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Lean Thinking in the European Hotel Industry

Abstract

The aim of this study was to assess the extent to which lean practices are applied in European hotel industry and whether or not their implementation contributes to hotel performance. Lean thinking has been applied in many industries in order to remove all types of waste. However, lean practices are not widely applied in service sector, particularly small and medium hotels across Europe, thus leaving a space for improvement.

We surveyed small and medium hotels across 19 European member states by sending questionnaires to hotel managers. We evaluated 7 value stream mapping techniques: Process activity mapping, Supply chain response matrix, Production variety funnel, Quality filter mapping, Demand amplification mapping, Decision point analysis, and Physical structure. We identified two value streams: (a) Reservation value stream: reservation – transportation – check in – housekeeping – check out – transportation; and (b) Procurement value stream: establishment of a need – placing an internal order – order / purchase – delivery to the hotel – delivery to the hotel segment.

Data analysis revealed that hotels do apply value stream mapping techniques in different ways. Results show high level of similarity in hotel operations regardless of hotel location. Every value stream mapping technique, except production variety funnel and supply chain response matrix, can have a high impact on detecting and eliminating waste across upstream as well as downstream value chain We offer managerial implications and suggestions for further research.

Keywords: Lean thinking, Value Stream Mapping Tools, hotel industry, Europe.

1. Introduction

In times of recession, companies are looking for ways to reduce cost without jeopardising quality. One way to cut costs is to focus on waste as there are ways of reducing wastage, some of them being lean practices. Lean Thinking (LT) is mainly inspired by the Toyota Production System (TPS) which has been focused on elimination of waste and improving customer satisfaction (Womack and Jones, 2005; Tsasis and Bruce-Barrett, 2008; Pegels, 1984). Lean Thinking is a set of principles, philosophies and business processes to enable the elimination of waste that add value to customers. According to lean thinking, waste can be anything other than the required equipment, materials, parts, space and working time. Since its adoption by Toyota, lean practices and tools have become popular among large-size companies. However, small and medium companies can learn and benefit from the application of lean practices and tools in order to detect and reduce waste (Womack and Jones, 1996a). Although it is true that lean as a philosophy has its origins in manufacturing and Toyota Production System is a stick yard of Lean Thinking, many service companies have also implemented lean thinking in a successful manner (Womack, 2004; Cuatrecasas, 2004; Cookson et al., 2011).

Waste is not something new in hotels but its elimination requires a systematic way of thinking. There is little doubt that lean practices can eliminate waste better than the non-systematic, empirical way that Small and Medium Enterprises (SMEs) apply more often than not. However, the question remains what lean tools and techniques are more applicable and profitable to hotel management (Anderson, 1991; Price, 1994; Baum, 1988).

The following section reviews the literature on lean practices focusing on services and hospitality. Then, next sections present the research method and the research findings. The last section discusses conclusions, managerial implications and makes recommendations for future research in this area.

2. Review of the Literature

There is consensus that lean techniques can eliminate waste and reduce risk to manufacturing industries including construction (Howell and Ballard, 1998) and aerospace field (Hines et al., 2004). In sharp contrast, there is scarce evidence on applicability of lean techniques in services including hotel industry. The remaining of this section reviews key lean concepts and techniques, introduces the Seven Value Stream Mapping Tools and reviews lean studies on the hospitality industry.

2.1. Lean concepts and techniques

Lean thinking focus on the removal of obstacles ("wastes") that hinder unremitting flow of work processes (Liker, 2004, p.31). According to lean thinking, there are seven types of wastes (Table 1)

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Womack and Jones (1996a) developed the "*The five steps model*" which assumes that there are five consecutive sets of actions from value to perfection which transform problematic, operational practices into well organised flows of goods and services. Defining 'Value' is the first step in lean thinking. Value can only be defined by the ultimate end customer. The second step is the identification of the Value Stream by Breaking down value adding activities into individual steps. In this way, value stream provides the possibility to recognize actions which represent or create "waste". The elimination of waste gives the possibility for process re-engineering and the creation a continuous "Flow". Companies then are able to develop a "Pull" system in which the customer, not the company, is the one who triggers the production, thus goods and services reach the customer only when asked for; neither before nor after requested. The final step is a step into "perfection", which is the complete elimination of waste so that all activities along a value stream create value. In many cases, lean transformations are radical changes that need a supportive organisational culture in order to be successful (Tsasis and Bruce-Barrett, 2008).

2.2. The Seven Value Stream Mapping Tools

Value stream analysis is an analysis of the value created within an organisation and is based on the assumption that that value flows through specific processes, and progressively is added in the final product or service. In order to increase the value offered to end-consumers, there is a continuous need to improve organisational processes by detecting processes and activities that operate inefficiently, add no value and create waste. McManus and Millard (2002) described value stream analysis as: "*The value stream is analyzed and mapped in order to reduce the waste in processes, enable flow, and move the process towards the ideal of rapid response to customer pull.*" Identification of these no value-added activities may not be easy for a number of reasons and require a set of tools in order to uncover waste linger in (Lasa et al, 2008). Hines and Rich (1997) proposed seven value stream mapping tools that can uncover seven different types of waste. The seven tools, which comprise *the value stream management tool kit* (Wood, 2004), are the following:

1. **Process activity mapping**, which is the only "tabular" approach, brakes down the process to the smallest detail. Each activity within a process is plotted onto a spread sheet. Each activity is described by its characteristics, thus creating a big and clear picture of the whole process. Process activity mapping offers a helicopter view of the value-added processes and helps managers to identify processes that add little or no value (Wood, 2004).

2. **Supply chain response matrix** is a diagram that depicts the lead-times throughout the entire process. In order to construct the supply chain response matrix, records of the time needed to conclude each step in a production process are combined and depicted in a matrix diagram. The matrix provides an overview on time wasted in lead-times and offers insights on corrective measures.

3. **Production variety funnel** is a tool that works more or less like the supply chain response matrix, except that, instead of time, the graph visualises two other critical variables: *sequence of processes* against *inventory quantities* at each stage. In doing so, production variety funnel helps detect and reduce excess inventory.

4. **Quality filter mapping** aims to reveal quality problems within the entire supply chain by identifying three types of defects: (a) defects with the finished product or service as noted by customers, (b) service defects not concerned with the production of the product and (c) defects exposed by internal inspection systems and may related to time wasted, product malfunction or similar impediments. Each defect can be mapped along the supply chain to target improvement activity.

5. **Demand amplification mapping** reveals demand fluctuations throughout particular time frames. The information produced by demand amplification mapping can be used for redesigning the entire value stream configuration based on actual customer demands, reduce unnecessary fluctuations or provide solutions to exceptional demand.

6. **Decision point analysis** is a tool that estimates the point where products stop being made according to actual demand and are made against forecast only. Knowing where this point is, it is possible to assess processes operating downstream and upstream from this point.

7. **Physical structure** represents the last of the seven VMS tools and it shows the supply chain at industry level. In doing so, physical structure can help to understand how the industry operates and particularly in areas that may not have received sufficient developmental attention.

2.3. Lean Applications within Hotel Sector

Lean techniques have been applied mainly in the manufacturing sector and there is scarce evidence of lean applications in service sector and in hospitality particularly. Health industry is the service sector with most lean studies and the majority of the results are supportive of the effectiveness of lean techniques.

Grove et al. (2010) reported the findings of a 13-month lean implementation in National Health Service (NHS) primary care health visiting services. Value-stream mapping was utilised to map out essential tasks for the participating health visiting service and found that 65% of processes were waste and could be removed. Furthermore, clinical staff performed on average 15% waste activities, and

the administrative support staff performed 46% waste activities. Cookson et al (2011) applied Value Stream mapping in their Emergency Department in the UK and achieved to identify over 300 instances of waste and potential improvements in processes. Bortolotti et al. (2010) developed a methodology to streamline and automate processes as well as reduce waste in the pure service-providing companies and found out that the automation of a process not streamlined can generate problems that can slow down the flow and increase errors.

Cuatrecasas (2004) developed a step-by-step methodology to evolve from a classical model of behaviour of a production system to a lean production one in a service sector (the check-out service of a hotel type establishment). Hsieh et al. (2010) modelled the Demand Channel and Supply Channel in hotel Industry and suggested that once a hotel executes the consumption cycle model of demand chain both hotels and customers are able to reach the win-win situation from dominant strategy equilibrium. Moreover, the cost from manufacture and consumption is reduced, customer needs are satisfied, and hotels' productivity and consumer buying power are raised (Sellitto et al., 2003)

Bowen and Youngdahl (1998) described the characteristics of a lean approach to hotel operations. Table 2 compares lean characteristics suggested by Siguaw and Enz's (1999) with best hotel practices widely used in hotel industry in order to eliminate waste and flexibly react to customers' pull.

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3. Methodology

3.1. Research Design

The main method of this research was a quantitative analysis of empirical data collected via questionnaires sent to hotel managers. Specifically, we surveyed small and medium hotels in 19 member states of European Union. In order to arrive at a representative sample, we first construct a list of 1.500 hotels by combining various lists from websites such as booking.com and Worldhotels.

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The research was limited to facilities up to 40 rooms – small and medium size hotels (Andriotis, 2002). Furthermore, only hotels with 2*, 3* or 4* were included using the HotelStars protocol (HotelStars, 2010). The HotelStars criteria result in a homogenous hotel groups rated from 2* to 4* then hotels and higher heterogeneity with hotels with higher or lower ratings.

Although that the European Union (EU) is a socially, culturally, and geographically diverse union of 27 member states, hotel industry across EU follows similar procedures in purchasing supplies such as food and drinks as well as in offering services such as accommodation and catering (Callan, 1993). Hotel customers impose market segment characteristics of which hoteliers mind by shaping their operations to suit the majority. However, hoteliers charge various market segments differently, selling the same services in most of the cases (Ladany, 1996). Processes in hotels around EU may differ in pace, style, or even in number of employees serving them, yet most hotels apply common operations, such as reservation, booking, transportation, and procurement of supplies. In order to facilitate data analysis, hotel operations were grouped into two broad categories: reservation and procurement.

The questionnaire included questions that assessed the hotel procedures in relation to the lean techniques using the five steps model (Womack and Jones, 1996a). Therefore, the instrument measured the concepts of Waste, Value, Value stream, Flow, Pull, Perfection. Specifically, waste and value were assessed as multi-dimensional concepts. Value Streams were examined as processes (reservation & procurement value streams). Flow, pull, and perfection, which represent higher level of leanness, were assessed using the following techniques: Process Activity Mapping, Supply Chain Response Matrix, Quality Filter Mapping, Demand amplification Mapping, and Decision Point Analysis Tool & Physical Structure.

The questionnaire was pretested and the final questionnaire was emailed to hotel managers along with a cover letter. Out of 420 sent emails, we obtained 84 usable questionnaires (20%).

To ensure that the respondents were comparable to non-respondents, analyses of variances were conducted between these groups. The non-response bias was assessed by comparing early

respondents with late respondents and found not significant (Armstrong and Overton, 1977). Table 3 presents demographic statistics of surveyed hotels.

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3.2. Measures

As hospitality is a service industry, the large number of intangible features may obstruct application of quantitative techniques especially for small and medium hotels (Chand, 2010). The questions included in the survey could only target a sub-set of the total variables that could be used to measure hotel performance. Variables included in the survey refer to the number of lean practices employed, the sectors in which these have been realised, management perceptions regarding accounting, customer loyalty, and employee performance (Banker, Potter and Srinivasan, 2000). A 5-item Likert scale was chosen to measure attitudes of questionnaire respondents (Clason and Dormody, 1993).

Value was assessed with the following measures: 'Staff Service Quality', 'Room Qualities', 'General Amenities', 'Business Services', 'Value', 'Security' and 'International Direct Dial -IDD Facilities' (Choi and Chu, 2001).

Hotel performance was assessed in a multi-dimensional lean approach, which derived from the seven value stream mapping tools (Hines and Rich, 1997). Measures of hotel performance included: just-in-time, quality systems, work team, supplier management, waste-free flow of goods and services, decreasing inventories and human resource capability (Shah and Ward, 2003).

Waste was measured as a multi-dimensional concept and the following types of wastes were measured: overbooking, inappropriate processing, unnecessary motions, transportation, waiting, defects, unnecessary inventory (Hines and Rich, 1997).

In order to assess the value streams, respondents were asked to report various aspects of their processes. The processes were broken down into two streams: the reservation process and the procurement process. Each process was then discomposed into single activities such as: reservation

inquiries, reservation confirmations, transportation, and more (the activities are presented analytically in the results section).

Further, in order to evaluate the extent to which each of the seven mapping tools can be applied to each value stream, respondents reported on the 'usefulness' and 'relatedness' of mapping tools for every type of waste. For relatedness variable, basic statistics were calculated: mean, median, and standard deviation. Then, responses were classified into three clusters: High (H), Medium (M) and Low (L) relatedness. High, Medium, and Low groups had statistically different means and standard deviations. Usefulness was measured by a single scale variable ranging from 1 (no usefulness) to 7 (high usefulness).

In order to assess the scope of leanness and the applicability of lean techniques, for each lean technique, a set of variables were measured. Specifically, in order to construct the process activity mapping, respondents reported the time needed (and/or wasted) in every activity, human and facility resources attached to it as well as respondent commented on problematic issues on an open-end question. Regarding the supply chain response matrix, the lead times (time needed, time wasted) between activities were measured. The Quality filter mapping was based on measuring three types of defects: Defects about finished product or service; Service defects not concerned with the production of the product; defects exposed by internal inspection. Demand amplification mapping, which depicts the demand fluctuations throughout particular time frames, was measured by the number of employees per shift over the different levels of workload. Decision point analysis was based on the measure of the time point where products stop being made according to actual demand and are made against forecast only. Decision point analysis was combined with the physical structure which puts the hotel within their operating environment in order to arrive at safer conclusions.

The questioning instrument consisted of a series of questions that gathered information for every variable and measure. For example, Quality filter mapping is based on three defect types, one of which was measured by the variable 'Defects about finished product or service' with a scale from 0 (no defects) to 5 (very large defects). Respondents reported for the defect rate for each value stream

activity from reservation inquiry and confirmation to departure of guests. In total, there were 10 stages in the value stream; therefore there were 10 measures for each of the 3 defects, a total of 30 measures in order to draw the Quality filter mapping. For each one of the 30 measures, the average defect rate was calculated. The standard deviation was also calculated in order to examine whether or not there were significant deviations or fluctuations from the average values. Then, the three types of defects were depicted as lines on the same diagram, which is the Quality filter mapping. Following the same process and by calculating the average values of each variable or measure and depicting them across the value steam, the survey responses allowed for the construction of lean diagrams for both the reservation and the procurement value streams.

Value stream mapping, as most lean tools, is basically a pencil and paper tool. Constructing a map with too much detail can obstruct the understanding of how the value flows in a sequence of processes, or pinpointing non-value added activities and waste. Therefore, mapping begins by identifying the process categories such as 'reservation' rather than individual steps like 'reservation inquiry and reservation confirmation'. After all processes categories have been identified, the map is drawn using symbols or icons such as rectangles and triangles to represent processes and flows. Once an overview value stream map is ready, then value mapping focus on specific processes by zooming in and out. This is an iterative process that helps work out the details of the value stream map. For example, in order to calculate the exact time in the reservation process, there is a need to zoom in this process and split it to the higher detailed possible level, such as 'reservation inquiry' and 'reservation confirmation'.

Mapping needs to begin at the customer level and go upstream. In this way, the processes that link directly to customers are the first to be in the map, which set the pace for other processes further upstream. After the processes and value-adding activities have been identified, then the calculation of process parameters such as distance, time, number of personnel etc. begins. To do so, the survey included variables for every step in the value process and for every step there were measures for every parameter (distance, time, etc). Then, for every measure, statistics such as medium, standard deviation

were calculated and the values are transferred onto the value stream map. After mapping process is finished and every measure was calculated, the value stream mapping can be sketched out or transferred into a table or figure.

4. Results

Results are presented in the following manner: First, the value streams are presented. Two value streams were identified: The reservation value stream and the procurement value stream. Then, the lean techniques are presented: Process Activity Mapping, Supply Chain Response Matrix, Quality Filter Mapping, Demand Amplification Mapping, and Decision Point Analysis & Physical Structure. Each lean technique is applied in both the reservation and the procurement value streams.

4.1. Reservation & Procurement Value Streams

Survey questions were structured around two major value streams: (1) *Reservation value stream:* reservation – transportation – check in – housekeeping – check out – transportation; and (2) *Procurement value stream:* establishment of a need – placing an internal order – order / purchase – delivery to the hotel – delivery to the hotel segment.

Table 4 depicts wastes identified on reservation value stream and categorise them according to seven types of waste (Overbooking, Waiting, Transportation, Inappropriate processing, unnecessary inventory, unnecessary movement, Defects). Table 5 presents wastes identified on procurement value stream. As can be seen from the data in Table 4 and Table 5, every lean mapping tool, except production variety funnel and supply chain response matrix, can have a high impact on detecting and eliminating waste across upstream as well as downstream value chain.

<<Insert Table 4 about here >>

<<Insert Table 5 about here >>

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4.2. Process Activity Mapping

Table 6 illustrates the Process Activity Mapping applied to Reservation Value Stream. Time from reservation to arrival is a lean variable that largely depends on external factors. All steps from Reservation inquiry to arrival of the driver are required and management cannot eliminate time by removing a process step. However, cooperation with main transportation stations (airports, train and bus stations, etc.) may decrease time waste.

Furthermore, the analysis shows that the number of people employed in the process may as well be lower by 50% since certain steps could be undertaken by the same person being in the same group. In this way, hotels become more adoptive and flexible with greater functionality of staff, which is a typical of lean principles (Ward and Zhou, 2006).

<<Insert Table 6 about here >>

Elements such as location, traffic predicaments, or other unperceived factors may hinder the creation of value during reservation operations. Volatility within the reservation value stream, which is inherent within hotel industry (Kozak and Rimmington, 1998), may hinder demand forecasting and reduce the quality of service offered during the reservation process. Therefore, even small improvements in the value generated by reservation value stream activities may result in high increases in quality of service, particularly when they are combined with a reduction of operational defects such as in the case of Just-In-Time (JIT) practices.

Table 7 presents the Process Activity Mapping tool applied to Procurement Value Stream. This value stream is also characterised by operational time, that is hard to compress. Steps of the value stream need to remain in such order, due to logistics or legal obligations, depending on the type of hotel ownership. Again, the number of people throughout the process may fluctuate and this is an area of improvement. The person-hours needed to streamline the process can be offered by a limited number

of personnel who should be flexible enough and functionally adaptable to other processes. In doing so, hotel management can achieve cross-functionality of personnel, which is a key attribute of lean theory (Hines and Rich, 1997).

<<Insert Table 7 about here >>

4.3. Supply Chain Response Matrix

Supply Chain Response Matrix (SCRM) uncovers the "*order to delivery cycle time*" for the Procurement Value Stream (Gunasekaran et al., 2004). Specifically, a cumulative lead-time of 2h8' has been projected onto Figure 1, which illustrates the order-delivery cycle. Since hotel industry tends to decrease its inventories, ideally cumulative inventory would remain as closest to horizontal axis.

<<Insert Figure 1 about here >>

It is expected that at some point ordered goods linger either within storage of a supplier or at the hotel dock, waiting forwarding to a hotel department. In the worst case scenario, a failure occurs and goods become obsolete and lose their value as a stock. In this case, value on the cumulative inventory axis (vertical axis – positions A or B) amplifies, raising total amount of "*order to delivery cycle time*" (Gunasekaran, et al., 2004) or "*response time*" (Hines and Rich, 1997), failing to lean the value stream in question.

However, daily hotel routine involves perishable goods in most cases, thus hotel managers are alert on wastes generated by inadequate inventory and supply chain management. In this respect, SCRM can be a powerful to uncover lead-time and wastes by trying to decrease defect rates and moving down to low level of the vertical axis of SCRM diagram.

4.4. Quality Filter Mapping

Figure 2 depicts the quality filter mapping for the procurement value stream. Assuming that customer's experience starts way before the actual check-in, it seems clear that the impression a guest brings to the hotel is in no way affected by hotel's products, services or even "internal scrap". However, clearly illustrated by *quality filter mapping tool*, any discontent occurred prior to arrival to the hotel, may either escalate, be pacified or retained at the same level by the quality of hotel's products and services.

<<Insert Figure 2 about here >>

Figure 2 demonstrates three settings, of which green and blue represent flows of services starting long before customers checked in at the hotel (Lovelock, 1993). Green line shows high level of defect, i.e. dissatisfaction of customers due to problems which occurred at booking point that providentially decreased as the flow started depending solely on hotel premises. Blue line however illustrates scenario without variations in quality of services throughout the value stream, however, certain level of dissatisfaction (defect rate between 1 and 2) apparently exists from the reservation point.

The dot line depicts high quality services until the moment customer entered the room. Any malfunction within the room, particularly certain large defects such as lack of heating or air-conditioning, water problems or similar may turn agreeable arrival into highly unpleasant departure. The visual representation of a flow may vary from position 0 to any direction, though as much as it depends on quality of services; it equally depends on customer's disposition and temporary mood.

Therefore, the state of complete absence of defects produces absolute customer's satisfaction (Erto and Vanacore, 2002), which indicates that the usefulness of *the quality filter mapping* in hotel industry lies in exposing the repetitive "curves and twists" upward on the graph. By pinpointing complains, hotel managers can exhibit an appreciation of excellence and an commitment in waste removal.

Analogously, *the quality filter mapping* can be applied to Procurement Value Stream, taking into account that the terminology refers to hotel purchasing practices as opposite to the previous value stream which regards customers' behaviours.

Based on the results of two previous analyses, Process Activity Mapping and Supply Chain Response Matrix, the length of the Procurement Value Stream can be calculated to be minimum 2h8'. This calculation allows for five possible scenarios:

Green line (a) depicts inability to establish the need, whereas once discovered, the value stream functions well. It opposes orange line (c), which projects somewhat adequate start of the flow, but fails to follow up. Like in the previous Reservation Value Stream, blue line (e) represents defect-less flow without variations in efficiency and effectiveness, while red line (d) illustrates in-house failure to deliver the order to an adequate hotel segment.

There are order-purchase cases however, as illustrated with the black line (b), which end prior to completion. It may happen that in such instances, entity decides to change the order (purchase), to renounce or postpone it.

Finally, in constant pursue of perfection, application of new information technologies and/or incremental improvements in the value stream could enable smoother flow of products and services, thus decreasing the duration of the process to less than 2h8'. High scores to survey questions suggest that hoteliers are aware of its importance, although they did not express it in a lean terminology.

4.5. Demand Amplification Mapping

The demand amplification mapping tool depicts demand amplification that is most likely associated to fluctuations of incoming and outgoing goods or services (Figure 4). Amplified work load in hotel industry may mean arrival of large group for convention, and/or incoming of new equipment, or ordered goods in amounts that go beyond average daily purchases. Figure 4 depicts the number of

employees in relation to the level of work load. The application of *the demand amplification mapping tool* to hotel operations confirm "leanness" of the hotel industry, but also emphasise specifics of each facility and importance of an ability to adjust and trade-off resources to needs.

<<Insert Figure 4   about here >>

4.6. Decision Point Analysis Tool & Physical Structure

The graphical representation of the Reservation Value Stream spans beyond the hotel borders and include 1st, 2nd, and 3rd tier suppliers. The end consumer of hotel services may not contact hotel directly but make a reservation via tier suppliers that are far up the value stream (Figure 5). The Reservation Value Stream depends largely on external suppliers as well as the Internet as a reservation medium with the remaining activities of the value stream carried out in-house (Tse, 2003).

<<Insert Figure 5   about here >>

The distribution of responsibility across various suppliers makes visibility a critical factor of value stream success. Visibility is critical in determine the points where pull demand meets push strategies. In doing so, value stream becomes leaner, as it removes waste in the pull stream as well as waste in the stream that pushes services and creates waste in inventories. Therefore hotels, which rely on efficiency of diverse reservation systems and entities around the world, utilise both "push" and "pull" strategies with equal frequency. However, once customers enter hotel premises, Reservation Value Stream functions mainly on "pull" approach.

Due to the seasonality in tourism, hotels are largely relying on "push" strategy of rooms, by promoting in-advance payment of multiple room packages using than one travel agency. In this way, customers receive lower prices and hotels gain steady occupancy rates, although it may result in overbooking and low service quality (Hadjinicola and Panayi, 1997).

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Procurement Value Stream reveals inefficiencies of "push" strategy which leads to excess inventories as demand coming from hotel customers, causes "pull" reactions further up the value stream and supply chain. Such inefficiencies in procurement value stream are associated with an inherent complexity of hotel industry.

<<Insert Figure 6 about here >>

5. Discussion

Hotel industry is a customer-centric business, which it could improve customer satisfaction by removing waste and defects from product and services offered to customers (Levy, 1997). The motto that two customers are never the same is based on the assumption that every customer defines value in a unique way. Therefore, hotel managers need tools and techniques for managing individual value streams in an effective and efficient way. This study examined the extent to which lean techniques, which are being successfully applied in manufacturing industries, could offer benefits and solutions in the hotel industry. The contribution of this study is twofold. Firstly, it offers a number of lean tools and techniques that can improve hotel performance. Secondly, it offers insights on how lean thinking can be applied in a service sector. Specifically, process activity mapping tool revealed high percentage of operational time of both "value streams", indicating that waste largely depends on external factors. Supply chain response matrix was applied to procurement value stream and revealed that there was no evidence of cumulative lead-time rising on the vertical axis. Quality filter mapping tool revealed factual and fuzzy reasoning regarding quality. In particular, reservation (booking) service, which is an activity mostly far from hotel premises and well ahead in time from guests' arrival, may suffer quality problems. This finding raises concerns about hotel quality but moreover security of reservations, seriousness of travel arrangements and other intangible features of both, a hotel and the destination. Moreover, quality defects signify the need for applying lean techniques more widely in tourism and hotel industry. According to the results of demand amplification mapping

tool, hotel managers deal with demand fluctuations by a number of ways such as temporal increase and decrease of number of employees, measuring quality of service, and encouraging team work as the most frequent form of composition in hotels (Lovelock, 1993). Again, the application of lean techniques could significantly reduce the number of person-days wasted in upstream and downstream value chains. The impossibility to "push" someone to travel and pay for a room at the hotel suggests that the "pull" strategy is one-way option for hotels and value stream suppliers. Major concerns of the pull strategy are seasonality, special occasions and justifying the needs of heterogeneous market segment. Decision point analysis and physical structure mapping can produce meaningful results for designing an appropriate pull strategy. Price competition is not an option, as sharp decreases in room rates are more likely to initiate price wars than to attract customers stay longer (Bradley and Ingold, 1993).

If pursuing quality assumes removal of defects from flows of goods and services (Womack and Jones, 2005) in order to achieve market expectations, than in the sense of two suggested value streams it would assume reduction or complete elimination of:

a)   ignorance, misunderstandings, misinterpretations (Berry et al., 1994), services defects or faulty equipment on hotel premises in the Reservation value stream, and

b)   lead-time throughout the stream, order mistakes, or avoidance of traffic congestions, and similar in the Procurement value stream.

Having in mind that most of hotel services quality defects emerge from the lack of knowledge and miscomprehension of what customers perceive to be of value (Berry et al., 1994), it seems reasonable to place substantial efforts in decrease of such imperfections. Personal experience of hotel customers largely depend on selected hotel category, implying possibility to surpass these expectations with additional services, beyond required nominal technical conditions.

Apart from defective services, there are other issues which may undermine hotel's reputation such as:

-      failure to preserve facilities and hotel equipment

- ignorance in keeping past data and guest histories

- ignorance toward employees progress; change of internal culture; empowerment of staff

- rigidity to adjust number of employees to the work load

Customers' perceptions about a hotel may depend on personal experiences unrelated to the particular premises. Therefore, a pleasant trip toward a destination may result in customer's experience being greater than the actual quality of provided hotel services and vice versa. In this sense, positive but temporary customer's mood will overcome most of the hotel service defects, whereas the opposite may leave everlasting damage to hotel's reputation in the customer's mind.

5.1. Managerial Implications

Research findings support *"the five step model"* for lean transformation that has been successfully applied in the manufacturing industry (Womack and Jones, 1996b). Adopting the five-step model to the hotel industry would be a managerial toolkit for removing waste and improving customer value. The adaptation of the five-step model to the hotel industry has the following implications for each step:

Step one - "**identification of value**" – The first move towards removing waste is to identify and describe operational processes as well as to prioritise them according to value added to end consumers. The description of procurement and reservation processes is the first step in identifying sources of waste.

Step two - Once the hotel processes are identified, then "**value stream mapping**" is a powerful tool to decompose hotel process into value added activities and tasks. In doing so, it is more likely to pinpoint wasteful tasks such as unnecessary movements, excess inventories, lead times, and/or surplus of staff.

Step three - "**creating flow**" removes "wasted" resources from the process to make it smoother. This step is hard to codify, thus a hotel need to map its unique flow of resources, calculate the cost of each resource, and finally trade them off to value pulled by customers. For example, hotel reservations

flow commences from reservation of a room, then it moves to transportation to the hotel, check-in, hotel stay, check out and departure. A disturbed flow of the natural sequence of events may result in confused bookings, meaningless waiting, luggage loses, transfer jams, unprepared rooms, etc.

Step four - "**establish pull**" - The hotel reservation process is a pull process as from the moment a guest checks-in until he/she leaves the premises, it is him/her who "pulls" other activities. Certainly, there is a standard set of activities which involve housekeeping, restaurant, and similar hotel sectors, included into the price of the hotel stay. However, a request for a service triggers the pull process. High response times to a customer request require establishing pull processes across the reservation value stream.

Step five - "**seek perfection**" – Perfection is a goal that is hardly achieved yet it sets a standard to pursue. Perfection or the "*absolute level of Lean*" (Crabill et al, 2000) is the final step in the five-step model and the one offering opportunities to gain a competitive advantage via continuous improvement. The periodic assessment of operational practices creates new insights on how customers perceive value, which, in turn, remarks new ways to eliminate waste and streamline processes.

5.2. Limitations & Suggestions for Further Research

This study was based on scarce literature about lean applications on hotel industry (Bowen and Youngdahl, 1998). As a consequence, findings and results from this study are limited to its assumptions (Courville and Hausman, 1979). The response rate of the study was acceptable but a pan-European survey has always limitations stemming from the heterogeneity of hotels across EU member states. Another limitation of the survey was that it is unlikely to capture 'ad hoc' situations and thus it draws generalisations than making a specific application of lean to each hotel. It was not possible to collect valid data to examine production variety funnel, however this tool can be also useful for hotel managers and further research is required. Preffered methods for researching ad-hoc situations would be case research, in-depth interviewing and participant observation.

Further research could compare lean techniques with existing hotel system such as Kanban card system (Pegels, 1984) or other customised systems for tracking defaults and errors (Goddard, 1982).

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Table 1 Seven Types of Wastes

1	Overproduction
2	Waiting
3	Transport
4	Inappropriate processing
5	Unnecessary inventory
6	Unnecessary motion
7	Defects

Table 2 Lean characteristics in hotel operations

	Bowen and Youngdahl's (1998) Lean characteristics	Siguaw and Enz's (1999) Best Hotel practices
1	Reduction of performance trade-offs Goals focus on internal efficiency and external flexibility.	Maintains system-wide process for quality operating and service standards Identified task-time requirements to reduce labour costs
2	Make the value-adding processes flow and implement JIT customer-pull	Created process for streamlining operations in resource challenged hotels
3	Eliminate waste from the value chain of activities from product development to product delivery	Elimination of non-value-adding activities allowing focus on quality, cost efficiency and profit effectiveness
4	Increase customer focus and involvement in the product development and delivery processes	In majority of hotels' processes, customers play inseparable role
5	Empower workers and teams	Empowering specific departments

Table 3 Sample Distribution

Country	Number of contacted hotels	responses	country percentages-sent	country percentages-received
France	109	12	7%	14%
Germany	103	7	7%	8%
Ireland	51	0	3%	0%
Spain	101	3	7%	4%
The United Kingdom	68	6	5%	7%
Luxemburg	31	1	2%	1%
Belgium	60	5	4%	6%
The Netherlands	47	2	3%	2%
Greece	46	1	3%	1%
Poland	52	0	3%	0%
Austria	65	0	4%	0%
Czech Republic	80	2	5%	2%
Latvia	34	0	2%	0%
Portugal	66	4	4%	5%
Bulgaria	56	1	4%	1%
Finland	49	0	3%	0%
Monaco	17	2	1%	2%
Denmark	53	4	4%	5%
Sweden	89	9	6%	11%
Norway	63	3	4%	4%
Italy	71	7	5%	8%
Malta	12	0	1%	0%
Romania	41	2	3%	2%
Switzerland	36	5	2%	6%
Slovenia	5	0	0%	0%
Hungary	95	8	6%	10%
Europe	**1500**	**84**	100%	100%

Table 4 Reservation Value Stream – selection of mapping tools

Mapping tool / waste	Process activity mapping	Supply chain response matrix	Production variety funnel	Quality filter mapping	Demand amplification mapping	Decision point analysis	Physical structure
Overbooking	H			H	H	H	H
Waiting	H			H	H	H	H
Transportation	M			M	M	M	M
Inappropriate processing	H			H	H	H	H
Unnecessary inventory	L			L	L	L	L
Unnecessary Movement	H			H	H	H	H
Defects	H			H	H	H	H
Degree of importance/ Usefulness	6			6	6	6	6

H = High; M = Medium and L = Low correlation and usefulness

Table 5 Procurement Value stream – selection of mapping tools

Mapping tool / waste	Process activity mapping	Supply chain response matrix	Production variety funnel	Quality filter mapping	Demand amplification mapping	Decision point analysis	Physical structure
Overbooking	L	L		L	L	L	L
Waiting	H	H		H	H	H	H
Transportation	H	H		H	H	H	H
Inappropriate processing	H	H		H	H	H	H
Unnecessary inventory	H	H		H	H	H	H
Unnecessary Movement	M	M		M	M	M	M
Defects	H	H		H	H	H	H
Degree of importance/ Usefulness	5	5		5	5	5	5

H = High; M = Medium and L = Low correlation and usefulness

Table 6 Process activity mapping – Reservation Value Stream

no	Step	Flow	Machine/ Facility	Distance	Time	Personnel	Group	Comments
1	Reservation inquiry	O	Phone Fax Computer In person Third party	Irrelevant	2 min	1	1	
2	Reservation confirmation	O	Fax Computer Voucher	Irrelevant	0,5 min	1	1	
3	Departure to the airport	T/D/O	Car/Van	Depends on location		1	2	Time varies from distance and traffic
4	Waiting for a guest(s)	I	None	Irrelevant		1	2	Time varies from previous organization and accuracy of arrival of a transportation mean
5	Arrival with the guest	T/D/O	Car/Van	Depends on location		1	2	Time varies from distance and traffic
6	Check in	O	Computer	Irrelevant	1 min	1 (+1 for higher ranked hotels)	1	Function of a "bell-boy" is frequent in hotels of upper categorization; Efficiency of operations highly important (AAQ 4)
7	Accommodation	O/I	Room and hotel premises	Relevant		1+1	3	Importance of accessibility, tidiness, quietness
8	Check out	O	Computer	Irrelevant	2-5 min	1	1	Efficiency of operations moderately important (AAQ 3,8)
9	Departure with the guest	T/D/O	Car/Van	Depends on location		1	2	Time varies from distance and traffic
10	Arrival of the driver	T/D/O	Car/Van	Depends on location		1	2	Time varies from distance and traffic
				Total	≥5,5 – ≥8,5	10-12	**Total**	
				Operations	≥5,5 – ≥8,5	5-7	**Operations**	
				Value adding	100%	50-58,33%	**Value adding**	

O – Operation, T – Transport, I – Inspection, D – Delay

. **Table 7 Process activity mapping – Procurement Value Stream**

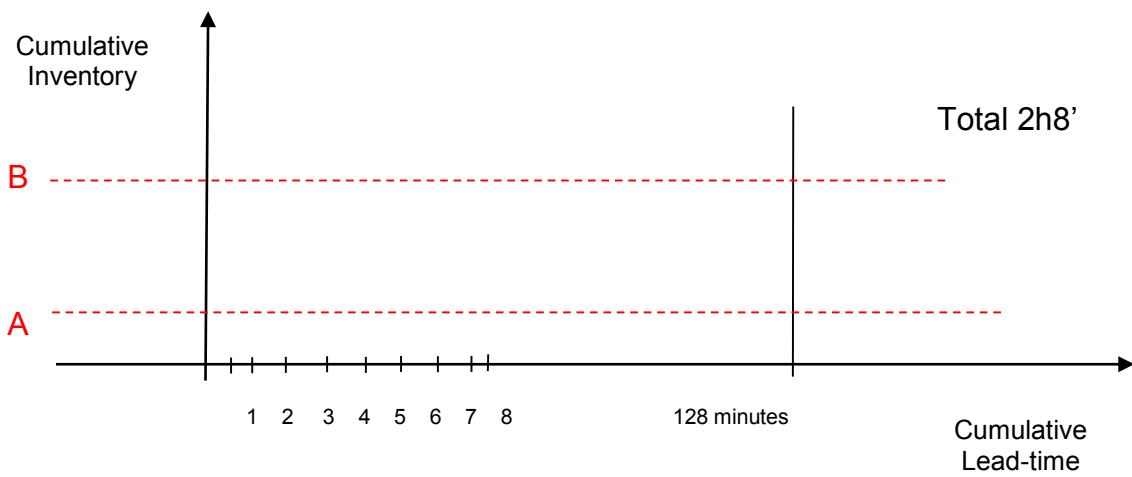|	Step	Flow	Machine/ Facility	Distance	Time	People	Group	Comments
1	Establishment of a need	I	None	Irrelevant	0,5 min	1	1	It could happen that more then one person recognizes a need
2	Placing an internal order /passing the message to relevant personnel	O	Internal worksheet, Fax, Computer	Irrelevant if in electronic form	0,5 min	1	1	
3	Tendering or finding the most adequate source	O/I	Computer, Fax Newspaper Other	Irrelevant	From 5min to 6 months	≥1	2	Duration varies on type of purchase
4	Order – purchase	O/I	In person, Fax, Computer	Irrelevant if in electronic form	≥1 min	1	2	Depends on a procedure
5	Delivery to the hotel	T/D/O	Car/Van/ Other	Depending on location	From 2h to 30 days	≥1	1	Time varies from distance and traffic
6	Delivery to the hotel segment	O	Carriage	Depending on location	1 min to 1 hour	≥1	2	Time varies from the distance
			Total		≥2h8'	≥6		
			Operations		≥2h7,5'	≥4		
			Value adding		≥99,61%	66,66 %		

O – Operation, T – Transport, I – Inspection, D – Delay

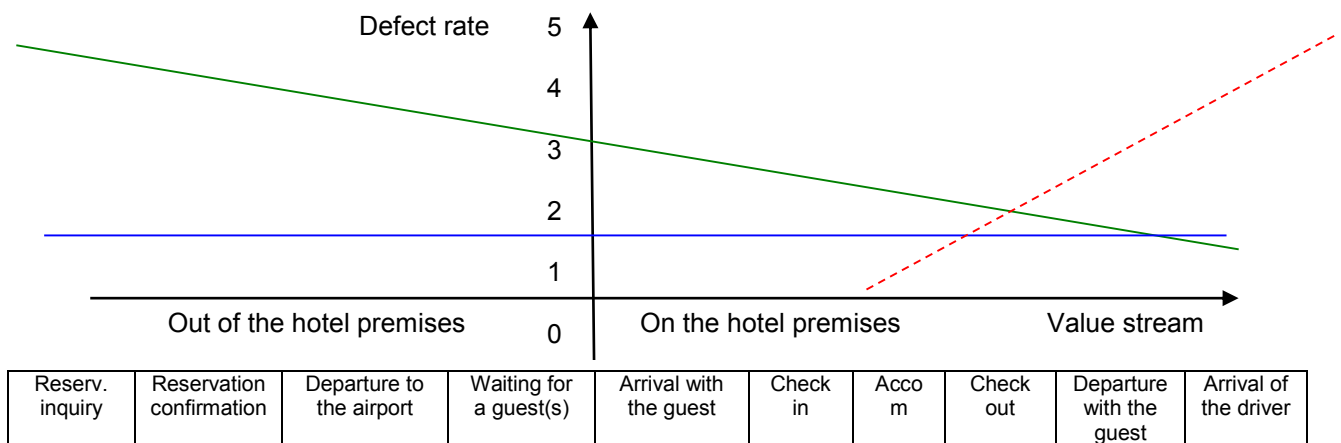**Figure 1 Supply Chain Response Matrix (SCRM) – Procurement Value stream**

Reserv. inquiry	Reservation confirmation	Departure to the airport	Waiting for a guest(s)	Arrival with the guest	Check in	Acco m	Check out	Departure with the guest	Arrival of the driver

Figure 2 Quality Filter Mapping – Reservation Value Stream

Defect rate

Out of the hotel premises   On the hotel premises

Establishment of a need	Internal order	Tendering or search for the source	Order - Purchase	Delivery to the hotel	Delivery to the hotel segment
O,5min	0,5min	5min to 6 months	≥1 min	2h to 30 days	1min to 1h
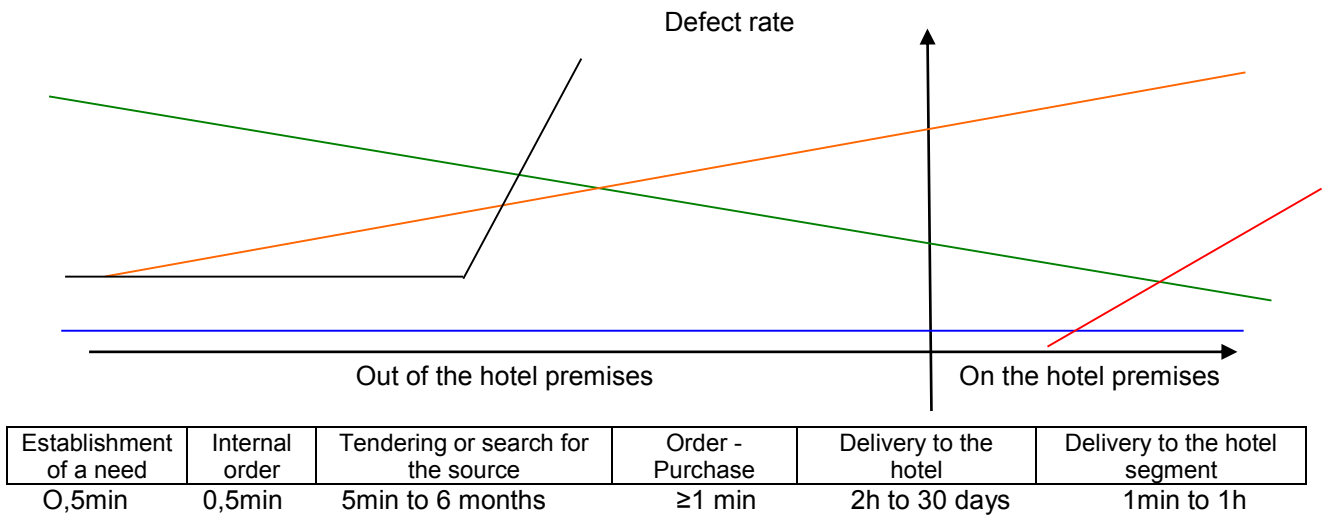
Figure 3 Quality Filter Mapping – Procurement Value Stream
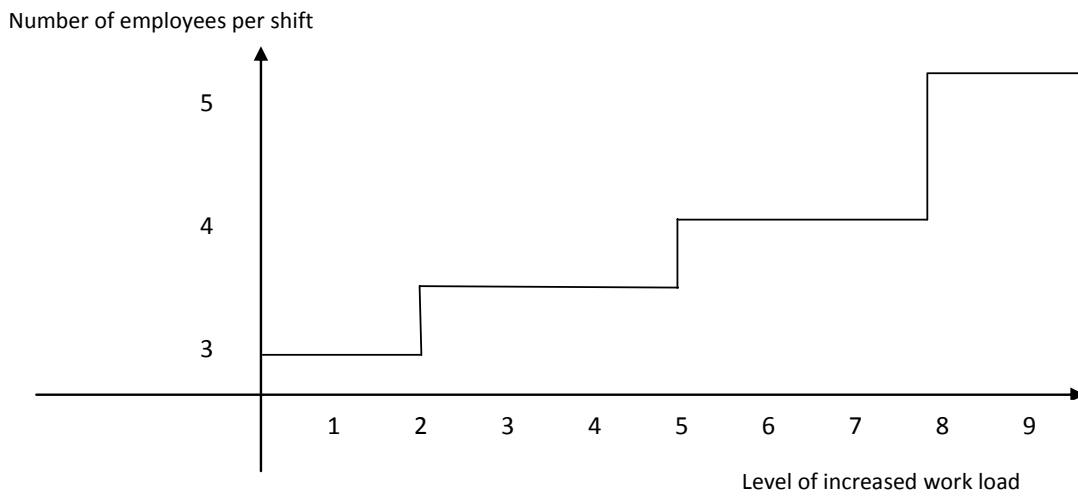
Figure 4 Demand Amplification Mapping

CUSTOMERS	TIER SUPPLIER 3	TIER SUPPLIER 2	TIER SUPPLIER 1	HOTEL						
Direct reservations	Tourism fairs and similar	Booking websites and other	Travel agents							

Reserv. inquiry	Reservation confirmation	Departure to the airport	Waiting for a guest(s)	Arrival with the guest	Check in	Accom	Check out	Departure with the guest	Arrival of the driver

Figure 5 Reservation Value Stream integrated with Physical Structure

Establishment of a need	Internal order	Tendering or search for the source	Order - Purchase	Delivery to the hotel	Delivery to the hotel segment

HOTEL			TIER SUPPLIER 3	TIER SUPPLIER 2	TIER SUPPLIER 1	HOTEL	Hotel customers

Figure 6 Procurement Value Stream integrated with Physical Structure