

Lean Thinking Implementation in The Public Healthcare: Results From Italy

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Abstract

Lean production tools and principles, which stem from Toyota Production System, have been applying also in the healthcare industry. In the last decade many organisations have tried to adopt Lean within their wards, departments and patient's routings. However, Lean in the healthcare, especially in the public healthcare, needs to be implemented with some adjustments.

This paper wants to contribute to the debate concerning lean implementation in the public healthcare, in particular analysing the possible benefits that can be achieved, the pitfalls and the adjustments to be made. The paper is based on a qualitative inquiry through the interview to three managers who belong to three large Italian public hospitals. In these hospitals, in the last years, many processes have been affected by lean applications.

Findings show that tools such as Value Stream Map (VSM), 5S and Single Minute Exchange of Die (SMED) and Kanban can be applied like so in the manufacturing industry. The main achievable benefits are bound to the lead time reduction of the patient's routing, cost reduction and patient's satisfaction. It is not that easy to measure the economic and financial benefits, moreover pitfalls and difficulties are sometimes in ambush. Problems related to senior managers' commitment as well as staff's involvement and motivation have to be taken into serious consideration.

Keywords

lean production; public healthcare; lean tools; senior manager's commitment; staff's involvement; improving performances

1. Introduction

Lean production is the term which Womack et al. (1990) coined in the 1990's through the famous book 'The machine that changed the world, the story of Lean Production'. In this famous and well-quoted book the authors investigated different production systems within the automotive sector including the Toyota Production System (TPS). The latter originated in the 1960's and was mainly developed by Taiichi Ohno (1984). Ohno theorised that production systems have to avoid and banish seven wastes which lead to lose profitability; these wastes in particular are (Ohno, 1988):

- Overproduction
- Inventory
- Transport
- Motion
- Defectiveness
- Waiting
- Over-processing

Lean production has brought to production and operations management in general a legacy of new tools and principles (Monden, 1983) such as Value Stream Mapping (VSM), 5S, Kanban, Single-Minute-Exchange of Die (SMED), Total Productive Maintenance (TPM) and Poka-Yoke to mention but a few. These tools are used for reducing the above mentioned seven wastes. In the last decades many organisations around the world have implemented Lean production principles and tools achieving relevant results in terms of efficiency and efficacy.

Lean production, as the name suggested, stems directly from production and manufacturing management, anyhow over time it has been implemented in different environments such as service industry and public administrations, including healthcare organisations (Radnor and Boaden, 2008). In this case Lean has received some criticisms mainly due to its manufacturing origin. Even so, as the literature review demonstrates, a number of authors consider Lean production suitable also for healthcare organisations.

This paper wants to enlarge the debate concerning the possibility of implementing Lean in public healthcare organisations, investigating the situation of three Italian public hospitals where Lean has been applied in the last years. Through an interview to three managers who are involved in many Lean improvement projects within these hospitals this research wants to bring to light new theory about Lean applications in the public healthcare. In particular, the interviews have gathered information for discussing the benefits and the pitfalls of Lean applied in the public healthcare.

To the scope this paper is structured as following. The next section deals with Lean implementation in the healthcare. Then section 2 reviews literature about Lean in the healthcare and public sector, trying to evaluate what the state-of-art of this topic is. Section 3 refers to the qualitative methodology employed for carrying out the interviews and section 4 analyses and discusses the findings from the interviews. A conclusion section summarises the results, limitations and discusses an agenda for further research.

1.1 Applying Lean in the healthcare

Since the 1970s, also in the healthcare competition has increased on factors such as zero defects, process time reduction, price and relevant customisation. This scenario is the opposite of the so-called 'Mass production' (Shingo, 1989), in which there is a huge demand for services and products and services are provided with low-cost resources and with poor personalisation and quality.

In order to implement Lean production a healthcare organisation typically has to follow a theoretical path (Pettersson, 2009) where the main stages are:

- Training Lean specialists and raising awareness about wastes inside the processes.
- Determining the sequence of activities within the processes using tools such as VSM.
- Eliminating activities that do not add value to the process, and design the future state of the process.
- Improving the process (start over) through agile and quick teams that remove the waste just when it happens.
- Using of standardised Lean tools.

In general, the shorter the processes, the leaner the organisation and consequently less waste (Sugimori et al., 1977). Thus Lean is focused on the extreme simplification of the patient mainstream with the intention of avoiding any kind of waste.

To achieve these goals, Lean uses very specific tools such as 5S, Kanban, Heijunka, SMED and many others (Shingo, 1989; Ohno, 1988) invented by Toyota and other Japanese companies.

According to Bell et al. (2006), agile and quick teams continually try to remove waste. These teams usually manage so-called 'Kaizen events' or 'Kaizen weeks' (Robertson et al., 1992; Manos and Alukal, 2006; Manos, 2007; Mazur et al., 2008; Dickson et al., 2009), where Kaizen is the Japanese translation for continuous improvement (Imai, 1986). A peculiarity of these improvement projects is the short duration (on average a week) and the maximum involvement of people (Wickens, 1993; Liker and Meier, 2007).

Lean tools are easy for everyone to use and within the Kaizen teams self-empowerment and responsibility are as important as team building and team efforts (Schattenkirk, 2012). The original tools derived from the Toyota Production System and their aims are summarised in the subsections below.

1.1.1 VSM (Value Stream Mapping)

VSM is the most used lean tools in the healthcare. VSM maps the process and information flow and can be used for mapping the patient's routing. This visual representation boosts the process of Lean implementation by helping to identify the value adding and non-value adding activities (Rother and Shook, 1993). VSM is made up of two maps: the Current State map and the Future State map. VSM is typically used for analysing the patient's routing.

1.1.2 Makigami

The second tool for mapping processes is the Makigami. Makigami is oriented towards transactional processes and it is derived from BPR tools (Hammer and Champy, 2003). There are no academic papers on this topic and practitioners and consultants have been implementing the tools under several names. Martin and Osterling (2007), for instance, introduced Metric-Based Process Mapping, a process-level mapping tool that helps to make effective and data-based decisions concerning waste reduction. It is used especially in the administrative processes of the healthcare.

1.1.3 5S

Another important lean tool is 5S. It improves order and cleanliness. The idea is that a messy workplace, desk, or area makes it hard to find things, easier to get distracted, and can introduce accidents, mistakes and lower productivity. 5S is structured by 5 important activities: separating staff, setting in order, shining, standardising and sustaining. In the healthcare order and cleanliness usually are linked to sanitation.

5S also means to introduce standard work documentation for doctors and nurses in order to keep alive the improvement achieved.

1.1.4 SMED - Quick Changeover

Using personalised treatments for the patients, it becomes fundamental to change quickly from one service to another. Surgery teams, for example, have to change from one patient within the operating theatre to another one. Quick changeover, also known in the manufacturing field as SMED, is a particular tool that avoids dead times and improves changeover operations increasing productivity.

1.1.5 Kanban

Kanban is a specific card or signal that signals the need of a product or a service. For instance it can be used for reordering a specific amount of drugs. It avoids inventories within the departments.

1.1.6 Poka-Yoke, Mistake proofing system

Poka-Yoke is a tool for avoiding human errors on the processes, reducing defectiveness and risks for the patients. For instance, it can be used during drug administration in order to not confuse patients and their relative prescriptions or in a laboratory in order to not mix up different samples.

2. Literature review

Literature review about Lean applied in the healthcare is relatively recent. Anyhow there are many papers which deal with the subject.

Fillingham (2008) analysed how Lean and its original principles and tools derived from manufacturing industries can be applied in public hospitals. He studied applications within the Bolton Hospital NHS in UK. According to the author, Lean inside NHS hospitals has to be adapted and personalised to the care processes. For the first time Fillingham proposed to reinvent the seven wastes specifically for healthcare (p. 236):

- *Transport – movement of patients and equipment*
- *Inventory – unneeded stocks and supplies*
- *Motion – movement of staff and information*
- *Waiting - delays in diagnosis and treatment*
- *Over production – unnecessary tests*
- *Over burden – stresses, overworked staff*
- *Defects – medication errors, infections*

It can be noticed how the transportation and movement of patients are top of the list. The author also demonstrated that Value Stream Mapping is a fundamental tool. Indeed, according to his results related to the Bolton Hospital case study, Value Stream Mapping (VSM) is very useful in structured organisations like public hospitals in which a multidisciplinary team and many departments are involved. Bolton Hospital's team takes in serious consideration the patient's routing, indeed, according to Fillingham (2007, p. 236):

...the progress of the patient's journey from arrival at A&E through radiology, the wards, theatres, back to the wards and the discharge process. In doing this they identified enormous waste, error and duplication.

Ballè and Réigner (2007) analysed a Lean application inside a department of a French hospital for two years. The authors concluded that Lean is not just a matter of tools. By contrast it is mainly based on people involvement, creating a culture of "no ambiguity" and resolving problems through quick responses. In any case in the French hospital, tools and

principles about avoiding wastes are based on 5S, standardisation of the workplace, and systems for reducing human errors and mistakes.

Brandao de Souza (2009) discussed the general advantages of Lean in the healthcare. He reviewed the existing literature on lean in healthcare, classifying over 90 papers. The author claims that Lean can introduce several benefits, even if it remains a challenge to better understand how principles and tools have evolved over the years.

Filingham (2008) wrote a book dedicated to explaining how to improve a patient's experience in healthcare. However the book is a more a collection of Lean tools rather than a discussion on their applications in healthcare and the encountered difficulties.

Radnor and Walley (2010) wrote an interesting paper analysing different case studies of Lean applications in the public sector, including healthcare. The authors claimed that lean can bring important benefits to the organisation. However in their conclusions they warn of lean as just a combination of tools. Lean has to be implemented as a philosophy involving all the staff and management.

By means of case studies, other authors analysed the application and the achieved benefits using different lean tools. In particular Wojtys et al. (2009) analysed VSM applications, Graban (2009) studied patients' path and its costs while Al-Araidah et al. (2010) discussed the possibility of reducing lead time in a pharmacy department using lean tools such as 5S.

Waring and Bishop (2010) in their research concluded that lean could not be the easy remedy for making both efficiency and effectiveness improvements in healthcare. They analysed in particular the pitfall linked to lines of power inside healthcare structures which can act as a resistance to change the social organisation of healthcare work.

Papadopolous (2011) discussed how lean is related to continuous improvement principles and these are linked to dynamic actor associations. Pitfalls derived from Lean application in the healthcare are due to a wrong cultural approach.

Radnor (2011) proposed a debate through a paper entitled 'how mean is lean really'? In this paper the author underlined how in the public sector lean introduces the principles of value, flow and reduction of wastes.

Radnor et al. (2012) introduced some criticisms about Lean in the healthcare. It seems that Lean tools and teams based on kaizen principles and rapid improvement events tend to produce small-scale and localised productivity gains.

Chiarini (2012a, 2013) analysed two case studies within the same Italian public hospital. In both cases he proposed tools such as VSM for analysing and reducing costs of processes. Moreover he claimed that Lean in the healthcare can reduce risks for patients and operators as well.

Radnor and Osborne (2013) in a recent paper investigated lean applications in public sector, including public healthcare. Their conclusions bring to scholars an unexpected theory that considers Lean in the public sector being successful only when applied in an organisation with dominant business logic.

To recap, different authors analysed and proposed lean applications in the healthcare especially through case studies. They agreed with each other in considering Lean and its tools as a powerful management system for reducing costs and improving quality. Several authors quoted VSM and 5S among the applicable lean tools as the most important. However other authors moved some criticisms especially concerning organisational difficulties such as management involvement and limited and localised benefits. Moreover other authors underlined how lean has to be considered a philosophy rather than a collection of particular tools and how lean can fail in organisations not inclined to business logic.

3. Methodology

This research is based on an interview to some managers who belong to Italian public hospitals. In particular three managers from three different hospitals located in Tuscany, Italy have been chosen because they:

- Have good skills about lean and quality management tools
- Have been appointed team leaders for lean implementation and they have used all the lean tools
- Have experienced different kind of organisational problems; for instance relationships with senior management, conflicts among team members, nurses, doctors and technicians
- Can give a neutral opinion on the lean implementation because they are not the top managers who have sponsored the projects.

The three hospitals have more than 500 beds each and they are structured with many departments. The hospitals' choices allowed at design a multi-case study approach, and the research was carried out according to an inductive and qualitative way trying to generate new theory on the subject. Many papers discuss the possibility of using case studies to generate theories inside a specific field. Social studies as well as management have not led to the generation of context-independent theories and therefore only context-dependent knowledge can be taken into account (Orlikowski and Baroudi, 1991). The case study format presents some weak spots that could affect the research. In particular it is practical, context-dependent knowledge and it is not as valuable as general context-independent knowledge. Ultimately it is quite difficult to generalise on the basis of few cases.

To collect data, a semi-structured interview method has been used. To this end, an interviewer guide was developed before interviewing the managers. The interviewer guide contains some open questions that explore specific areas of interest. The theoretical underpinning of the interview protocol is mainly based on the possibility of finding a pattern among the answers. Table 1 shows the open questions used for the interviews that were developed based on the theoretical underpinning discussed in the literature review section.

Table 1: Open questions used for the interview

<i>Interview focus: Benefits and pitfalls in Lean implementation</i>		
Interviewer guide	Open questions	Notes
1	<i>Do you believe Lean has brought economic and financial benefits?</i>	<i>Discussion about benefits introduced by lean and its economic- financial quantification</i>
2	<i>Have relationships among managers, doctors and nurses improved in some way since lean has been implemented?</i>	<i>Discuss in particular relationships with head of departments and senior managers. Investigate relationships related to team-working and team-building</i>
3	<i>What are the main benefits perceived by the patients?</i>	<i>Investigate how Lean has affected patient's satisfaction</i>
4	<i>What kind of performances has lean improved?</i>	<i>Discuss improvements such as lead time, defectiveness, transports, waiting lists, etc.</i>
5	<i>Do you believe that the achieved improvements are general for the hospital or located just in few departments?</i>	<i>Discuss the reasons that lead to the success for the entire hospital</i>
6	<i>What kind of organisational obstacles have you experienced?</i>	<i>Investigate organisational obstacles at any level and considering the hospital as a whole</i>
7	<i>Which kind of lean tools have you implemented?</i>	<i>Investigate whether all the lean tools can be implemented</i>

The interviews produced much data, and the practice of coding qualitative data (Lofland and Lofland, 1995) was used to assign labels to classify and assign meaning to parts of the information. An initial coding generated several categories from the responses. A second

coding known as focused coding was used to reduce the number of initial coded categories by eliminating the less useful ones. Sometimes codes are not mutually exclusive thence the same information could be assigned several codes. In order to avoid these interrelationships in the coding process it is important to review the codes several times, eliminating less useful ones, and grouping smaller categories into larger ones (Lofland and Lofland, 1995).

At the end of the process, five theoretical results emerged. These represent how lean production has been implemented in the three Italian hospitals and what kind of benefits and pitfalls can be experienced in these organisations.

4. Results of the interviews and discussion

The results below discussed represent the five categories of theoretical results which underpin Lean implementation in the three Italian hospitals. Following the discussion of the findings from the interviews and some important interviewees' comments.

4.1 Economic and financial benefits

All the interviewed managers agreed that lean can surely bring many economic and financial results. Lean reduces all the waste; consequently costs related to the operations can be significantly reduced. Indeed the three managers underlined that the reductions usually affect:

- The average cost of the patient's treatment, by shortening times
- The average cost of the inpatient management, by shortening times
- Cost of medical and surgical supplies, by reducing inventories
- Cost of capitalised or fixed assets, by increasing productivity and availability
- Cost of repairs and maintenance on equipment and buildings, by improving maintenance

The managers declared that lean tools can increase productivity. This means that a single department and even the hospital as a whole can increase the number of health services provided to patients with a consequent increasing of turnover. Being public hospitals, turnover is usually linked to transfer of funds from the local regional government.

All the interviewed managers agreed that the economic and financial benefits are typically measured after several months or one fiscal year. These benefits are measured through monthly Key Performance Indicators (KPIs) and consolidated in the balance sheet. The managers also declared that it is not that simple to measure the achieved improvement from an economic and financial point of view. At the end of kaizen events the team is able to evaluate benefits in terms of performances such as lead time, waiting list time, defectiveness and clinical errors. However it is difficult to exactly and immediately quantify for example the economic and financial impact of a waiting list reduction. This seems related to the particular accounting system implemented by these Italian public hospitals. In fact some authors argued that lean needs a different accounting system for measuring the day-by-day improvements (Pryor, 2010; Chiarini, 2012b; Kaplan and Anderson, 2013).

4.2 Improvement of processes and services by means of specific lean tools

The three managers declared that through lean tools an interesting and measurable improvement in terms of process and service performances can be reached. The interviewed managers have used a similar Performance Measurement System (PMS) for measuring the improvements introduced by Lean initiatives. In particular the most used metrics for the Lean PMS and the most used lean tools for achieving results are the following:

- Lead time; this metric in particular is used for measuring the patient routing in terms of time. Patient's routings are divided by typologies and patient's progress is tracked across

different theatres, wards, outpatient clinics, diagnostic departments, etc. in order to understand where wastes and inefficiency are. For measuring lead time one of the most used tools is VSM. One interviewed manager suggested that VSM can be kept updated over time to evaluate whether or not waste and consequently lead time is decreasing or not. According to all the three managers when theatres are involved one of the most important lean tools to be utilised for reducing dead times is SMED. Furthermore, all the three managers consider 5S a basic and fundamental tool for introducing visual management concepts and the so-called standard work. Two managers out of three are trying to implement TPM for improving maintenance. Notwithstanding in the manufacturing industry there is a high involvement of operators, in these public hospitals they prefer to manage maintenance using external professional or just clinical engineers. Medical machines are considered

- Waiting list time; this metric calculates the patient's waiting time before accessing care or diagnostic processes. Waiting list time can be considered part of the total lead time or something a part but in any case bound to the patient's routing. VSM can be once more useful for measuring and shortening waiting times
- Customer satisfaction; all the interviewed managers underlined how the reduction of lead time and waiting list time inevitably increase patient's satisfaction. Anyhow, according to one interviewed manager, the increase of patient's satisfaction can be appreciated only after a while and not immediately launching lean initiatives.
- Defectiveness; defectiveness is measured with metrics such as complaints, infections, errors in treatment and diagnostic, etc. Lean tools such as 5S can affect the results in terms of defectiveness. However two managers argued that Lean tools are not as effective as other tools derived from risk management for avoiding errors such as infections. Reducing infections means to employ advanced tools often based on statistical data analysis. These particular tools do not belong to the lean environment.
- Inventory reduction; all the managers are trying to implement Kanban signal for reducing and taking under control the amount of drugs, disposables and other medical devices. Kanban is important for reducing inventories within the internal pharmacy as well within each department.

To sum up, the interviewed managers who know well lean tools and principles argued that not all lean tools can be employed in the healthcare. VSM, 5S, SMED and Kanban are the most important ones.

4.3 Improvement of organisational performances

All the three interviewed managers agreed that Lean can bring other improvements more linked to human resources. However these kinds of improvements are usually not that easy to measure. Anyhow the interviewed managers listed improvements concerning:

- Involvement and awareness of the staff on the decision-making process
- Motivation
- Empowerment and self-responsibility
- Group identity
- Communication among departments
- Team working

As discussed in the next section, some of these issues when not successfully pursued can change from improvements into obstacles and pitfalls.

4.4 Pitfalls related to management commitment

One of the most dangerous pitfalls when lean is applied in the Italian public healthcare is the possibility of failing in a complete implementation. The majority of Italian public

hospitals are structured and complex organisations with many departments and many heads within these units. As a consequence a typical patient's routing often has to pass through different 'companies' with their own senior management and centres of power. The three interviewed managers explained how much could become difficult to implement lean in this particular situation. The keystone for succeeding is to get the strongest commitment. In the Italian public hospital this means that lean sponsorship has to come from the General Manager of the hospital or even from an external institution such as the healthcare department of the local government. Indeed in Italy public hospitals usually receive funds from the local regional government and therefore they are under the authority of the strategic political choices of the government. Anyhow, commitment from General Manager and other top managers such as the Health Director and the Administrative Director is fundamental.

Another important pitfall can come from the possibility of a drop in attention over time. Once more this could be related to a lack of commitment from top management or frequent managers' changes. One of the interviewed manager told that in his hospital he worked with a lean skilled doctor, head of a department. Unfortunately the doctor was posted to another hospital and as a consequence now there is a lack of attention on lean tools and principles in that department. Indeed the new appointed head of the department is not tending to lean implementation. Another interviewed manager told that in his hospital the General Manager has always boosted the lean implementation project. On the other hand the previous General Manager was more focused on other strategies and did not pay the right attention to lean implementation.

4.5 Organisational pitfalls and obstacles

Management a part, the three interviewed managers stated that other pitfalls can obstacle lean implementation in a public hospital. One important aspect of medical care is the extreme personalisation depending on the patient and the kind of illness. According to two of the three interviewed managers, in these cases it is difficult to apply lean tools. For instance it is difficult to map all the processes within a customised patient's routing using VSM. Problems are related to the lack of data and information considering the scarce repeatability of the service. Moreover it is difficult to create specific standards for the particular care. Ahlstrom (2004) investigated this aspect comparing the concept of product and service.

According to all the interviewed managers lean does not need any particular technology or software for its implementation. On the contrary lean tools are simple and with immediate impact when well-comprehended. However, talking about comprehension, all the interviewed managers underlined the importance of a deep training at all levels at the beginning of the journey. You need to train team members on lean tools and how to apply them, but you also need to train all the staff in order to raise the awareness around lean principles. According to one interviewed manager some doctors and nurses can live the project as something forced if they have not been involved in some way; undoubtedly training is experienced as an important means for being involved.

5. Conclusions

This research has been led interviewing three managers of three Italian public hospitals. The results show how lean can bring relevant benefits when applied in the public healthcare. According to the results from the literature review benefits can affect the economic and financial performances. Moreover this research has brought to light improvements on the processes and services measurable through specific indicators. One of the most important improvements concerns patient's satisfaction. Indeed lean can shorten waiting list times and

the patient's routing as well. However, it seems that not all the economic and financial benefits are that easy to quantify, especially in the short period. This is due to a particular lack in the accounting system.

Not all the lean tools seem so implementable in the public healthcare. The three Italian hospitals much prefer VSM, 5S, SMED and Kanban. Besides they reckon lean tools not that effective in reducing defectiveness. 5S and other tools such as Poka-Yoke can surely help, however they are limited in their results.

Lean tools and principles have also a positive effect on organisational performances such as motivation, communication and team building.

When a public hospital implements lean production, there are also several pitfalls in ambush. The most important one is commitment from top managers. A public hospital has usually many departments with many managers, therefore it is important to align strategies within all the departments. And this can only be done by top managers or even external institutions.

Other important pitfalls are related to staff's involvement and training aspects. For instance, training is an important vehicle for getting the right involvement of doctors, nurses and technicians. Otherwise that can live the lean journey as something forced.

There are some limitations in this research which led to develop an agenda for further research. First of all the research has been carried out just in Italian public hospitals. Thence similar investigations could be managed in other countries. Secondly the sample of three hospitals is linked to a qualitative inquiry. Researchers could use a larger sample and investigate these issues by means of quantitative inquiry. For instance they could state the results of this research as hypotheses to be tested.

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