

48th CIRP Conference on MANUFACTURING SYSTEMS - CIRP CMS 2015

Lean Hospitality - Application of Lean Management methods in the hotel sector

Erwin Rauch^a, Andreas Damian^a, Philipp Holzner^{a*}, Dominik T. Matt^{ab}

^a Faculty of Science and Technology - Free University of Bozen-Bolzano, Universitätsplatz 5, 39100 Bolzano, Italy

^b Fraunhofer Italia Research s.c.a.r.l., Innovation Engineering Center (IEC), Schlachthofstrasse 57, 39100 Bozen, Italy

* Corresponding author. Tel.: +39-0471-017111; fax: +39 0471 017009. E-mail address: philipp.holzner@unibz.it

Abstract

The tourism businesses faces the challenge to reduce significantly their costs in the future and to structure internal processes more efficient. The hotel and tourism industry, which showed continuous growth in recent years, now looks ahead to economic turbulences and general difficult times. Given these developments, hotel companies will earn in the future less than before. This phenomenon has not been considered in tourism, while it exists since decades of years in the industrial sector. The industry applies successfully for many years modern methods and instruments to optimize productivity and efficiency and to increase the quality of services even further. These existing experiences to increase productivity in the industrial environment were taught for years as "Lean Management". This research aims to show practical experiences of the application of Lean Management methods in the hospitality sector and to make a statement about their suitability and the possible potential for optimization. The work refers to a case study in a hotel company, where several Lean methods have been implemented successfully.

© 2015 The Authors. Published by Elsevier B.V. This is an open access article under the CC BY-NC-ND license

(<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

Peer-review under responsibility of the scientific committee of 48th CIRP Conference on MANUFACTURING SYSTEMS - CIRP CMS 2015

Keywords: Lean Management, beyond Lean, Lean Hospitality

1. Introduction

The effects of the recent economic and financial crisis now has also reached the hospitality and tourism industry. The branch that until a few years ago was used to report continuous growth today has to deal with new challenges. For the great majority of the companies from these industries (especially hotels) nowadays turnover decreases and at the same time, costs increase. As a result, the profits are getting less or as the case may be posting losses becomes inevitable. There are several reasons underlying this phenomenon. First of all, the cost of labor, food and energy are still increasing with no end in sight. Secondly, also the tax burdens has a significant impact on a company's financial situation. Lastly, also the effect that is widely known as "loss of the center (or middle)" plays an important role in the current development since many companies of the branch lose their core-client-group. In order to counteract these developments, working in an efficient and effective way and to focus on the complete fulfilment of the customer needs becomes even more important. In other

markets, especially in the industry, these challenges has been successfully faced with Lean Management. Unfortunately, Lean approaches are not very popular in the hospitality sector. In the existing literature there are only few and not well documented examples for the implementation of Lean Management up to now. The objective of this work is to investigate the application of traditional Lean Management methods in the hospitality area and to make a statement about their suitability and the possible potential for optimization.

2. State of research and application of Lean Management in different sectors

In the context of Lean Management, "Lean" essentially means flexible, agile or light. Lean is a bundle of principles, methods and actions for the effective and efficient configuration and examination of the whole supply chain. Goal of Lean Management is to create value without producing waste ("muda"). Value is any action or process that a customer would be willing to pay for. Lean tools therefore help to

identify and to eliminate waste. As waste is eliminated, quality improves while production time and costs are reduced [1, 2].

2.1. State of the art in Lean Management

Principles of Lean Management

In the present literature exist various definitions regarding the main principles of Lean Management. One of the most widespread approach refers to the book “Lean Thinking” from Womack and Jones. According to the two authors the philosophy of Lean Management is based on five principles [3, 4, 5]:

1. **Specify value:** Specify value from the customers point of view.
2. **Identify and map the Value Stream:** Identify all the steps in the value stream for each product family eliminating whenever possible those steps that do not create value.
3. **Create flow:** Make the value-creating steps occur in tight sequence so that products will flow smoothly toward the customer.
4. **Respond to customer pull:** As flow is introduced, let customers pull value from the next upstream activity.
5. **Pursue Perfection:** As value is specified, value streams are identified, wasted steps are removed, and flow and pull are introduced, begin the process again and continue it until a state of perfection is reached in which perfect value is created with no waste.

Kaikaku vs Kaizen

The initiation, implementation and improvement of Lean Management in a company’s processes proceeds usually on an organizational and operational level [4, 6]:

Organizational Level: fundamental and radical changes (also “Kaikaku”: japanese for radical changes) during a limited time. Includes changes in peoples thinking and acting processes. These changes are no continuous changes.

Operational Level: on the operational level the focus lays on continuously improving processes, also called “Kaizen” (japanese for “good change”). These step-by-step improvements consists of Lean methods referred to the single processes in a company. The underlying ideology of Kaizen is that anything is perfect and everything can be improved.

2.2. Beyond Lean Manufacturing – application of Lean methods in different industries

Today Lean Management is applied in many different areas and belongs to the most important and most popular management technics at all. For instance, it is used in the administration, healthcare, construction, maintenance, product development and many more.

Lean Office

Lean Office refers to the application of Lean Management in a company’s administration, service and business process. Principally it is about to increase the transparency regarding the costs of these secondary processes, to manage and standardise better the organisations complexity and to make the administration process more efficient [7, 8].

Lean Healthcare

Since decades of years, the healthcare sector is faced with one big problem: the costs are too high. To reduce rising medical expenses based on expensive medication and increasing labor costs, Lean Management has found its way into the healthcare area. The main goals are: reduction of the process and waiting time for the patient, standardization and optimization of the interfaces between different divisions and wards, integration of IT-systems to avoid extra work, reduction of inventory and the reduction of patients length of stay [9].

Lean Construction

Lean Construction includes the planning, design and execution of construction projects. Thereby the focus is laid on the interfaces between the project planning and the project execution. The peculiarity of the construction area in comparison with the manufacturing industry is that companies have to manage with continually changing partners/suppliers and with the absence of permanent staff. To avoid long delays for the completion of the construction object it is essential that the parts and components as well as tasks are carried out in highest quality and within the prescribed time. Therefore flexible strategies and methods are needed to ensure a continuous flow of all processes and tasks at the construction site [10, 11].

Lean Management has shown that it is a very flexible and universally applicable management technique with highly customizable tools for many different areas. Because of this, the obvious consequence would be the application of Lean Management also in fields like the hospitality and tourism industry. Unfortunately, Lean approaches are not widely known in these areas up to now. In the existing literature there where only a few examples for the application of Lean Management in the hospitality area.

3. Examples of Lean Management in the hospitality and tourism sector

In the past, Lean Management has shown its applicability to the service or tertiary sector that includes also the hospitality and tourism area. Nonetheless, in todays literature there are only a few examples of companies that have implemented Lean Management in their organisational processes up to now. This may be caused by various factors. Surely, one of them is that Lean methods are used only partially in the single departments of an organization and therefore the overall approach is missing. Consequently, these applications are not attributed to Lean Management. Particularly worth mentioning is that when Lean Management is applied in the hospitality area this occurs mostly in combination with the management system Six Sigma.

Yukai Resort – Japan

The Yukai Resort in the famous Gero Onsen Hot spring area of Japan is part of a traditional Japanese hotel chain that performs Lean hotel operations in order to offer great value to their customers, to reduce costs and to remain competitive in the fierce hospitality industry. Thanks to Lean Management methods for the resort it is possible to offer to its guests the same standards and services as other hotels do, but for only half of the price regardless of high or low season. In the Yukai resort all resort duties are shared by all personnel. This has allowed the resort to operate with minimal staff and reduce overall costs while maintaining high quality. Dinner and breakfast are buffet style, which reduces staffing requirements. Staff are also active in Lean Management or Lean Kaizen efforts. The manager leads Kaizen circles weekly and monthly. The receptionists, in their free time will go to areas needing assistance, perhaps the kitchen or laundry [12].

Apex Hotels – UK

The laundry at Apex hotels is one of the hotels largest spends each month. The Lean team mapped out the end to end cycle involving the laundry process demonstrating how each morning the laundry service deliver clean linen to the hotel and take away the dirty linen to be laundered. Further analysis highlighted the non-value-adding activities of the process. By eliminating these tasks and restructuring processes, organisational structures and workforce planning, the Lean team was able to save about 5.728 man hours per annum. Applying Lean Methods not only lots of money can be saved, also the service for the guests and the working conditions for the hotel staff have improved significantly [13].

Towne Place Suites by Marriot Hotels – UK

One of the main goals of Lean Management is to maximize the customer benefit and at the same time to minimize the use of resources. This is what happened at the Town Place Suites by Marriot Hotels. After 5-days of workshop about the application and the effect of Lean principles, the customer and staff satisfaction has increased significantly. The key for this was:

- Nobody is negligible for the achievement of the goal
- The hotel's staff is the first customer
- More responsibility was assigned to employees.

In addition, Marriot's Hotel elaborated 12 principles to improve the customer service [14, 15].

Starwood Hotels

Starwood Hotels implemented Lean Six Sigma in 2001. As a result, the company realized some quick financial wins. Incremental revenue increased by 19% and overall spending's by customers, while staying at the properties, increased by nearly 12% in the few months after implementation. By centralizing the spa reservations group by utilizing tools of Six Sigma, Starwood claimed a revenue increase from 91 to 141 million pounds. Food production, due to its similarities to the manufacturing industry has had success on case-by-case basis in using Lean and Six Sigma principles [16].

4. Identification of suitable Lean methods for the hospitality sector

Today exist a lot of different methods and tools in the field of Lean Management. Due to the fact that Lean was born in the ambit of production, also the majority of its tools come from this area. Through adaptation over time, today they are applicable also in other fields and are no longer subjected to single industries. Nonetheless, not every method would be equally suitable for every section and process. Therefore, an adequate evaluation procedure has to occur to get a ranking with the most suitable Lean methods for the hospitality area.

4.1. Criteria definition

In order to get indications of which Lean methods are the most suitable for the hospitality field, the definition and weighting of appropriate assessment criteria is unavoidable. In this validation model, four criteria were defined and differently weighted.

Criteria 1 – Effort and costs for implementation: In practice, the cost of investment and the use of resources should be as low as possible to ensure a very short amortisation period. Also in this validation model, this criteria plays an important role.

Criteria 2 – Time to visibility: Criterion two focalises the short term visibility of positive effects regarding the practical application of the methods. Project failure is often caused by missing results in short terms. Therefore, also this factor should be taken into account.

Criteria 3 – Impact on KPIs: KPIs have a big influence on decisions taken by a company's management and help to decide on the continuation, extension, limitation or abortion of a project, investment or other strategic activities.

Criteria 4 – Sustainability of outcome and application: In comparison to criteria two, the focus is lead on the sustainable outcome and use of the method. One main goal of Lean-Thinking is the long-term benefit for the enterprise. Changes in the mindset of people cannot occur in few days, but it takes its time. Therefore, also this criteria should be affiliated in the validation model.

4.2. Evaluation of suitable Lean methods for the hospitality sector

As already mentioned the validation of the methods depend on their performance regarding the four defined assessment criteria. To ensure the adaptability of the validation model to the needs of various enterprises in the tourism industry, the single criteria can be weighted differently. In this research case the above-mentioned criteria where weighted together with the management of the case study hotel. To criterion three (Impact on KPIs) was given the biggest weight in order to recognize the fact that often KPIs are the main argument in taking strategic decisions.

Typ	Lean Management Method	Effort & costs	Time to visibility	Impact on KPIs	Sustainability
		20%	20%	20%	20%
Machinery and Equipment	Low Cost Intelligent Automation	●	●	●	●
	Overall Equipment Effectiveness (OEE)	●	●	●	●
	Setup Time Reduction	●	●	●	●
	Total Productive Maintenance (TPM)	●	●	●	●
	Single Minute Exchange of Die (SMED)	●	●	●	●
	Workplace ergonomics	●	●	●	●
Material flow and Layout	Cellular Manufacturing	●	●	●	●
	First In-First Out (FIFO)*	●	●	●	●
	One-Piece-Flow	●	●	●	●
	Simulation software	●	●	●	●
	Optimization of the supply chain	●	●	●	●
	Value Stream Mapping	●	●	●	●
	Work station design	●	●	●	●
	Process function diagram (PFD)	●	●	●	●
	Value Analysis	●	●	●	●
	Supermarket	●	●	●	●
	Pull	●	●	●	●
	ABC-Analysis/Paretodiagram*	●	●	●	●
	XYZ-Analysis*	●	●	●	●
Sankey-Diagram	●	●	●	●	
Organization and Staff	Benchmarking	●	●	●	●
	Ideas-Management*	●	●	●	●
	Job Rotation	●	●	●	●
	Kaizen (CIP-Workshops)*	●	●	●	●
	Communication rules & standards	●	●	●	●
	Gantt-Chart	●	●	●	●
Production planning and control	Lessons Learned Workshops	●	●	●	●
	Just-in-Sequence (JIS)	●	●	●	●
	Just-in-Time (JIT)	●	●	●	●
	Kanban	●	●	●	●
	Heijunka: Line Balancing	●	●	●	●
	Milkrun*	●	●	●	●
	PPS Simulation software	●	●	●	●
	Economic (optimal) lot size*	●	●	●	●
	Visual Management*	●	●	●	●
	Theory of Constraints	●	●	●	●
Quality	FMEA	●	●	●	●
	Poka Yoke*	●	●	●	●
	PDCA	●	●	●	●
	Quality Function Deployment	●	●	●	●
	Six-Sigma	●	●	●	●
	Statistical Process Control (SPC)	●	●	●	●
	Supplier Development	●	●	●	●
	Total Quality Management (TQM)	●	●	●	●
	Control Charts	●	●	●	●
	Dashboard	●	●	●	●
5S*	●	●	●	●	
* TOP-10 Lean methods in the hospitality area		○	●	●	●

Fig. 1. Analysis of the suitability of traditional Lean Management methods

As we can see from Fig. 1, not all of the listed tools and methods are equally suitable for their application in hospitality. We can observe, as expected, that methods from certain groups, for example Organisation and Staff, Material flow and Layout seem to be more suitable than others are.

Machinery and Equipment: Methods from this cluster show in comparison to others a low suitability, especially regarding criterion one and two. This may be caused by the high cost and the excessive planning impact for implementation.

Material flow and Layout: The methods from this class present a mixed picture. Some of them are performing very well others again are lagging far behind. The strengths of methods from this cluster lay in their effects on KPIs and sustainability.

Organisation and Staff: In this cluster, there are not big differences between the performances of the single methods. Throughout they are suitable very well for hospitality.

Production Planning and Control: These methods are particularly expensive in their implementation and suffer from the effort and time needed to get the desired result, although they are very sustainable in use and application.

Quality: Comparable with Material flow and Layout. Some of the methods are time-consuming and very complex in their implementation. In addition, their benefit is not always recognizable at first sight.

The results from this analysis and validation model show that the single cluster with their methods perform very different regarding the single criteria. On average, the performance of the methods satisfies the expectations. To verify these results in the next chapter the application of some of the methods was carried out in a real case study in a North-Italian hotel.

5. Case Study – Application of Lean methods in a premium family hotel

The enterprise from the case study represents one of the biggest and noblest family spa hotels worldwide. The hotel is open all year round, has a maximum capacity of 110 beds and employs about 120 persons.

5.1. Introduction of CIP-Workshops

CIP-Workshops (Continuous Improvement Process) are a very flexible Lean Management method and applicable in lots of different company areas. CIP-Workshops were implemented in different departments of the hotel. CIP-meetings were and are held for example in the reception with front and back office, in the kitchen and in the service, as well as in the hotel spa and at the housekeeping.

Regularly held workshops form the fundament for the CIP-method. The participants should arrive well prepared to the workshops. This could occur by on-site-visits, by analyzing process specific data or reports. Employees that are involved directly in the process usually have the most extensive knowledge and should explain the process to the rest of the participants at the beginning of the workshop. In addition, also a CIP-leader has to be named. For example, at the kitchen department, this was the junior chef. In sense of the Lean principles, it was important to assign him more responsibility, secondly it was a good opportunity to let him and his social capabilities grow and thirdly the group-dynamic is much more flexible if no one is afraid to speak one's mind. The junior chef was also responsible to take care that the agreed tasks were realized until the next CIP-meeting.

In order to collect as much improvement suggestions as possible and to motivate the hotel staff to care about the CIP-method a reward system was developed (Ideas Management). A CIP-board was placed for everyone visible in the hotel (see Fig. 2). For the hotel staff it is possible to write their improvement ideas on prefabricated idea cards. These ideas are then rated by the CIP-jury and either endorsed or rejected. Another CIP-board shows the status and the results of the endorsed suggestions. At the end of the year, a lottery with the cards of all endorsed suggestions is held out. The employee with the most suggestions therefore has the best chance to win a prize (for example a holiday travel to New York).



Fig. 2. Realized CIP-Board for Idea Management

5.2. Application of Lean methods in warehouse management

The hotel in the case study has different warehouses and storages at different places and floors distributed over the whole building. This circumstance should in effects be positive for running the hotel because this makes it easier to place the different goods near the destination where they are needed. Due to the fact, that no one was responsible for the organization of the warehouse, this happened more or less randomly. Therefore, goods that were needed at the ground floor were placed often two or even three floors off. To avoid such inefficient situations in the future, the different warehouses and their contents were analyzed. The articles were clustered into different product families regarding their intended use and place of consumption.

To reduce time and distance for moving goods in and out of the warehouse and to improve the clarity, an ABC-analysis was done. The focus was primarily hold on A-products that were needed very often. These products were then placed as near as possible to the entrance of the warehouse (for example pasta). Applying this actions, not only the time to access has been reduced, but also a so called quarantine zone found its place in the storage.

To facilitate the warehousing even further and to reduce the time for purchasing goods a barcode-system was implemented. The barcodes were stuck to magnetic cards and placed in front of the relative article. Now purchasing and reordering the goods is much more easy than before. Provided with a scanner, it is possible to scan the codes placed in front of the articles and to insert then directly the desired quantity. Another positive fact is that now it is no longer necessary to fill out order sheets manually. By using the scanner, orders will be sent automatically to the purchase department.

5.3. Reduction of movement in Housekeeping

Housekeeping is one of the most important activities in a hotel. Firstly, because the majority of the guests attach high value to order and cleanliness, especially in the price segment of the case study hotel. Secondly, it is a major cost factor in a

company's budget. To analyze the process and to identify non-value-adding activities, a video recording was done and the path traveled by the staff was set down with the help of a typical spaghetti diagram known from Lean material flow analysis (see Fig. 3). The advantage of the spaghetti diagram is that two types of waste, transportation and motion, can be visualized in a very easy way. At every floor were placed two trolleys. One for the clean laundry and one for the dirty one. The housekeeping staff was divided into single teams. One team consists of two or three people, responsible for different tasks. Task one is to free the rooms from dirty laundry and garbage and put them on the assigned trolley. Task two consists in taking the clean laundry from the second transport carrier and change the covers. Task three is about replacing the dirty towels with new ones and cleaning the room.

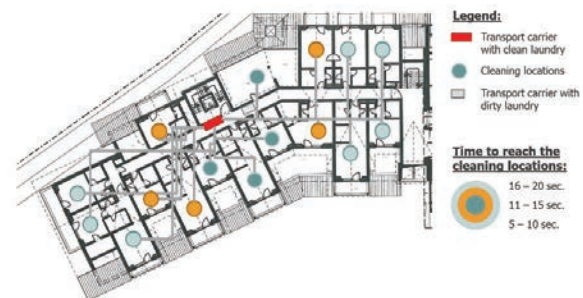


Fig. 3. Spaghetti diagram

The identified weakness in the process was that the two transport carriers were positioned at a fixed point in the corridor instead of moving them to the single cleaning locations because it was nearly impossible to move them. They were completely overloaded and therefore very unstable. To improve the process the two old transport carriers were substituted by new and ergonomically designed trolleys. Now every team had three transport carriers: one for the clean laundry, one for the material needed to clean the rooms and one for the auxiliary staff. Overloading the trolley now is prevented by charging only the amount of clean laundry and materials that are needed during one day. A packing list for every trolley was made and fixed on the carriers. Now the personnel can move the trolleys to the single rooms. In addition, also the accessibility to the different materials on the trolley has improved significantly. Due to the optimization of the routes and an improvement of the work management, savings in time and distance of about 30% were obtained. Therefore, not only the working conditions for the housekeeping staff, but also service to the customer has improved significantly.

5.4. Application of 5S in the hotels work place

The hotel also has an in-house repair workshop assigned to the staff responsible for the maintenance of the building. The workshop was also used as a warehouse for technical spare parts and consumables. Analyzing the workshop more in detail was identified high disorder and therefore high inventory as well as searching time. The workstations were dirty, untidy and unorganized and broken tools laid between good and

functioning tools. This situation triggered the Lean team to implement another Lean Management method, 5S (see Fig. 4). 5S stands for the Japanese words Seiri (Sort), Seiton (workplace organization), Seiso (cleanup), Seiketsu (standardize), Shitsuke (discipline). Starting with the first of the five S, “sort”, the staff began to sort and check the tools about their functionality on every workplace. Afterwards, all the broken or not used tools were carted off.

The second step was to arrange the remaining tools and materials systematically on the worktables and to assign to every piece a determined place. The assignment of the position for the single tools was influenced by the number of accesses, the ergonomic use and their heaviness. Tools that were used very often, were positioned in gripping distance from the worktables, tools that were used only scarcely were placed further away. Afterwards to every tool was assign a unique place. On the wall behind the worktables were mounted shadow tables to fix every tool at a given position.

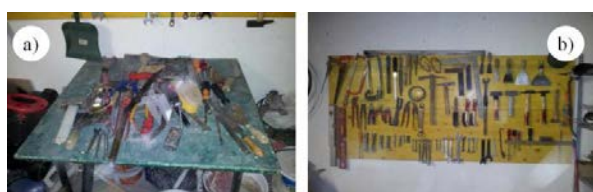


Fig 4. (a) work place before and (b) after the application of the 5S method

To fulfill the third of the five “S” (cleanup) an agreement with the workers was arranged. Everyone has to clean his/her workplace periodically. In this way broken or damaged tools can be sorted out immediately, the safety, quality and reliability improves significantly. “S” number four asks for standardization. This means, that all the previous steps need to become a standard pattern, which has to be repeated in defined periods. In reference to the last step, “sustain”, it was important to sensitize the staff of the relevance of order and cleanliness on their worktables. In the future, it will be their mission to keep the 5S cycle alive.

6. Conclusion and outlook

The results of this paper in reference to the applicability of Lean Management methods to the hospitality field are very positive. Through the analysis and appropriate validation process, a Lean Toolbox with suitable lean methods for Hospitality could be identified. Unfortunately, not all of the selected methods are suitable at all for the hospitality area. This includes also methods like value stream mapping and other.

Some of the “suitable” methods were applied successful in a real case study at a premium family resort. Through CIP Workshops and Idea Management the staff could be integrated in the reorganization implementing a lot of measures for cost saving as well as increase of customer service. The warehouses could be optimized by the implementation of barcodes and an ABC-analysis. In housekeeping optimizations were found by the use of the spaghetti diagram for visualization of inefficiencies in the room cleaning process. In addition the 5S methodology was applied in maintenance and administration with the aim to tidy up and introduce standardization.

Concluding can be observed that the expectations where fulfilled and Lean Management holds additional potential for the tourism and hospitality sector in the future. Tourism should be more aware in future for Lean methods. In addition, Lean methods should be adapted to the special requirements of the hotel sector.

References

- [1] Ohno T. *Toyota Production System: Beyond Large-Scale Production*. New York: Productivity Press; 1988.
- [2] Womack PJ, Jones DT, Roos D. *The Machine that Changed the World: The Story of Lean Production*. New York: Harper Perennial; 1991.
- [3] Cardiff University. <http://www.cardiff.ac.uk/lean/principles/>. Last update 25.02.2015.
- [4] Womack PJ, Jones DT. *Lean Thinking. Banish Waste and Create Wealth in Your Corporation*. New York: Free Press; 2003.
- [5] Rother M, Shook J. *Learning to See: Value-Stream Mapping to Create Value and Eliminate Muda*. Cambridge: The Lean Enterprise Institute Inc.; 2003.
- [6] Zollon HD. *Grundlagen Lean Management: Einführung in Geschichte, Begriffe, Systeme, Techniken sowie Gestaltungs- und Implementierungsansätzen eines modernen Managementparadigmas*. München: Oldenburg Wissenschaftsverlag GmbH; 2013.
- [7] Chiarini A. *Lean Organization: from the Tools of the Toyota Production System to Lean Office*. Bologna: Springer; 2013.
- [8] Wiegand B, Franck P. *Lean Administration 1: So werden Geschäftsprozesse transparent*. Aachen: Lean Management Institut Stiftung; 2004.
- [9] Wellman J, Hagan P, Jeffries H. *Leading the Lean Healthcare Journey*. New York: Taylor and Francis Group LLC; 2011.
- [10] Cain CT. *Profitable Partnering for Lean Construction*. Oxford: Blackwell Publishing; 2004.
- [11] Alarcón L. *Lean Construction*. Rotterdam: A.A. Balkema; 1997.
- [12] <http://www.process-improvement-japan.com/lean-hotel-operations.html>. Last update 26.02.
- [13] Apex Hotels. http://www.rkmsuk.co.uk/casestudies/apex_hotels_accelerate_programme.pdf. Last update: 26.02.2014.
- [14] Startin4. http://www.startin4.it/metodologia_innovazione/processo-lean-in-hotel-si-puo-fare/. Last update 26.02.2014.
- [15] Leansystems. <http://blog.leansystems.org/2012/07/lean-hotels.html>. Last update 22.04.2014.
- [16] Starwood turns to six sigma to boost quality and maximise profits. *Hospitality Matters* 2004;36:35-36.