IMPLEMENTATION OF LEAN MANAGEMENT IN AN AIRLINE CABIN, A WORLD FIRST EXECUTION?

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SAMANTEKT

Þessi rannsókn tók fyrir innleiðingu straumlínustjórnununar í farþegarými Icelandair, sem er í fyrsta sinn sem flugfélag fer þessa leið í straumlínustjórnun. Í rannsókninni var kannað hlutverk og markmið með beitingu straumlínustjórnunar í flugumhverfi. Í rannsókninni var kannað hvernig Icelandair notar straumlínustjórnun til að draga úr sóun og auka ávinning farþega sinna sem og flugfreyja og flugþjóna. Gerð var eigindleg rannsókn með þeim sem verkefnið snerti á einn eða annan hátt sem og hagsmunaaðilum innan Icelandair, þar sem farið var yfir það sem vel gekk og annað sem betur mátti fara. Einnig var stuðst við megindlega rannsókn sem og mælingar sem gerðar voru á vettvangi. Út frá því voru ályktanir dregnar um framkvæmd straumlínustjórnunar í farþegaflugi.

Lykilorð: straumlínustjórnun, flugfélög, minnkun sóunar, auka ávinning

ABSTRACT

This research focuses on introduction of lean management into the cabin environment of an aircraft. It is based on a case study of a lean implementation project that was pioneered by Icelandair, which is Iceland's largest airline. The research examines the background and objectives of a lean-oriented project in the context of the very specific challenges and opportunities of cabin management in the airline environment. The paper examines how Icelandair uses lean management to reduce waste and increase benefits of their passengers as well as flight attendants. The paper uses qualitative research with project members and stakeholders within Icelandair to critically evaluate the nature of project success. It also uses quantitate research and measurements done on site. From that that conclusions are drawn about the execution of lean project management in the airline industry.

Keywords: lean management, airline, waste reduction, increasing benefits

1. INTRODUCTION

Lean management is a process improvement methodology built on Toyota Production System (TPS) that focuses on reducing waste and increasing benefits. According to lean management there are eight categories that non-value added waste can fall into. These categories are: overproduction, waiting, unnecessary transport, over processing, excess inventory, unnecessary movement, defects and unused employee creativity.

Icelandair, which is the largest airline in Iceland as well as being the largest privately owned company in the country, decided to implement lean management in 2008. Their pilot project was to introduce lean management to Icelandair Technical Services (ITS). That division of the company is responsible for maintenance and repairing of Icelandair's aircraft fleet. This lean management implementation was a big success, and resulted in reducing the time it took to change an engine in an airplane from twenty hours to eight hours. In the following years, lean management specialist was hired full time within that division to lead more improvements. Based on the success of lean management implementation within the ITS division, the company begun seeking opportunities to replicate that success by introducing lean management into other parts of their operation, including the office environment as well as the aircraft cabin, which is the first known lean management implementation example of its kind.

In an aircraft, the part where passengers sit is called a 'cabin'. Therefore the employees working there are called 'cabin crew'. But even though the main purpose of them being on board, is to perform security and safety related matters, such as helping everyone finding their way out in an emergency and assisting those in need, the part that takes most of their time is servicing their passengers. That means rolling a trolley through the cabin and supplying people with drinks and food. The front of the cabin, closer to the flight deck, is where the business class is. But where the two economy classes are, is called the 'aft cabin'.

A cabin in an aircraft is a place where everything has its place, where all spaces are used to their fullest, and the cabin crew and the airline have streamlined their work methods. In such work environment one could wonder if there is room for improvement. However there are many things in the work environment of a cabin that can cause waste due to how unstable it is. On each flight cabin crew works with different people, do not know what kind of passenger to expect, and are subject to unpredictable weather conditions.

The business model of Icelandair is that there are three classes in the cabin; economy class, economy comfort and business class. Icelandair has always made a priority to serve children well, through the years they have all gotten special service where they all get a package from the airline. Before, this service was all provided after take-off, which meant that the children didn't receive entertainment early enough. Previously that meant many visits to each child; one visit with a coloring book and colors, another with free headphones, third with a blanket, fourth with a free children's meal.

After a workshop with the cabin crew and inflight office the projects were prioritized in that way that Icelandair decided to implement lean management only to two economy classes. Three cabin crew members executed this part of the service. They work in the phase 'Work to meet', which means that one trolley, with two cabin crew members, starts in the front by the curtain that separates business class from the rest, and works their way towards the back of the cabin. The third cabin crew member starts with a separate trolley in the back of the cabin and works his way towards the front, until the two trolleys meet.

In 2014, Icelandair's route combined 38 destinations, 26 in Europe and 12 in Northern-America. After the kaizen workshops, projects were prioritized in that

way that in the first phase, lean management in the cabin was implemented on European routes only, and a few months later it was implemented on Northern-America routes. Cabin crew member's work on all routes that are randomly assigned to their work schedule. All the aircrafts are Boeing 757, although the kitchens may differ between aircrafts, and that of course helps a lot on implementing lean in the cabin, since the cabin crew only need to be trained for one type of aircraft.

The lean cabin project started early in 2014. It was led by an external advisor that came and taught those that would manage the implementation about lean management at the office about the benefits the cabin could gain from lean management. Then project managers, from human resources and inflight department, were assigned as leaders of the project that was intended to carry the torch onwards and implement lean management into the cabin environment of the aircrafts. Lean management was only implemented in the aft cabin of the aircraft which is why this research is limited to the two economy classes and does not explore the business class environment.

2. LITERATURE REVIEW

This research sheds a light on how those tools and methods were used in the lean cabin implementation.

What is lean?

Lean management has many names e.g. lean thinking, and continuous improvement. This research uses lean management for all terms. Lean management has its origins in the Toyota Production System, often called TPS, where eliminating waste is one of the key essentials. TPS identifies seven different types of waste and later the eighth was added. Those are: Overproduction, waiting, unnecessary transport or conveyance, over processing or incorrect processing, excess inventory, unnecessary movement, defects and unused employee creativity. (Liker, 2004)

The assumption of TPS is that teamwork is the foundation of the organization, each worker will do their best to make the company successful. Originally TPS was called 'respect for humanity system' because the main input was to challenge and respect the employees at the same time. (Liker, 2004)

When eliminating waste, reducing cost, making better use of the resources and deliver better customer value can be done at the same time. (Abdi, Shavarini, & Hoseini, 2006)

The phrases lean working, lean and leanness can also be described as doing more with less or improved utilization of the organization's resources. (Abdi, Shavarini, & Hoseini, 2006)

When an organization wants to implement lean management there has to be a sense of urgency, pull together the guiding team, and develop the change vision and strategy. Communicate for understanding and buy in. Old ways are not working and we need something new. (Lankinen, 2015)

Shigeo Shingo, the world's leading expert on manufacturing practices and the TPS, said that there are four purposes of improvement: easier, better, faster, and cheaper. These four goals appear in the order of priority. (Hamilton, 2015)

Tools of lean

Lean management has a toolbox. When implementing lean management, different tools work for different organizations and different department or situations. Therefore one needs to pick and choose what will have the most impact with the least amount of effort. In this research we focus on four tools that were the key tools used in implementation of lean management in the cabin project; the 5 S's, gemba, kaizen and value-stream mapping.

A lean management approach is about giving employees, the skills and shared means of thinking, to reduce waste and design a better way of working improving connections and easing flows within the supply chains. It is not to apply a collection of tools mechanically to problems or implement Japanese philosophy. (Abdi, Shavarini, & Hoseini, 2006)

Lean tool: 5S

The 5 S's are also a contribution of TPS to lean management. The idea is that if everything has its place, everything is in order, not too much of materials one doesn't use much and just enough of what one does use. Then the worker can work faster since they don't have to start looking for their things, clean them and use them. They can just grab the item they want, use it and put it back. The 5 S's translate to:

- Sort: sort, keep what you need while losing what you don't need.
- Straighten: everything has its place and is put there after use.
- Shine: cleanliness, having everything clean can help workers see quality issues sooner.
- Standardize: have rules, standards and a system to keep everything sorted, straightened and shined.
- Sustain: maintaining the new situation, continuous improvement. (Liker, 2004)

Sustain is a big part of lean management but some lean management leaders' say that sustain is not an option, though plateau is better than the starting position the mind-set has to be to accelerate. (Hamilton, 2015) Standardization is not freezing the situation in 'as-is'-mode. The process must be standardized and stabilized before continuous improvement can be made. This is the way zero defects are ensured. If there is a defect the first thing to check is whether the standardized work was followed. (Liker, 2004)

Lean tool: Gemba

One of the core tools of lean management is the genchi gembutsu, the more common phrase is gemba. The main idea of gemba is for the managers to go and see the actual situation for understanding.
There are many ways to do the gemba, but those doing the gemba walk should always be respectful, ask why, see for themselves, and ask how they can support the process. (Liker, 2004)

The purpose of a gemba walk is:

- To see how they do their work.
- Ask open questions about their work.
- Be open minded.
- Be respectful.
- But at the same time asking them if they already are or could do their jobs in a simpler way or quicker with fewer steps.
- See and ask how management can support them in that process (Liker, 2004) (Womack & Jones, 2003) (Modig & Åhlström, 2012).

Gemba walk is not something management does only once. They have to do it at a regular basis, this has to be a part of their job description, and it has to be a part of the culture of the company. That will show the employees that the management is interested in helping the employees and that will help sustain the process. (Liker, 2004)

It is important to talk to everybody, everybody has their burdens, and this is how to develop trust. Then keep in mind many small changes for the better. Emphasize many one-time one-off changes and do not focus on batching improvement. Celebrate the learning. Even thank people for making the mistakes since then they also found a solution. Make sure your facilitator is credible, no snobs or geniuses. (Hamilton, 2015)

Lean tool: Value stream mapping

Resource efficiency is the traditional form of efficiency and it means that resources are utilized to their fullest or as much as possible. For over 200 years industrial development has been built around increasing the utilization of resources. This has led to economics of scale, grouping smaller tasks together so that individual parts of organizations can perform the same tasks over and over again to increase resource efficiency and the purpose is to lower unit costs. Lean management would be on the other end of that thinking which would be not focusing on unit cost or high utilization of resources. Flow efficiency is created through an organization's processes. To understand how flow efficiency works it is necessary to understand how organizational processes work. Flow efficiency is to map out the process and see where the process is value-added for the customer and where it is non-value-added. The project is then to eliminate all the non-value-added waste, making the process lean, to the benefit of the customer. (Modig & Åhlström, 2012)

Value stream mapping is another important tool of lean management. The main idea behind the value stream mapping is to see the process 'as-is', not how it should be. To map out current situation, see where and how the process can be improved. Where is the waste e.g. waiting and unnecessary movement. Then a new value stream mapping is drawn with the wishful situation. Then improvement opportunities can be caught and you have a starting point. (Womack & Jones, 2003) (Liker, 2004)

In Toyota activities, connections, and production flows are stiff and scripted, everything is constantly being challenged and therefore it constantly gets more advanced in benefit for the company as a whole. Organizations have to be flexible and adaptable (Spear & Bowen, 1999)

Lean tool: Kaizen

Kaizen means continuous improvement and the main purpose of it is to make gradual improvements, small or big, as long as they are done to eliminate non-value added waste. (Liker, 2004)

Kaizen workshop is something that is used in lean management, to determine who the customer is, analyze current state, develop future state vision, implementation and evaluate; measuring performance. (Liker, 2004)

Kaizen workshops are widely used phenomenon in lean management. That is a remarkable social invention that frees up a cross functional team to make changes in a week that otherwise could drag on for months. Selecting the right people is critical, as is getting the time set aside for those individuals and giving them a lot of management support. The session should start with a review of the scope of the process to be improved and a review of the objective with the team.

Some training is provided on basic lean management concept, especially of what is value-added and non-value added. (Liker, 2004)

Lean in aircrafts

When compared to a research from 2009 on lean implementation at FedEx it is clear that Icelandair's approach to implement lean management into the repair and maintenance part of the business first, is in line with what other airlines have been doing in recent years. (Bartholomeuw, 2009)

Although the business models of Icelandair and FedEx are different, their maintenance teams seem to work in a similar way. Both teams execute C-checks and scheduled maintenance but mainly perform unpredictable and unscheduled repairs and maintenance. (Bartholomeuw, 2009)

3. RESEARCH METHOD

A qualitative research study was conducted to approach the research questions. This study was built on interviews, a questionnaire and results from gemba visits. This approach was chosen because qualitative research is based on interviews that help to reach a deeper understanding of the participants' experience and viewpoints.

The type of interviews that were used in this research can be classified as a 'general interview guide approach'. This approach allows a lot of freedom while providing a certain focus, with the questions already formed (Turner, 2010). Not all the interviewees got the same questions because they had different insights on the topic.

The following seven people were selected for interview based on their involvement in the lean implementation process, and/or how their work had been impacted by it.

- External advisor for the implementation.
- Project manager within the organization who is responsible for supervising the overall implementation process.
- Four employees from cabin crew who fulfilled certain conditions that give different insights to the process.
    - One employee with a lot of experience of past continuous improvement projects.
    - One employee who was involved in the workgroups at the start of lean implementations.
    - One employee that was in the position of running the kitchen in the back during flights.
    - One employee who is a common cabin crew member who didn't participate in any workshops or didn't run the aft kitchen at any time.
- One passenger who has been traveling a lot both before the lean cabin project and after.

In addition to the interviews, this research is also based on data from a questionnaire that was conducted by project managers for implementation of lean management into the aircraft cabin in December 2014, where cabin crew was asked about their view on the lean cabin project. The questionnaire included five questions and one open question for new ideas. Those questions try to shed a light on how the cabin crew feel about the lean cabin project, if it has improved the work environment, which improvements were better than others and if the

cabin crew members would like to see the project continue. This data was also used in this research, since it gives a better idea from more people on their basic view of the project as a whole and how it has affected their life.

4. RESEARCH RESULTS

Both office workers of the inflight office and some cabin crew members went to kaizen workshops. The kaizen workshops included all processes in the cabin. From front to back. They mapped up the work-flow and made a value stream map for the 'as is' condition and created a 'should be' value stream map. Then projects were initiated to build a bridge in between. Finally, implementation was prioritized and the aft part of the cabin was the part that received the initial implementation.

The project managers of the lean cabin project, both external and internal, did some gemba walks, where they asked questions, brought their stopwatches and measured time duration of some of the tasks. They counted movements, walks and distances. They did many gemba walks both on the European routes and Northern America routes. The routes differ a little as the procedures of the cabin crew differ. There is a different menu and a different bar set-up, and therefore the assumptions made are not the same for the different routes. The first gemba walk on a European route was in February 2014 and the first Northern America gemba walk was in July 2014. The gemba walks were repeated again in December 2014 to re-measure everything. This was included in this research to see impact of the changes. What had changed and how much.

Doing the gemba walk the managers observed that the cabin crew visited each child approximately five times during each flight and always after take-off, the child often didn't have any entertainment for the first 20 minutes and then received both entertainment and food at the same time. This meant that the cabin crew member was looking for those items in at least five different places. Now a child receives a package on arrival on the aircraft, with the entertainment, blanket and headsets.

Previously a lot of time went to looking for the children's food, putting it into the oven and heat it, then finding the box it belonged to, rearrange everything in the box, since it all had moved during take-off, putting the warm meal (not always appropriate for the time of day, dinner-like food in the morning) and then deliver it. This process could take from 10 to 35 minutes. Now all meals are appropriate for the time of day, most meals are cold and ready in the box. The boxes are in the front of the meal trolley, since the process says children eat first. Now the process takes under a minute: opening the trolley, take out the box and deliver.

There are three types of cutlery. Regular, only spoon and finer cutlery for economy comfort passengers. Before the trolleys only had the regular ones, the spoons were in the food trolley and the finer cutlery was in the water trolley on European routes and in the headphones trolley in the front galley on Northern-America routes. Now, all cutlery is in one place on each side of the trolley, so no time goes into looking for the right cutlery. This is in the spirit of the 5 S.

Before, when no changes had been made to the trolley, the extra visits of the cabin crew to the kitchen were up to 55. On these extra visits they were getting merchandise that they had too little of, more food, single spoons. After they added an extra hot bag to keep warm food in, therefore each trolley had more warm food, all merchandize had been reevaluated according to sales figures, so that each trolley had more of popular merchandise and less off less popular. This is also in the spirit of 5 S.

The food carts are two, one for they flight from Iceland, the other for the flight to Iceland. Before they were always organized in whatever way that the flight attendant on duty wanted. Now it has been standardized in a way that is supporting the process, children's food in the front, since they always are the first ones to eat, food for the cabin crew in the back, since they never eat until the service is over. Then the drawers inside the trolley are color coded and standardized in a way that the cabin crew never has to take the trolley out to check the backside, it's all labeled on the front side. This is in the spirit of value stream mapping, that the order of things support the process.

The labelling was different every time before, depending on who was working in the catering department that day, sometimes even handwritten and hard to read. Now all the labels are standardized with the same color code as the drawers inside the food trolleys, making it easy to see on the label what is inside. This is the 5 S treatment.

Previously the catering department delivered the food trolleys to the aircraft according to how they thought it would be best, and therefore the trolleys varied depending on who prepared them. Now there are pictures hanging in the catering department showing how it should be organized and the process is now standardized and everything is easier for both the cabin crew and those working in the catering department.

Before there were two types of red wine and two types of white wine served. The trolley often didn't have the kind the customer wanted and therefore the cabin crew member had to go to the other trolley or the aft kitchen to look for the right type. Now there is only on type of each wine, and the new bottle is plastic and is 46% lighter than the same sized glass bottle. So this makes the trolley lighter and requires no extra visits to the aft kitchen since there is no choice, just one type. This is in the spirit of value stream mapping but also the 5 S.

During flights cabin crew members collect trash from passengers. Often the trash trolleys on board fill up and then they have big bags that they fill up and have to put in to the lavatory during landing since it has to be secured away from passengers and kitchens. After there are specially made trash bag frames in the trolleys that will be emptied during the flight. So when all trash trolleys are full, cabin crew have this solution, to use an empty trolley and this new trash bag frame and then the trash is secured in that trolley. This is an example of a good gemba visit, the management observes a problem and suggests a solution.

When those extra movements, visits, heating of food and other non-value-added wastes are taken into account, Icelandair believes that they are saving at least 40 minutes on each flight.

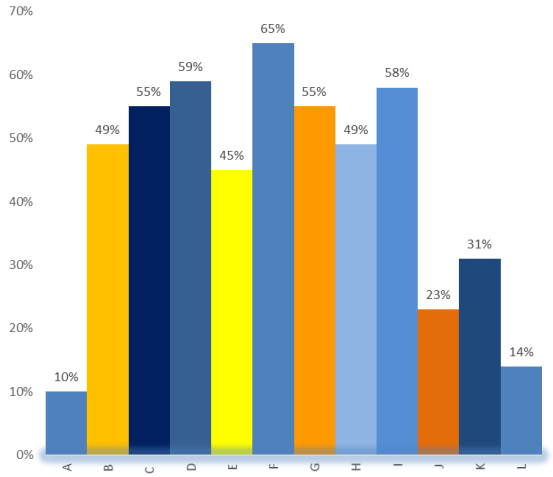
Table 1 Measurements from Gemba visits, before and after

	Before	**After**
Children's service	5 visits from cabin crew to child at the start of a flight	1 package per child when arriving to aircraft
Children's food preparation	10-35 min	1 min
Cutlery	4 different places	1 place in trolley
Merchandise	a lot of everything	more of popular, less of less popular
Extra visits cabin crew to kitchen	up to 55	12
Food cart	different every time	standardized, labelled and color coded
Labelling on board	different every time	standardized, numbered and color coded
Catering	different every time	pictures hung in work area, everyone delivers to aircraft according to pictures
Wine selection	2 types of each	1 type of each and plastic bottles, 46% lighter.
Trash problem	big bags of trash, put into WC before landing	table that is emptied throughout the flight, has a special built in trash bag

The questionnaire was sent out to all cabin crew members working in December. The answers in the questionnaire do echo many of the opinions expressed in the interviews as well as the results of the gemba walks that mirror many of the views expressed in interviews and in questionnaire findings.

Based on the survey results, all of the respondents claimed they had heard of the lean cabin project. Large majority of them, or nearly 90%, were satisfied with the changes that followed the project. Only 4% were dissatisfied, 6% were indifferent and 3% said they didn't know the project well enough. 87% of the respondents thought their work environment improved after the lean management improvement project started. 10% didn't think that it had improved and 3% said they didn't know it well enough. 92% said yes to the question if they would like to see the lean cabin project continue in 2015. 5% said no to that question and 3% said they didn't know the project well enough.

The fifth question was phrased like this: 'What improvements/changes have attracted the greatest pleasure for you?' each respondent could answer multiple possibilities.



	Answers
A	Easier preparing and deliverance of children's food
B	Re-evaluated children services
C	Re-evaluated and standardization of stock in bars
D	Standardized installation in food carts
E	Addition of information labels on board
F	Simplified process around sales computers logout
G	Simplified wine selection on board
H	Re-evaluated newspapers on board
I	Coordinated pickup times between cabin crew and flight deck
J	Hot water in a thermos flask on carts to be used to make porridge
K	AQD reports (reports done by senior cabin crew member about each flight.
L	Other improvements

5. DISCUSSION

Many cabin crew members expressed in the interviews that they would have wanted to know at the start what they now know about lean cabin. They didn't know from the start how it would impact their jobs and how much. If they had known then what they now see and know, they would have made more suggestions and been more inviting to e changes.

The cabin crew members said that phrase 'lean cabin' was in the air, and they had to guess in a way what that meant. The questionnaire showed that everyone had heard of the term 'lean cabin', but the interviews indicate that even though everyone had heard of it, it didn't mean that they knew what it was all about. Although that didn't affect the implementation since the cabin crew is used to ever changing environment. Those in charge of the implementation said they felt very welcomed in the gemba visits and that the cabin crew really understood that they were there to make their jobs easier. Those involved in the implementations talked about the process taking longer than they had initially expected and that only in the last couple of months did they notice the difference. Even though no timeframe was mentioned they thought that the time from the kaizen workshops and the gamba visits would show earlier, that some of the

results would come clear on an earlier point. The project manager said they knew that they wanted to go slow, and that the planning state was crucial. They knew that the corporate culture was to 'just do it', but they wanted to slow it down, plan to the end, and involve the cabin crew members, since it was their jobs and the core customer being affected.

The interviews with the cabin crew indicated that people are overall very pleased with the results. Some people thought that the results are first showing now, even though some of the first changes were made during the summer of 2014. These opinions echo the results from the questionnaire, most cabin crew members are pleased with the lean cabin project. The people in charge of the implementation wanted to move on a slower path and plan carefully but overall thought it went well considering how many employees and passengers, the core business, it affected.

In the interviews, the regular cabin crew member, the ones who didn't take part in a kaizen workshop or a gamba visit, expressed they didn't know what to expect or how they could make their opinions heard. They didn't know really what it was all about and asked others while working, where some employees seemed to know a lot and others were also guessing what it all meant. They said that they would have wanted more information from management on what is was, how it was going, what to expect and that everyone's opinions was appreciated.

Many interviewees expressed that their job was now easier, they didn't know why or how. They didn't expect so many small changes to impact so much. Looking at the results measured in the gemba walks, one can see that extra running to the kitchen, less places to look for cutlery, easier access to candy, less complexity in wine selection and lighter bottles and therefore lighter trolleys all amount to a significant time saving. One of the more fun side effects of changing the wine bottles to plastic is that they don't leak anymore and it is making the job even easier to not have that problem on a regular basis anymore. It is interesting to see that this is in line with the many one by one changes that Hamilton talked about, and no batching improvements.

The interviewees expressed the feeling of being heard. They would make a suggestion and for the most part within the month that particular improvement would have been implemented. Many small tweaks eventually building up to a big change. The one cabin crew member who had previous experience with other improvement work said that in the past only high level cabin crew members were involved in workshops and then they never really saw any changes as a result. At least not compared to how everything is changing now with lean management. This is also in line with the idea of that people doing the work are the specialist and the management need to listen to all individuals.

6. CONCLUSIONS

Based on the result on this implementation of lean management into an airline cabin, one can draw the conclusion that is has been a great success. In the spirit of lean management, where continuous improvement should always be the first thing in mind, there are some improvements that can be done.

To make this an even greater success story, Icelandair will implement a better way for the cabin crew to bring up their suggestions, and even provide an electronic process where employees could see if their suggestion has been approved and where in the implementation process it is at each time.

Icelandair, both organization as well as employees, could also benefit from a lean management course, to educate the employees about the basic concepts

of lean management, get them on board and encourage them to bring their ideas to the table, throughout their work. That could make the lifespan of the project longer and employees as well as managers engaged for a longer time and could get into the core of the company culture.

The author would suggest another research on how to sustain lean management in the cabin and how to accelerate the mindset of all of those involved.

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REFERENCES

Abdi, F., Shavarini, S. K., & Hoseini, S. M. (2006). Glean Lean: How to use lean approach in service industries? *Journal of Services Research*, 191-206.

Andrew, K. (20. March 2015). RBS lean transformation. Reykjavík, Iceland.

Bartholomeuw, D. (17. may 2009). *Lean Thinking in Aircraft Repair and Maintenance Takes Wing at FedEx Express*. Sótt frá www.lean.org: http://www.lean.org/common/display/?o=987

Hamilton, B. (12. march 2015). How to engage the entire workforce. Reykjavik, Iceland. Sótt 22. april 2015 frá http://leanisland.is/wp-content/uploads/2014/12/Bruce-GBMP.pdf

Koeningsberg, O., Muller, E., & Vilcassim, N. J. (2004). *easyJet Airlines: Small, Lean, and with Prices that Increase over Time.* London: Londin Business School.

Lankinen, P. (12. March 2015). Lean and CSI (Continual Service Improvemen) - Mission Impossible or Opportunity. Reykjavík, Reykjavík, Iceland. Sótt 23. april 2015 frá https://vimeo.com/124095145

Liker, J. K. (2004). *The Toyota Way.* Madison : McGraw-Hill.

Modig, N., & Åhlström, P. (2012). *This is Lean, resolving the efficiency paradox.* Stockholm: Rheologica publishing.

Spear, S., & Bowen, H. (1999). Decoding the DNA of the Toyota Production System. *Harvard Business Review*, 97-106.

Turner, D. W. (2010). Qualitative Interview Design: A Practical Guide for Novice Investigators. *The Qualitative Report 15(3)*, 754-760.

Womack, J. P., & Jones, D. T. (2003). *Lean Thinking, Banish Waste and Create Wealth in your Corporation.* New York: Free Press.