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# TOWARDS A NEW PERFORMANCE MODEL INTEGRATING HEALTH AND SAFETY

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## ABSTRACT

This paper presents some analyses and results initiated in a research program held in an ambulance manufacturing company. The problem of our research program relate to the integration of Health and Safety variables in the decision-making process of the company. We first of all sought after understanding in-depth how the company adapted the Lean approach, and more precisely on what kind of performance model it based its implementation. Once the performance model was identified as “quality, cost, time, stock” variables, we tried to enrich this model by integrating Health and Safety, risk prevention and working conditions to improve it.

*Keywords: Performance Modeling, Lean Management, Health and Safety*

## 1 INTRODUCTION

This research work is a part of a doctoral thesis having started in December 2012 and deals with the integration of Health and Safety variables in the performance model of a company implied in a Lean approach. We consider the term “Health and Safety” in a very broad direction, by integrating the questions of the risk prevention and working conditions.

The current competing background leads companies to move towards innovative products and services. This implies for them to organize their work and their production so as to design and manufacture products and services more quickly to answer increasingly volatile and customized orders, involving flexibility [Womack, 2012].

In order to achieve this, more and more companies change or make evolve their production models to adopt methods of work inspired by TOYOTA methods and tools (described since 1990 under the name of Lean by researchers of the Massachusetts Institute of Technology). These methods are characterized by shortening the duration of production changeover while reducing make-to-stocks, by allowing customers to pull production flows according to their own orders and by standardizing working tasks in order to ensure quality [Womack, 2012].

Often, companies adjust these new forms of organization according to their representation of performance which is based on a common model designed with “quality, cost, time, stock” criteria. They also use approaches based on a Top-Down model, resolutely downward.

However, we have to admit that some side-effects are occurring little by little whereas productivity increases [Valeyre, 2006]. These effects affect particularly the Health and Safety of workers, and have also consequences on the long-term productivity of the companies.

This statement requires to redefine the performance model adopted by the companies and to identify an improved model reducing the impact of these consequences as well on Health and Safety as on productivity and competitiveness. In other words: what kind of performance model could take into account Health and Safety of the workers while ensuring productivity and competitiveness?

To reply to this question, we initially sought after defining the subjacent concepts of this problem: Health and Safety, Lean and Performance.

## **2 STATE OF THE ART**

Focusing on the Health and Safety of workers requires to consider other concepts such as the occupational risk prevention and Health and Safety.

We agree with the definition of health given by [Dejours, 2000]. According to this psychodynamic author, “health is not a state, but a dynamic construction. For each man, each woman, each child, Health involves being able to follow a personal and original way towards a state of physical, psychic and social wellness”.

As we shall see, taking into account the health dimension in the companies is not really unusual and refers to a common safety approach [Pilnière, 2007]. According to this approach, consideration given to workers can partly explain the fact that health dimension variables are under-represented in the decision variables of the Lean models of performance.

### **2.1. Consideration of workers in the common Health and Safety approach**

#### **2.1.1. Common Health and Safety approach**

Occupational hazard may be defined as the result of an encounter between a danger and a worker. Danger is held in the work environment of the worker. As mentioned by [Bourgeois, 2004], this definition refers to the common approach of safety. In this context, danger and damage have a direct causal link. Risk prevention is considered as the reduction of the probability and/or the gravity of this encounter.

This approach has given life to tools and methods which were developed in the fields of engineering. As [Verdel, 2000] reminds us, these tools and methods are the results of the reliability domain which were developed in several industry sectors (nuclear industry, aircraft industry and chemical industry) and are close to two other approaches: the human factors and the sciences of the danger. Human factors are close to ergonomics. However, [Journé, 1999] underlines a major point of divergence between human factors and ergonomics. Ergonomics is about fitting machine to man unlike to human factors which is based rather on fitting man to machine.

Sciences of the danger [Wybo, 1999], represented by the risk analysis sciences, has as an aim to study of the unexpected events. Their object aims “to know, understand and represent the various aspects of the danger in all the sectors of activity”; they are intended for complex situations of danger involving many actors.

These approaches have given life to methods and tools used in professional risk management. As we shall see, these approaches of prevention consider workers under a negative point of view.

#### **2.1.2. A poor consideration of workforce**

The common approach considers occupational risk as a process where danger and mankind meet each other's, “the ultimate appearance of the risk is the point when it is processed into accident” [Bourgeois, 2004]. The objective is to avoid, as much as possible, this meeting process. According to the direction given to this meeting process (danger towards the man or the man towards the danger), two main trends can be declined [Bourgeois, 2004]: technical and regulation approach then human behavior approach.

**Technical and regulation approach:** In this approach, as seen previously, danger and damage are considered as a direct causal link (noise is seen as the cause of deafness, lead is seen as the origin of lead poisoning, etc.). Risk prevention then consists in reducing the probability and/or the severity due to this meeting. It comes down to remove danger at the source when possible or to protect workers with personal protective equipment (PPE) or other protective ways (hooding of machines, etc.). The attention is drawn on dangerous conditions that prevention will try to reduce with a law recall referred to it (noise standards, etc.).

This orientation means that “man is considered as a target, with a passive behavior, exposed to dangers of its environment, without any control on them, and the goal is to protect him in spite of him. It is “the target of the risk” [Bourgeois, 2004].

**The human behavior approach:** As an extension to the approach seen previously, risk prevention aims to explain that dangerous conditions occur with dangerous actions, due to human errors. The pointed cause is a poor working knowledge or ignorance of a no dangerous work method, bad attitude, deficiency or physical maladjustment, etc. In fact, training is generally designed “to educate” workers. Its actions take various forms:

- Awareness of rules and procedures (recall of safety instructions, mandatory use of EPI, etc.).
- Appropriate behaviors and postures to be adopted (movements and postures training, compliance with safety distances, etc.).
- Motivations, abilities and skill assessment, (to hold a workstation, to be co-operative, etc.).

In this way, one “admits with the man an ability to act, but he is exposed to put himself, through his behavior, in position of target toward danger. Man is then considered as a weakest link in a technical-organizational system, responsible of mistakes, faults, wrong attitudes which are subject to correct, to educate, to discipline...” [Bourgeois, 2004].

It is obvious that this representation considering Man as a danger target or as a source of errors does not promote the implication of the employees in the prevention approaches and more broadly, to consider workers as actors of performance.

Now that we discussed about health and workers, we will address the Lean approach.

## 2.2. Lean approach

Lean is a qualifier given in 1987 by a MIT research team (Massachusetts Institute of Technology) in reference to methods and tools used in the Toyota Production System. Lean is organized in several stages:

- 1) to define what is the real value of products or services;
- 2) to improve the value chain;
- 3) to optimize flows;
- 4) to pull flows,
- 5) to tend towards the perfection [Womack, 2012].

This approach has several names according to sectors in which it is applied. For example: Lean Manufacturing for industries, Lean Services for the services, Lean management for the global management. In this document, we do not make this distinction and will use only the Lean term.

This approach is based on principles like the cost-cutting, total quality management, removal of supply surpluses, thus giving rise to just in time production, workers involvement and participation in the diagnosis and resolution of problems, endless improvement. It uses Toyota Production System single tools such as Kan Ban, 5S, Kaizen, Hoshin, VSM, SMED, etc.

Lean is a competing approach that can help companies to win volatile orders while ensuring quality of products [Womack, 2012]. Particularly since 2008, companies are brought to innovate to survive. Innovating forces to produce differently, in a flexible way, generating fewer make-to-stocks in order to avoid to be forced to sell exceeded products. Companies consider Lean and the associated tools as the best way to gain in competitiveness and taking over market share, thanks to their ability to respond.

We must admit multiple forms of application of Lean [Eklund, 2007]. For example, some companies follow only first parts of the stages, others use Lean tools without wiring them to the global approach. Thus, it is not uncommon to meet companies claiming to follow a full Lean approach whereas they apply only a cost-cutting process via 5S, without modifying its system of production with just-in-time tools (stock).

In spite of the various applications, Lean goal focuses on performance improvement and competitiveness. [Bonnefous, 2001] defines performance as “the ability of a system to achieve its goals. It defines the links between the functions to be filled and conformity to be enhanced. Performance is actually measured by the resources through several indicators, such as time, quality and costs, in order to evaluate the efficiency, the effectiveness and the relevance of the resources settings concerned”.

In the Lean approach, performance is declined under variables such as cost, quality, delivery deadline and stock and refers to indicators. Remember that performance indicator is “a quantified data, which measures the effectiveness of the variables of a decision compared to the achievement of an objective defined in the level of decision considered, within the framework of the company objectives” [Ducq, 2007].

After having tackled Lean and the subjacent model of performance, we will now have a look into Health and Safety in the specific Lean Approaches.

### **2.3. Health and Safety in Lean Approaches**

By comparing the learning organizations, Taylor organizations and Lean organizations, a European study showed the particularly side effects of the Lean organizations on health [Valeyre, 2006]. These effects are translated, for example, by an increase in the absenteeism, stress, turn-over, and occupational diseases.

Having regard to the concepts we recalled and the analysis we made, it enables us to refine our initial aim. Two questions can be formulated:

- What kind of performance model can support the integration of workers Health and Safety while ensuring productivity?
- Which methods of intervention can facilitate this integration in an effective way?

These questions thus asked, we tried to answer through a research-action work dealt with a company. We will present now first results of this work, which is still ongoing, then we will develop some subjacent discussions.

## **3. CASE STUDY**

### **3.1. Description of the case study**

#### **3.1.1. The context**

Our case study has been conducted from March to July 2013. It relates to a manufacture of ambulance employing nearly twenty operators. This company addresses an important competing market. It draws its strengths on this market by offering tailor-made products to its customers, by modifying vehicles right before the delivery. This “hyper-customization” of the vehicles implies a specific work organization. To achieve this, Lean approach was chosen to enhance this necessary flexibility. The implementation of this approach has been done for two years and is not yet clearly finalized.

For the company lead manager, the fact that Lean approach is not yet settled 2 years after raises questions. This questioning is the origin of our case study. The request of the lead manager could be formulated as follows: “help us to implement Lean approach within our company in an effective way”.

### 3.1.2 Used approach for our research

Before answering to this request, we first of all proposed to carry out a diagnosis in order to identify appropriated axes of action. This proposal is part of a broader engineering approach which follows the model presented in Figure 1 [Doumeingts, 2000]:

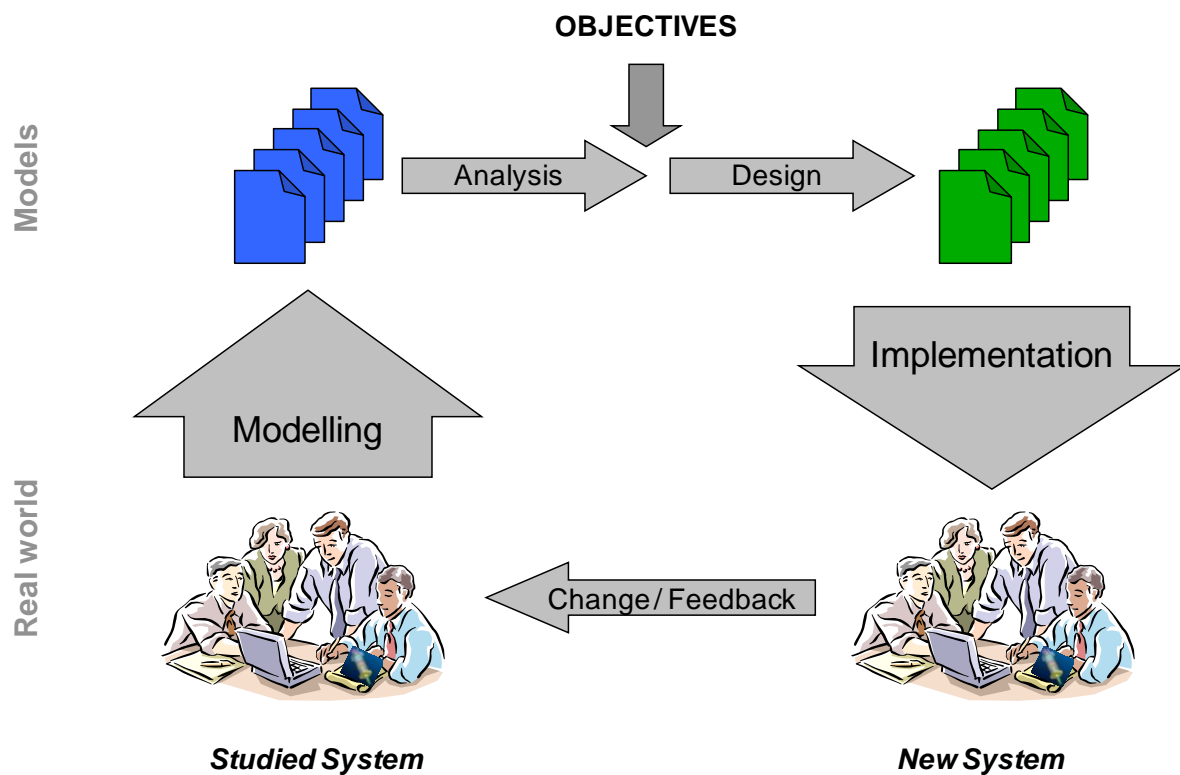


Figure 1: Re-engineering Approach [Doumeingts, 2000].

It is worth remembering that this approach is declined in various phases which are part of a cycle:

- The first phase consists in defining the perimeter of the existing system to study and to extract the useful information from people of the system.
- The second phase consists in modeling this existing system using a set of models relevant with the type of system analyzed and with the kind of improvements expected. In our case, it consists in modeling the system of performance on which the company is currently based on.
- The third phase consists in analyzing the achieved models of the existing system in order to elaborate a diagnostic and to propose improvements influencing positively on its performance, taking into account the strategic objectives of the company.
- The fourth phase consists in modeling the future system integrating the improvements validated with the company management at the end of previous phase.
- The fifth phase consists in the implementation of the new models in an effective way.
- Once this new model has been tested, the cycle can be repeated to adapt the models, the methods and tools, and start a continuous improvement approach.

## 3.2. Current existing diagnostic

### 3.2.1. Holding of events

To carry out this diagnosis, we used the systemic point of view and applied it on the study of working situations. We particularly focused on the interactions between work activity and the effects on the individual and the company. We have focused on the way how workers were dealing with work requirements. This organizational diagnosis is based on day to day work understanding. It is also based on the dynamic and global decisions of the company.

In order to achieve this, we collected and analyzed information from these different sources:

- Documents helping to identify what kind of quantitative and qualitative indicators are daily used by the studied company.
- Individual discussions with various company partners.
- Observations of work.

At this stage, we formalized the diagnosis and we will expose below the main results.

### **3.2.2. Diagnosis results**

What about the implemented Lean approach?

#### **Quality as a prevalent variable of decision:**

As already noted, this company manufactures ambulances. To do so, it transforms existing vehicles into ambulance by complying with quality and safety standards and requirements. These standards are part of regulations regarding transport of the patients. If the outgoing vehicles do not meet these requirements, they are not approved and cannot be sold. To ensure an effective follow-up, the lead manager hired a part-time employee. Its role is to define the appropriated quality procedures. Workers have to respect them and apply these procedures during the transformation of vehicles. Quality is thus a prevalent variable of decision which dictates the achieving of work and more largely the organization of work.

#### **Variables of decision “cost-time-stock” strongly represented:**

To reduce stocks, costs and manufacturing lead times, the company modified its process and the subjacent organization of work. For example, before the approach lean, the operators did themselves the checking of stocks in a random way. This way of making introduced problems of stock shortage. Today, by the installation of Kanban, it is a person and only one which ensures this task and which conveys the parts. The variables of decision “cost-time-stock” thus are strongly represented.

What about the operator’s Health and Safety?

The diagnosis has identified a degradation of the health status regarding some production workers. The company thus was penalized by sick leave of workers suffering from periarticular pathologies. For example, during the absence of these qualified people, the company noticed delays in production, losses of productivity, quality problems, overtime increases from their colleagues.

Thus, in addition to human and social issues, these illnesses came to disturb production and more widely performance defined as “quality, cost, time, and stock” parameters.

After a closer look at occupational risk prevention management within the company, we noticed that participative management is not the preferred method. Indeed, the preferred management is based on the top-down type, very descending. In this decisional system, participation of workers is confined to an information feedback regarding technical dysfunctions, feedback which does not include Health and Safety aspects. The Health and Safety aspect is thus only considered under a technical and regulation point of view or a “human factor” point of view. As we saw previously, these approaches of Health and Safety consider workers as targets of danger or source of mistakes. This consideration does not stimulates involvement of workers in prevention approaches and more widely, to consider man as an individual player of performance.

Our point of view states three elements:

- The variables of decision of the company performance model are confirmed as the following ones: quality-cost-time-stock,
- Health and Safety is not considered as a variable of decision in the performance model,
- Workers are not considered as participants in risk prevention or performance,

We have just introduced the main results of our diagnosis. Starting from this point, we now propose to deal with the two following questions, as seen previously:

- What kind of performance model can support the integration of workers Health and Safety while ensuring productivity?
- Which re-engineering methods can facilitate this integration in an effective way?

This discussion is regarded as an important statement since our action within the company is not yet finished.

#### 4. DISCUSSION AND CONCLUSION

First, the two questions are closely linked, and have to be simultaneously studied.

Indeed, the first question “what kind of performance model can support the integration of workers Health and Safety while ensuring productivity?” is referring to a “what” type of question. In other words: “What do we want? What are the pursued goals?”

The second question “which re-engineering methods can facilitate this integration in an effective way?” is referring to a “how” type of question. In other words: “How can I manage to make this model applied in the company in an effective way?”

If these two questions are studied independently one from the other, a main risk comes out: the non integration of this model by the company due to a non appropriation of this one by managers and by workers of the company.

Consequently, our central assumption is that these questions concern a socio-cognitive research field. Concerning the performance model, lack of appropriation by workers and managers leads us to consider that it is necessary to have a look on people cognitive representations. We are talking not only about representation of various variables of decision (cost-quality-time-stock-health), but also about interests that workers and managers have to integrate them in the achievement of their day to day work. The matter of the actors’ representations is thus a central question.

The conditions for facilitating and supporting such approaches are paramount in the degree of success, in the appropriation and the perpetuation of the performance model which will be applied.

Questioning the evolution of the representations is like questioning learning under two aspects: learning considered as a result (“what do we have learned?”) and as a process (“how do we learn?” or “how do we have learned?”). In this way, methods for facilitating and supporting must help learning under these two aspects.

One of the methods on which we bring our attention is the “learning action workshop” which can lead participants to be actors of their own learning.

To conclude, we focus in this paper on the way Health and Safety can be integrated in a performance model of a company involved in a Lean approach, in order to avoid negative long-term impacts of such approach, applied in an incomplete way. First results of our case study show that their integration through specific indicators and relevant methods and tools is only one aspect of the possible solution. We must consider also how people consider such questions and how they will keep interest on them. In other words, the way improved models and tools will be efficiently applied depend on people appropriations and representations of health and Safety dimensions, which is the second aspect of the possible solution.

The next steps of our collaborative work with the ambulance company will then focus on these two aspects.

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