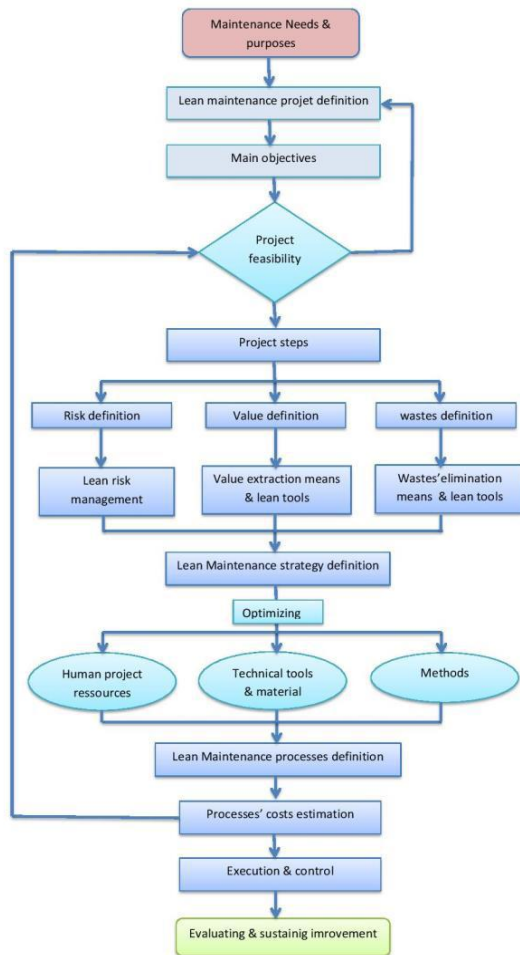


Chart -2: Lean maintenance project management chart.

3. CONCLUSIONS

Lean project management is a large discipline opening a wide horizon for enterprises and production systems to make fast and reliable improvements, considering any new product manufacturing project a set of lean projects optimizing resources to reach the main project's objectives. It will be more reliable and fertile to integrate this kind of management in maintenance project which takes part of the main manufacturing project.

The growing awareness of sustainability requires more efforts to concretize it not only trying to define the concept but giving sustainable tools to promote and evaluate industrial improvements [15].

Proposing practical steps to manage a lean conception and maintenance projects, in order to draw a general manufacturing control model based on lean projects. Implementing the proposed model ,industrial production systems would not waste money and time experiencing many ways. In fact, waste reduction techniques are the linking junctions between lean and green cultures [14] clarifying why "lean must be green" [13].

REFERENCES

- [1] S. Shingo and A. P. Dillon, "Study of the Toyota Production System: From an Industrial Engineering Viewpoint (Produce What Is Needed, When It's Needed)," 1989,Productivity Press.
- [2] L. M.Miller,"Lean management," Management Meditations,May 2013, <http://www.lmmiller.com>
- [3] "Lean-management," <http://www.logistiqueconseil.org>.
- [4] Quality management systems, "Guidelines for quality management in projects," ISO 10006(en),May2003.
- [5] A. Zandhuis and R. Stellingwref, "ISO 21500,Guidance on project management," Van Haren Publishing,May 2013.
- [6] A. Karim and S.Nekoufar, "Lean Project Management In Large Scale Industrial & Infrastructure Project via Standardization," Project Perspectives,XXXIII, pp. 72-77.2011.
- [7] J. P. Womack and D. T. Jones, "Lean Thinking: Banish Waste and Create Wealth in Your Corporation,"Free Press, June 2003.
- [8] F. A. Abdulmalek and J. Rajgopal, "Analyzing the benefits of lean manufacturing and value stream mapping via simulation : Aprocess sector case study," International journal of production economics, November 28,2006.
- [9] B.Nazim, Che A. Sobri and M, Shahimi, "TPM AND lean maintenance - a critical review," Interdisciplinary Journal of Contemporary Research in Business,June 2012.
- [10] R. Smith and B. Hawkins, "Lean Maintenance: Reduce Costs, Improve Quality, and Increase Market Share," Life Cycle Engineering Series, 2004.
- [11] L. BENSON , "Why Project Maintenance is the Key to Success," <http://project-management.com>, July 23, 2015.
- [12] "System Effectiveness,"system reliability engineering,August 2011, <http://www.reliabilityanalytics.com>.
- [13] J. Womack, " is lean green," Jim Womack's eLetters & Columns, Lean Enterprise Institute,2003, <http://www.lean.org>.
- [14] A. Fercoq,S.Lamouri and V.Carbone, "Lean/Green integration based on waste reduction techniques ,"Journal of Cleaner production, July 2016.
- [15] V.Veleva, M. Ellenbecker , "Indicators of sustainable production: framework and methodology," 2001.