

Executives' Attitudes toward Lean Management at the National University Hospital of Iceland

Eydís Ýr Rosenkjær

Eðvald Möller

Vigdís Hallgrímsdóttir

Abstract

According to the definition, the term 'lean management' involves increasing value for a client at minimum cost. In order to reach that goal, companies and institutions must realize that the flow of the products and/or service needs to be increased throughout the whole value chain. All waste taking place during the procedure must be prevented, from the beginning to the end, as it is not enough to eliminate it only in isolated areas. It is, therefore, important to create processes that require less labor, space, money, are less likely to cause mistakes or flaws, and require less time when handling and dealing with products and/or services.

The application of lean management is a different approach to labor efficiency, involving a diverse and lean journey towards improved operations, and is thus not solely a process. Lean management can be applied to any form of activity, and after implementing the methodology, new and goal-oriented work begins.

The objective of this study is to examine the attitudes of Landspítali executives toward Lean management. In order to shed better light on this topic, answers were sought to the following research questions:

- *Are Landspítali executives familiar with Lean management methodology?*
- *Do Landspítali executives feel that they have received adequate instruction and training in Lean management methodology?*
- *Are Landspítali executives of the opinion that the implementation of Lean management methodology is yielding results?*

Keywords: Lean healthcare, lean management, service, organization; management, waste

JEL Codes: D20, I12, I15, I20, I30, M11, L23, Q50

1. Introduction

In the fall of 2011, Landspítali, the National University Hospital of Iceland (hereafter Landspítali), decided to obtain the assistance of the international consulting firm McKinsey & Company in implementing Lean management methodology. The situation of the hospital was reviewed, following which, a roadmap was produced that introduced Landspítali's future vision, as well as its goal of using Lean management to effect improvements within the hospital. Patient safety and service quality were identified as key priorities, along with the necessity of reducing waste (Guðrún Björg Sigurbjörnsdóttir, personal communication, February 19, 2015; Landspítali, 2013).

One of Landspítali's goals for this implementation was to improve workplace morale and relations by encouraging employee participation in the improvement initiative. Secondary goals were for Lean management to become a methodology that all Landspítali executives would use in their jobs and for the methodology to become integrated with other quality and improvement initiatives within the hospital (Landspítali, 2013).

By definition, the concept of Lean management involves increasing value for the client at a minimum cost. In order to accomplish that goal, companies and institutions must realize that the flow of the products and/or services must be increased throughout the entire value chain. From start to finish, all waste that occurs during the process must be prevented—it is not enough to simply eliminate waste in isolated areas. It is, therefore, important to

create processes that require less manpower, less space, less money, are less likely to cause mistakes or flaws, and require less time spent on products and/or service.

The application of Lean management creates a different approach to labor efficiency, as the journey toward improved operations is a diverse and intricate one, and as such, is not solely a process. Lean management can be applied to any kind of activity and once this methodology is implemented, a new and goal-oriented kind of work will begin.

The objective of this study is to examine the attitudes of Landspítali executives toward Lean management. In order to shed better light on this topic, answers were sought to the following research questions:

- *Are Landspítali executives familiar with Lean management methodology?*
- *Do Landspítali executives feel that they have received adequate instruction and training in Lean management methodology?*
- *Are Landspítali executives of the opinion that the implementation of Lean management methodology is yielding results?*

Research Methods and Information Retrieval

A quantitative research method is used in this study. Quantitative research deals with measuring a specific subject, where the objective is to explain or describe something specific, for example, persons attitudes or opinions. Quantitative data processing is statistical (Cooper & Schindler, 2006). The quantitative method involves a researcher collecting data regarding people's attitudes toward a specific subject, with an emphasis on trying to prove a hypothesis and support numerical information. The data in quantitative research are measurable and countable, and it is possible to interpret the whole from the sample. It is also possible to draw conclusions from statistics and to rely on graphs or tables when offering explanations (Bogdan & Biklen, 1998; McMillan, 2008).

One hundred and sixty-nine Landspítali executives participated in the study (Guðrún Björg Sigurbjörnsdóttir, personal communication, February 19, 2015). Landspítali's executives include CEOs, department directors, directors of nursing, and chief physicians and the staff members are hired for five years, after the advertisement. Landspítali executives are required to be leaders and to have extensive and specialized knowledge about management and hospital operations (Landspítali, 2009). The study was conducted in February and March 2015.

The Likert scale was used for five questions included in this study. The Likert scale is the most widely used method for measuring people's subjective assessments. The Likert scale is a five, seven, or nine-point scale that examines how much participants agree or disagree with a particular statement. The middle of the scale describes participants' neutrality when they neither agree nor disagree (Bryman & Bell, 2003). The study was comprised of 18 questions, which were answered by a total of 83 executives. This yields a response rate of 49.1%.

Lean management

A great deal of theoretical writing has been done on Lean management, but it has proven difficult to reach a consensus on the definition of this concept. Lean management is a methodology that is both used a tool and a managerial practice (Graban, 2012). Lean management creates a different approach to labor efficiency, as the journey toward improved operations is a diverse and intricate one, and as such, is not solely a process. Lean management can be applied to any kind of activity and once this methodology is implemented, a new and goal-oriented kind of work will begin (Drew, McCallum, & Roggenhofer, 2004).

Womack and Jones (2003) define Lean management as a methodology where the intention is to minimize clients' time and effort by satisfying their needs and wishes, but at the same time, increasing the company's value by preventing waste.

Mark Graban (2012) defines Lean management as a concept, methodology, and tool that is used to create and return as much value to customers as possible. The goal of this methodology is to prevent waste, and at the same time to utilize all the knowledge and skills that the employees possess (Graban, 2012).

Taiichi Ohno defines Lean management as a methodology where the focus is on the time axis from the moment that the client places an order until the product and/or service has been paid for. The purpose of Lean management is to shorten the time axis by preventing all waste that takes place while handling the product and/or service (Garban, 2012).

The preceding definitions of Lean management involve increasing value for the customer at a minimum cost. In order to achieve these goals, companies and institutions must realize that the flow of the products and/or service must be increased throughout the whole value chain. From start to finish, all waste that occurs during the process must be prevented—it is not enough to simply eliminate waste in isolated areas. It is, therefore, important to create processes that require less manpower, less space, less money, are less likely to cause mistakes or flaws, and require less time spent on products and/or service (Lean Enterprise Institute, e.d. –a). There is no one right way to implement Lean management (Liker & Meir, 2006).

The Implementation of Lean Management

When starting to implement Lean management, it is important to realize that there is no one right way to do it. Every company or institution that decides to implement Lean management methodology has its own starting point for the journey, and its own goal for the implementation (Garban, 2012).

It is important not to plan too much at the beginning of the implementation, but rather to set a limited, but clear and well-defined set of objectives. Doing so increases the probability of a successful implementation. The purpose of setting limited but well-defined objectives is that it makes it easier for people to learn from their experience and gain more perspective—to determine what works each time, and what does not. The organization is important right from the start and the same applies to experience and execution, in which respects each company and institution are uniquely positioned. As has been said previously, however, there is no one right way to implement Lean (Garban, 2012).

Experience has shown that it is not effective to introduce Lean management within a company or institution as a whole. Rather, it is thought to be better to divide the company or institution into smaller units or departments. In this way, it is possible to support the implementation, provide the right instruction and training for employees and has follow-ups (Garban, 2012).

Preparations for the implementation of Lean management are made in five-set phases, as described in Image 1. These phases are: define, measure, analyze, improve and control (Breyfogle III, 2008).

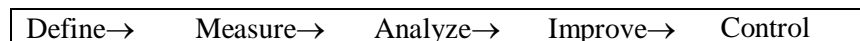


Image 1–The process of implementing Lean management (Breyfogle III, 2008)

According to Breyfogle III (2008), each phase has a definite purpose and value in the implementation.

Define: *At the start of implementation, a specific project group that will take part in the implementation and that will receive training in Lean management methodology is designated. Implementation can be said, to begin with, the designation of this group. The company's situation is evaluated in terms of production, management, values, attitude, and behavior. When the implementation begins, it is important that everyone involved in the project is well informed, irrespective of whether it is a single department or a whole company in question. This applies to all staff members, both managers and general employees (Breyfogle III, 2008).*

Measure: *Once a project group has been established and all staff have been informed, the work site itself is visited so that it is possible to observe how things are done there. Waste sources, inconsistencies, and instabilities in work processes are identified. The major phases of the project are then defined with reference to this findings and the data that needs to be obtained is determined (Breyfogle III, 2008).*

Analyze: *In the analysis phase, the causes of wastage and instability are examined, following which, the company's policy is defined. Performance indicators are worked out for the company and the staff has formal discussions about what they believe can be improved. Efforts are made to immediately address those issues that can be solved easily, such as the improvement of working conditions or the flow of communication among staff members. In Lean management, a significant emphasis is placed on every staff member taking part in the work—*

not just managers. In this way, the general staff is involved in the creation of company's future policy. (Breyfogle III, 2008).

Improve: In the improvement phase, the company's future vision is introduced to, and defined for, all of its staff. Following this, instruction and training in Lean management methodology are organized (Breyfogle III, 2008).

Control: In the last phase—that is, the control phase—the focus is on supporting the company's executives. There is a follow-up on new work processes and special care is taken to ensure that there is continuous progress being made so that the company doesn't stagnate (Breyfogle III, 2008).

Eight Types of Waste

As outlined above, Lean management deals with the prevention of all waste, while simultaneously creating and delivering as much value for customers as possible (Graban, 2012). Waste can be defined as anything that increases cost but does not deliver increased value at the same time (Drew, McCallum, & Roggenhofer, 2004).

Car manufacturer Toyota originally identified seven types of waste: *defect, overproduction, transportation, waiting, inventory, motion, and over processing*, but the theoretician Liker (2004) added an eighth type, which concerns the underutilization of staff knowledge and skills (*human potential*). Each type of waste has a set definition:

Defect: Defect refers to when something needs to be repeated because it was not successful the first time. Time has then been wasted on doing something wrong, meaning that the relevant person needs to start by finding the fault, correcting it and then repeating the process or action again (Graban, 2012).

Overproduction: Overproduction occurs when more is produced than the customer wanted, and/or when production takes place too early and the products cannot be used (Graban, 2012). In order to prevent overproduction, the production quality must be improved every time (Drew, McCallum, & Roggenhofer, 2004).

Transportation: Transportation refers to when a product (patient, sample, or material) is transported unnecessarily. This happens when work sites are badly defined, for instance, if a patient has to be transferred from Area A to Area B before it is possible to transfer him to Terminal C. In order to improve the process, Area B should be eliminated so that the patient may be transferred directly from A to C (Drew, McCallum, & Roggenhofer, 2004; Graban, 2012).

Waiting: Waiting is defined as the time when the staff is inactive and/or when equipment is not in use. While the staff is waiting, the value is not being created and an unnecessary delay is created. This wait can, for instance, be caused by a delay in the delivery of raw material, technical breakdowns with equipment, poor planning regarding the utilization of work areas or faulty equipment. It is important that work processes be continuous and that equipment is in working order to prevent all waiting (Drew, McCallum, & Roggenhofer, 2004; Graban, 2012).

Inventory: A great deal of expense is involved each time that products are stocked, in addition to the fact that there may be limited space available for inventory. Products or items placed in inventory when production has been completed, but the customer has not requested delivery at the time in question. When a great deal of inventory has accumulated, products may need to be disposed of, for instance, expired pharmaceuticals. The reason that overproduction occurs is that production batches are too large and, as such, the company ends up with leftover stock. Better control of production batches must be ensured in order to prevent accumulation of inventory (Drew, McCallum, & Roggenhofer, 2004; Graban, 2012).

Motion: Unnecessary movement of manpower or raw material within the work process causes waste. Unnecessary motion can, for instance, be caused by a poor organization of a work site, which necessitates staff looking for equipment/tools, or walking long distances between areas in order to do their work. The work site needs to be better organized in order to reduce the unnecessary movement of staff, particularly regarding the distance between work areas, organization, and access to equipment or tools (Drew, McCallum, & Roggenhofer, 2004; Graban, 2012).

Over processing: Over processing, is work that is performed, but does not pay off economically. This involves, for instance, handling raw materials prior to production or unnecessary quality control. In order to prevent overproduction, work processes must be thoroughly reviewed and the factors that cause over processing eliminated (Drew, McCallum, & Roggenhofer, 2004; Graban, 2012).

Unused knowledge and human potential: Staff often possesses a great deal of knowledge and experience. It is generally possible to take advantage of their knowledge and experience to resolve issues. It is, therefore,

important to listen to the staff, to allow them to present ideas for improvements and to be encouraging (Grabau, 2012).

Lean management can be supported by the implementation of specific tools that go hand in hand with the methodology, such as Kaizen, 5S, value chain mapping, visible management and more. Though there is more at work behind Lean management than just these tools, they are nevertheless helpful (Grabau, 2012).

Change management as part of Lean management

Change management is a wide-ranging concept that deals with approaches to transforming existing situations into new and different ones. New situations not only affect the behavior and attitudes of the whole organization but also of individuals and groups. Change management is a method and methodology that involves managing the introduction of changes and, as a result, achieving the best imaginable results successfully as possible (Kreitner, 2008).

The way in which organizations develop has an effect on company culture and therefore, the staff must be assisted in coordinating both their work within the organizational whole, as well as their treatment of one another. Change management makes use of methods and approaches that deal with the behavior of individuals and relies on methods used in the fields of psychology, sociology, educational science, and management theory in order to accomplish its objectives. The primary objective is to strengthen staff relationships, increasing trust, communication, cooperation, and support. Furthermore, an effort is made to improve the staff's understanding of the organizational whole and its objective and to better explain the future vision. It is also important to encourage staff to seek solutions to any problems that may arise, to increase staff knowledge and ability, and to improve workplace morale (Kreitner, 2008).

One of the foremost pioneers of change management was the psychologist Kurt Lewin. His primary goal was to find solutions that would improve the human side of organizations. According to Lewin, the change process is a fixed learning process. Both individuals and groups need to have the opportunity to make sense of changes that have been announced and the effects that they will have on people personally. It is important that people receive pertinent information about the necessity of the changes, as when people are thus informed, they have the chance to make sense of their own situations and to develop pertinent solutions (Hayes, 2002).

Lewin's key initiative in regards to changes within organizations was the formulation of his so-called Freeze Phases Change Model. The change model is a three-phase model that deals with how to successfully manage changes and policy through the behavior of individuals and groups (Burnes, 2004). The first phase *unfreezes*, the second phase is *change* and the third is *afreeze*. Each phase has a specific purpose. In the first phase, the groundwork is laid for the coming changes. The purpose of the changes is explained to the staff and an understanding is reached regarding their necessity. The better an understanding there is regarding the necessity of changes, the more motivation there will be to make the changes work. In the second phase, the changes are executed. It is in this phase that supports in the form of instruction and training for the staff is most important. The staff must have time to become informed about the changes, gain a definitive understanding of their purpose, and get accustomed to working with the changes. Mistakes should be expected during this phase. In the third and final phase, stability is realized in the wake of the implemented changes. The changes become a part of the staff's daily work and then they become routine (Burnes, 2004).

One of the things that Lewin (1951) investigated was the behavior of individuals and groups and it was his conclusion that it is easier to change the behavior of a group of people than the behavior of an individual. What the group has above and beyond the individual are group dynamics: a single group can contain many different individuals who collectively, may have comparable or similar attitudes (Hellriegel & Slocum, 2004).

Another well-known theoretician in the field of change management is John P. Kotter (1996), who is best known for his eight-phase process for successful change management. Introducing changes in such a way that they will be successful and that the organizational whole will achieve its goals are the biggest challenges that executives face today. Kotter believes that in order for changes to be successful, it is necessary to go through all eight of the phases. If this is not done, there is a danger that problems may arise. According to Kotter (1996), the eight phases are as follows:

1. Establishing a sense of urgency
2. Creating the guiding coalition
3. Developing a vision and strategy
4. Communicating the change vision
5. Empowering employees for broad-based action
6. Generating short-term wins
7. Consolidating gains and producing more change
8. Anchoring new approaches in the culture

Processing, Data Analysis, and Discussion

It is a big step for an institution like Landspítali to begin the implementation of Lean management methodology. The implementation calls for the various changes among executives and employees. Employees' institution, culture, and attitudes must be changed. At the start of this study, the researchers believed that several questions regarding the implementation of Lean management were of particular importance. The purpose of the study is to examine the attitudes of hospital executives toward Lean management at Landspítali, where the implementation of Lean management began in 2011. Answers are sought to the following research questions: Are Landspítali executives familiar with Lean management methodology? Do Landspítali executives feel that they have received adequate instruction and training in Lean management methodology? Are Landspítali executives of the opinion that the implementation of Lean management methodology is yielding results?

In order to get a good sense of the answers, the principal findings have been summarized in Table 1, although these findings will also be discussed in detail below.

Question	Yes	No
Did you know that Lean Management involves increasing patient safety, improving service quality, developing work systems and reducing waste?	100%	0%
Have you received instruction on Lean management?	91%	9%
Have you had training in Lean management?	25%	75%
Have you taken part in improvement initiatives that applied Lean management methodology?	73%	28%
Do you think the application of Lean management has yielded demonstrable results?	85%	15%
Have you received information about results that can be credited to the implementation of Lean management?	71%	9%
Do you think the changes that have been made using Lean management methodology will become better established in time than ones that were made before?	83%	17%

Table1 – Principal Findings

Of the 83 Landspítali executives who responded to the study, all of them claimed to know about Lean management methodology. 56 of 82 respondents, or 68.3%, claimed to know quite a lot or a lot about Lean management methodology. According to change management theory, it is important that staff members be well

informed about changes and their purpose. In their work, leading change management scholars Kotter (1996) and Lewin (1951) both mention how important it is that the staff comes to an understanding about the purpose of changes.

The findings show that 71 of 78 respondents, or 91%, have received instruction on Lean management, but only 21 of 83 respondents, or 25%, say that they've received training in the methodology. From these findings, can be concluded that the institution has done a good job of introducing Lean management methodology to its executives, but the focus must be placed on more practical training in the methodology so that executives can use it in their daily work. In spite of the fact that 25% of respondents have received training in Lean, 58 out of 80, or 73%, claim to have taken part in improvement initiatives that applied Lean management methodology. At the same time, the findings show that executives do not believe that participation in improvement initiatives constitutes sufficient practical training in Lean management methodology. The manner in which Lean methodology is implemented depends on the company or institution. Based on these findings, the researchers believe that executives' practical training needs to improve in order for the implementation to start yielding better results.

It is often said that organizations shouldn't plan too much at the start of implementation, but rather set themselves very clear and well-defined objectives (Grabau, 2012). One idea about how to improve practical training is that each executive would undertake one improvement initiative within his or her organizational whole which would make use of the tools of Lean management. This way, the training would be much more individualized: executive would see for himself or herself what changes were brought about through the use of Lean management in their own organizational. Researchers believe that the impetus to use the methodology would increase with executives who undertook such a project. In addition, researchers believe that general staff within the organizational whole who see and understand the changes being made are more likely to have positive attitudes toward them, as opposed to when executives force changes without the staff's understanding. According to principals of Womack and Jones (1996), it is important that all staff—not just the executives—take part in the work. In this way, it is possible to take advantage of the knowledge and abilities of the staff members within the organizational whole.

The study shows that 46.3% of respondents very much agreed or mostly agreed that they have received adequate training or instruction. It's clear that practical training must improve, but nevertheless, it seems that executives are satisfied with the instruction that Landspítali offers. The researchers come to this conclusion based on the finding that 91% of respondents say they have received instruction in Lean management, but only 25% say that they have received training.

Based on the findings of the questions related to training and instruction, researchers believe that Landspítali is making progress with the implementation of Lean management methodology. It is the researchers' assessment, however, that it would benefit Landspítali to have better follow-ups on their instruction. For example, shortly after executives had sat through a briefing about Lean management methodology, another meeting would be held which reinforced that instruction. After this, it would be ideal for the executives to undertake one project within their organizational which applied the tools of Lean management and to have a consultant to assist them.

According to Breyfogle III (2008), it is important to go through each implementation phase of Lean management methodology. Researchers believe that Landspítali has done a good job of going through each, discrete phase, but there could be more emphasis on the last phase, control. In that phase, the focus is on supporting the company's executives and follow-ups on new work processes begin in order to ensure that continual progress is being made. Researchers have come to this conclusion based on the finding that there is a lack of support for executives, who appear to be insecure about starting to use the methodology if their training has been inadequate.

The researchers have two recommendations about how to improve training. The first involves repeating instruction about Lean management methodology for executives as quickly as possible after it is first introduced. More weight should be placed on more individualized training, with the goal that executives should observe changes within their own organizational whole with support. Secondly, the consultant—who is either an employee of Landspítali or an outside consultant—should be on hand for executives in case the need arises.

Are Landspítali executives of the opinion that the implementation of Lean management methodology is yielding results? What comes to light when the executives' answers are examined is that they believe that the implementation of Lean management methodology is yielding results. This is based on the reasoning that more than half of the executives are generally more satisfied with their work after implementation has begun and 87.5% believe that the Lean management working methods will become better established in time and yield better working methods, or 83% of executives.

The researchers come to this conclusion this based on Landspítali executives' answers that they are satisfied with the implementation and believe that it is a methodology that has come to stay and not just a trend, especially where the advantages of the effort are visible. This corresponds with the work of Kotter (1996) and Lewin (1951), where it is stated that it is important to inform executives and staff members about the results that have arisen from the changes. What comes forth in this study is that executives are informed about the results, whereas 71 out of 80, or 89%, say that they have received information about the results while also getting a pat on the back and that they see the result of the effort. This reinforces their belief that they are doing well with their unit and simultaneously spur their staff into more action.

It is gratifying for the researchers to see all the varied and objective answers that the Landspítali executives gave to the questions and in the open questions. The researchers believe that this indicates that executives generally feel positive toward the implementation and the methodology, although it is always possible to do better. The researchers believe, however, that it is important not to over-interpret the findings and conclusions, and moreover, that they should be sent to other institutions or companies because of the findings of the present study are contingent upon the executives of one institution.

Conclusion

The goal of this article was to present the findings of a study on the attitudes of Landspítali executives toward Lean management and to answer the following research questions:

Are Landspítali executives familiar with Lean management methodology?

Based on the answers, it is deemed clear that all Landspítali executives are familiar with Lean management methodology. Based on the theories of both Lean management and change management, it is important to have a clear future vision. It is also important that the staff is well-informed about the purpose of the changes or, in the case of the Landspítali implementation.

Do Landspítali executives feel that they have received adequate instruction and training in Lean management methodology?

According to the findings, executives believe that they have received adequate instruction but not adequate training. Consequently, training must improve considerably and Landspítali needs to look for a way to accomplish this goal. Landspítali is encouraged to improve training and provide support for executives, the majority of whom believe there is a need for changes in their workplace. With improved training and support, executives would be better able to undertake the implementation and changes in their organizational.

Are the executives of the opinion that the implementation of Lean management methodology is yielding results?

In examining the executives' answers, the researchers conclude that they believe that the implementation of Lean management methodology is yielding results. This is based on the reasoning that more than half of the executives are generally more satisfied in their jobs following the start of implementation, that 87.5% believe that the work methods of Lean management will become established in time and because 83% of executives believe that those changes that have already been made using Lean management methodology will become established in time. Based on these findings, it is clear that the implementation is yielding results.

References

- Bluman, A. G. (2007). *Elementary Statistics; A step by step approach* (7thed.). New York: McGraw - Hill.
- Breyfogle III, F. W. (2008). *Integrated enterprise excellence - The Basics*(B. I). Austin, Texas: Bridgeway Books.
- Buchana, D., & Huczynski, A. (2001). *Organizational Behaviour* (4thed.). London: Prentice Hall.
- Burnes, B. (2004). Kurt Lewin and the Planned Approach to Change: A Re-appraisal. *Journal of Management Studies*, 41, 977-1002.
- Drew, J., McCallum, B., & Roggenhofer, S. (2004). *Journey to lean: Making operational change stick*. New York: Palgrave Macmillan.
- Graban, M. (2012). *Lean hospitals: improving quality, patient safety and employee engagement* (Second Edition). New York: CRC Press.
- Hayes, J. (2002). *The Theory and Practice of Change Management* (2ndedition). New York: Palgrave.
- Hellriegel, D., & Slocum, J. W. (2004). *Organizational behavior*. Ohio: South-Western: Thomson Learning.
- Herold, D. M., & Fedor, D. B. (2008). *Change The Way you Lead Change: Leadership strategies that really work*. Palo Alto: Standford University Press.
- Hiatt, J. M., & Creasey, T. J. (2003). *Change Management: The People Side of Change*. Loveland: Prosci Research.
- Kreitner, R. (2008). *Management* (11thed.). New York: Houghton Mifflin Company.
- Landspítali Háskólasjúkrahús. (2009). *Ábyrgðarsvið stjórnenda á Landspítala*. Retrieved from: <http://www.landspitali.is/lisalib/getfile.aspx?itemid=23467>
- Landspítali Háskólasjúkrahús. (2013). *Skilvirkir verkferlar með Lean Healthcare, vegvísir 2013-2016*. Retrieved from: http://www.landspitali.is/library/Sameiginlegar-skrar/Gagnasafn/Skrifstofur/Skrifstofa-forstjora/i-fostudagspistlum/Landsp%C3%ADtali_Lean_vegvísir_2013-2016_nov_2013.pdf
- Lean Enterprise Institute (e.d. -a). *Brief History of Lean*. Retrieved from: <http://www.lean.org/WhatsLean/History.cfm>
- Liker, J. K. (2004). *The Toyota Way*. New York: The McGraw-Hill.
- Liker, J. K., & Meir, D. (2006). *The Toyota Way Fieldbook*. New York: McGraw-Hill.

Personal Communications

- Guðrún Björg Sigurbjörnsdóttir, Director, Landspítali Project Office. (2015). Implementation of Lean management. February 19, 2015.