

Are you lean or just mean?

A study of the application of lean principles in
face-to-face service operations

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Abstract

Title	Are you lean or just mean? – A study of the application of lean principles in face-to-face service operations
Authors	Johan Belfrage and Per Hedberg
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Purpose	The purpose of the thesis is to analyze whether specific organizational changes could be interpreted as an application of lean principles. Furthermore we aim to study what the potential effects of such changes could be in terms of productivity.
Method	Due to the explorative nature of the thesis a midway between the inductive and deductive research approach has been used, referred to as abduction. The empirical research has been carried out by a single case study of two dental practices. The majority of the empirical data has been collected using qualitative methods whereas the theoretical framework that has been constructed is based on previous research on the subject.
Theory	Well established theories on the subject of lean production and lean principles constitute the theoretical foundation of the research carried out. Interpretations and translations of these theories and concepts have been necessary with regard to the fundamental differences between manufacturing and services in general and to face-to-face services in particular. A similar translation of the productivity measurement has been carried out with regard to the nature of face-to-face services.
Conclusions	The study concludes that the organizational changes that have taken place in the dental practices show many similarities to the concept of lean. Furthermore, evidence has been found that such initiatives have had significant impact on the performance of the dental practices. Various types of wastes have been successfully eliminated by stressing the need for quality awareness permeating the company as well as increasing the competencies of the work force, enabling a redefinition of the roles in the daily operations. In relation thereof we have concluded

that it is possible and relevant to apply the concept of lean to face-to-face service operations.

Key Words

Face-to-Face Service, Kaizen, Lean Principles, Lean Production Principles, Operational Transformation, Productivity, Service Processes, Waste.

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1.1 Introduction

The subject of operations management is concerned with managing and developing the internal resources, processes and capabilities in order to deliver superior customer value in the most efficient way. During our studies at Stockholm School of Economics we have both developed a strong interest towards the subject due to the fact that operations management constitutes the core of company activities with significant impact on its performance.

The essence of operations management can be summarized in one key performance measurement; productivity (Schmenner & Swink, 1998). Productivity measures the ratio between the input and output of a process, a value stream or the company as a whole. Our interest in productivity has its origin in the simplicity and the strong impact that concept have in understanding how to improve or increase the performance of companies.

The service industry has during the last decades had a strong growth and stands for a considerably larger share of country's GDP. Since operations management has its origin in manufacturing, the shift towards services has forced scholars to reconsider some of the well-established truths within operations management. The challenge is to apply the quantitative tools of operations management to the qualitative service factors such as value and experience. An operational paradigm that handles this transition is the concept of lean (Bartezzaghi, 1999). In its original form, lean production, focused on the elimination of waste but gradually lean production has widened to incorporate a more customer centered approach that incorporates the value perspective into operations (Hines et. al, 2004). This has been referred to as lean thinking with its corresponding lean principles which aim to identify and define what value to be created. Furthermore, this value should permeate the entire operations enabling cost-efficient value creation.

Our interest lies in understanding to what extent lean concepts can be applied to increase the productivity in service industries. We will therefore test these concepts in an "extreme" service situation where the qualitative values are of great importance, hence in a face-to-face service situation where the customer is physically present during the service process.

1.2 Background

Since Womack, Jones and Roos (1990) published the book *“The Machine That Changed The World”* the principles of lean production have spread and gained widespread acknowledge in the western world. Today lean manufacturing is considered the leading operational paradigm on the subject of operations management and the lean concepts are being practiced worldwide (Bartezzaghi, 1999). *The machine that changed the world* illustrated the performance gaps compared to other carmakers that the Japanese Toyota had been able to create through the application of a set of principles later referred to as lean principles. At this point in time the focus of the lean approach was on the cost cutting side of the firm and the ultimate goal was basically to eliminate everything, i.e. waste, that did not add value to the end product (Womack & Jones, 1996).

However, to know what waste is one also need an understanding of what is considered as value , but even today the value creation is often seen as equal to cost reduction. To some extent this has to do with lean’s origin from the highly competitive car manufacturing industry but from the 90’s up to date there has been a gradual widening of the focus beyond the shop-floor. Womack and Jones (1996) stressed the importance of the value dimension in lean principles and by turning towards a stronger focus on value one highlights the position of the customer in these processes (Hines et. al, 2004).

The evolution from the shop-floor to other types of businesses has also resulted in a debate whether a manufacturing logic could be applied in service industries. Similar discussions have taken place even prior to the introduction of lean. Levitt proposed such as transfer in the mid 70’s in *“Production-line approach to service”* and *“The industrialization of service”* but during the late 80’s and 90’s the management literature turned from viewing this as ideal to inappropriate with regard to the unpredictable nature of customer demand for services, the treatment of service employees etc (Levitt, 1972 & 1976). Throughout the discussions of whether manufacturing logic could and should be applied to services discussions concerning the transfer of service logics to manufacturing have been taken place. Some scholars advocate that this indeed have been carried out extensively (Bowen et. al, 1989; Chase & Garvin 1989; Chase et al, 1992; Youngdahl, 1996) since manufacturers often turn to services to differentiate their products. In one sense one could say that the boundaries between the two are beginning to blur and that there is a development towards a “common industrial paradigm” (Bowen & Youngdahl, 1998, p.222).

Turning back to the discussion of lean principles some scholars have argued that lean production, with some translations, is an instrumental methodology to improve service operations (Bowen & Youngdahl, 1998; Swank, 2003; Ahlström, 2004). But the empirical research regarding “lean service” is still limited and there is little knowledge about its general applicability (Hines et. al, 2004). The research to date has also been focusing on back office operations to a large degree such as the insurance industry, see for instance Swank (2003). The differences to manufacturing in these operations are not always that large which facilitates such a translation (Bowen & Youngdahl, 1998). However, looking at front office operations the research carried out have very often incorporated interfaces such as telephone or internet but when it comes to pure face-to-face interactions there is little research carried out on the subject. What distinct these operations from back office and remote interface services is that the customer needs to be physically present during the creation of the service and it is not only the outcome of the service but also the total experience that determines its quality and hence the customer’s level of satisfaction. The value dimension thus becomes subjective which might harden the service deliverer’s task to determine what value is and hence what waste is, creating a great challenge when it comes to applying lean principles in these operations. In relation to this and the lean concept’s prominent position in manufacturing industries we find the subject highly interesting as the question is whether service organizations could apply this paradigm to improve their performance. It is also a relatively unexplored area that create greater possibilities for a making a contribution that can be valuable for both theoreticians as well as for practioners.

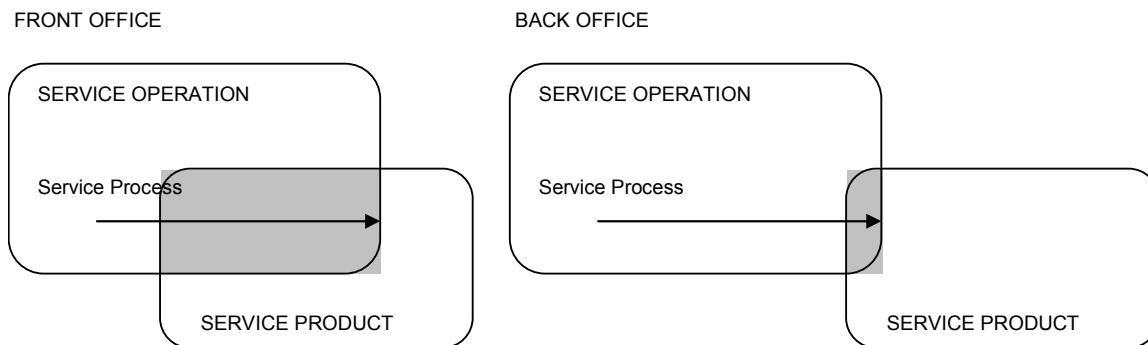
1.3 Purpose

The purpose of the thesis is to analyze whether specific organizational changes could be interpreted as an application of lean principles. Furthermore we aim to study what the potential effects of such changes could be in terms of productivity. Our unit of analysis in this research is the service process of two dental practices that has been trying to increase their efficiency of their operations through various organizational changes.

1.4 Limitations and definitions

Looking more closely at the service operation and processes as such we have already mentioned that one often makes a distinction between front and back office operations. The front office can be explained as the interface between the organization and the customer. It contains the parts of

a business that process customers and this is hence the part of the organization that the customers directly experience. Back office operations then contain the processes that are taking place behind the scenes, without any involvement of the customer. Depending on what kind of services we are talking about there are of course differences of the weight and importance of front versus back office. As mentioned in the background section research concerning the applicability of lean concepts to services has been performed to front office operations before but not that extensively in pure face-to-face operations. Hence we find it important to make it clear that we have chosen to delimit our research to operations with a distinct face to face character. Furthermore we have limited this research to the dental industry which we consider as a suitable industry, something we will motivate more extensively in the methodology part.¹



Johnston & Clark (2001, p.10)

Figure 1.4.1 The difference between back and front office operations

1.5 Disposition

In the figure below you can see how we have chosen to present the research we have been carrying out. After the introduction we are moving into the methodology part presenting why and what approaches and strategies we have been using. As to be explained in the methodology chapter we have been conducting our research with an abduction approach. Because of this the methodology part will be followed by a theoretical background which constitutes the foundation for our theoretical framework. It is on the basis of this framework that we have been carrying out

¹ Normally one should avoid references to textbooks but due to the pedagogic nature of figure 1.4.1 we have chosen to make an exception.

the empirical research which we present our as empirical findings in a rather descriptive manner. Based on these findings then we carry out our analysis which creates the foundation for our synthesis. In the synthesis we wrap it all up by; presenting our main conclusions, managerial implications as well as some interesting subjects for future research.

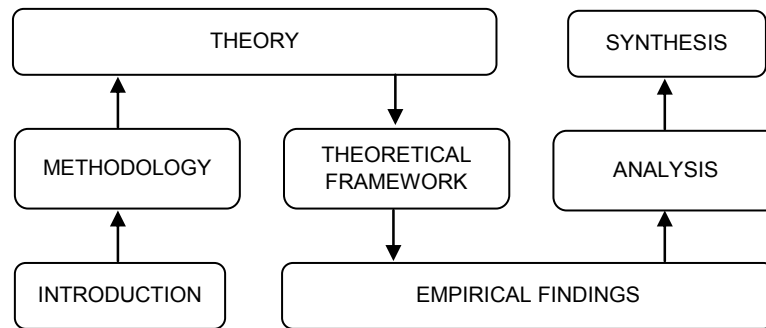


Figure 1.5.1 The disposition

2. Methodology

2.1 The Choice of Theory

The choice of lean thinking and its applicability to face-to-face services has three main strengths that make the study highly relevant; first, the concepts of lean has been described as the currently most acknowledged operational paradigm (Bartezzaghi, 1999) and consequently it becomes the natural choice when deciding among which operational theories to apply in a study of the possibilities of increasing the productivity in face-to-face services businesses.

Second, the service sector has during the last decades grown to stand for an increasing amount of countries GDP increasing the importance of the service economy. Due to fierce competition manufacturing companies are often reconstructing their market offerings by adding service dimensions to differentiate themselves and service features are emerging as order-winning criteria (Johnston, 1994). In some cases companies have even gone into functionalizing their products, e.g. by selling kilometer usage of a truck instead of selling the truck in a single transaction. Because of this there is a strong demand for an operational perspective that can handle the shift from pure waste reduction to value creation. Lean thinking is one operational paradigm that can help handle these new operational complexities.

Third, lean thinking add a strategic perspective to operations management. Hines, Holweg and Rich (2004) states that lean thinking is crucial in understanding customer value on a strategic level whereas lean production and the elimination of waste is crucial on an operation level, hence not necessarily linked to the strategic objectives of the company. As the customer is present throughout a face-to-face “manufacturing” process we consider the service provider’s notion of what is value to be of strategic importance to the success of the business. Hence, the fact that lean thinking incorporates these factors makes it highly relevant to the study.

2.2 Research Approach

When conducting research there are basically two extremes when it comes to what kind of research approach that could be used; the inductive and the deductive one (Arbnor & Bjerke, 1994). Making this choice is however highly dependant of the research question at hand. As can be seen in the figure below the inductive approach is concerned with creating theory whereas the

deductive is about testing inductively generated results. Hence the inductive approach has its starting point in a certain phenomena or phenomenon and in contrast the deductive one starts out in theory. Because of this the research question and previous research carried out affects what kind of approach that can be applied. As mentioned earlier there is not much research carried out within the subject of lean principles and its applicability to face-to-face service operations. Because of this the possibilities for conducting deductive research are limited. A weakness with deductive research as we see it is also the fact that the researcher chooses a hypothesis to be tested leaving other factors that could affect the studied phenomenon out of the picture. Strictly inductive research on the other hand should be carried out on the basis of no theory at all but as Alvesson & Sköldberg (1994) states; no one comes empty-handed to a research process.

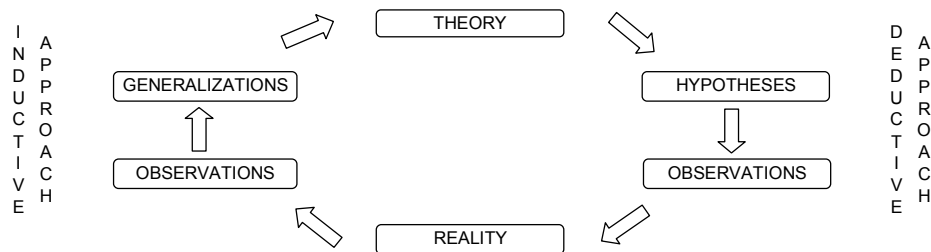


Figure 2.2.1 The abduction approach

As an alternative to the two extremes there is a third research approach; abduction, which could be described as a midway of the other two (Alvesson & Sköldberg, 1994). During the research process both the theoretical and empirical findings are adjusted. The main difference is that abduction incorporates the understanding of the underlying pattern while the other two take a more general perspective. In practice, this approach interprets a case by an underlying theoretical framework that has been developed prior to entering the field. The benefit of this is that the researcher can come up with conclusions that are highly valid for a limited setting, and in comparison to an inductive approach the researcher is not forced into striving to make the findings become generally applicable to the same degree. Even though inductive research is highly important we believe that the requirements to make it generally applicable results in a risk that it becomes too general to be valid for practioners. Hence, abduction seemed to be a suitable approach to the kind of research we are interested in undertaking. In our research the principles of lean constitute the foundation and it is with this perspective that we will enter the “world out there”. The connections and accuracy of these theoretical predictions are then tested with regard to our empirical findings and necessary adjustments to the theoretical framework are carried out to make it more accurate.

2.3 Research Strategy - The Case Study Method

2.3.1 Why the Case Method?

Given the purpose the question then comes to how we should go about conducting our research. One method when undertaking abduction is the case study method (Yin, 1994). This explorative approach is especially good when it comes to gaining a deep understanding of the studied cases. Meredith (1998) cites three outstanding strengths of the case research method

- The phenomenon can be studied in its natural setting and meaningful, relevant theory can be generated from the understanding gained through observing actual practice.
- The case method allows the questions of why, what and how, to be answered with a relatively full understanding of the nature and complexity of the complete phenomenon.
- The case method lends itself to early, exploratory investigations where the variables are still unknown and the phenomenon not at all understood.

Since we are dealing with abduction the case method also offers great flexibility both regarding the research question itself as well as how the data collection process and the data collecting methods are designed. Possibilities for using virtually any kind of data collection methods and strategies e.g. qualitative, quantitative as well as observations etc is referred to as triangulation and we see these possibilities as a considerable strength with regard to our research question. In one sense one could say that the research question evolves over time, gradually shifting from theory building to theory testing. (Voss et al, 2002). Underlying this flexibility is the inevitable feature of the case study method of overlapping data collection and data analysis processes enabling flexible data collection where adjustments (e.g. by changing a interview protocol) can be made to better capture the essence of the phenomenon. Eisenhardt (1989, p.539) comments this:

“These alterations create an important question: Is it legitimate to alter and even add data collection methods during a study? For theory building research, the answer is “yes”, because investigators are trying to understand each case individually and in as much depth as feasible. The goal is not to produce summary statistics about a set of observations....” but “to better ground the theory or to provide new theoretical insight.”

Other reasons for choosing a case study method are the facts that we are being exposed to real problems in this kind of research as well as working closely with practitioners who can be seen as the ultimate user of research, something we find personally stimulating.

2.3.2 Choosing cases

The choice of industry

The actual selection of cases and industry has been carried out with a couple of factors in mind;

- We were only interested in looking into service operations with a distinct face-to-face character which requires the customer to be physically present during the service delivery.
- We also restricted our search to services where the customers are directly paying for the service as price is an important determinant of the perceived value.

After discussing several alternative industries we choose to go for the dental care industry. There are several reasons to this; first of it lives up to the conditions we have stated above. Besides this we had good possibilities for gaining access to this industry through personal contacts. The dentist industry is also a service that we are familiar with due to own experiences and we also had some awareness of different methods of working which we believe could be interpreted by the application of lean concepts. We also assumed that what customers seek for in the demand for these services vary, especially nowadays when dental services are no longer regulated. Our interpretation is that such variations might give rise to differences in customer preferences.

The choice of number of cases

There is always a trade off regarding how many cases to choose; choosing a limited or even a single number of cases creates possibilities for great in depth analysis but it also limits the possibilities for generalize from the models or theory developed from the research. When choosing multiple cases then it reduces the possibilities for in depth analysis but augments external validity and help guard against observer bias. Some scholars advocate that when one is reaching saturation, that is when the marginal utility of another case is low, then is a suitable time to stop adding cases (Voss et al, 2002). When writing a thesis however you have to keep to certain time frame why we have chosen to limit the number of cases to one.

Choosing cases

When it comes to actually choosing the cases the question arises of which companies to contact. Regarding this a stark contrast between inductive and deductive research arises. When carrying out deductive research aiming at testing hypothesis the choice of cases should be made by sampling out cases, in a rather statistical form, from an appropriately chosen population. However, when it comes to abduction and more inductive research in general, such sampling is unusual and instead replication logic is used. This is done by building a sample of cases

according to different criteria. Three methods are proposed that have great pay-off in case research; (1) to find a typical and representative case, (2) to find disconfirming cases or (3) to identify polar types (Yin, 1994) i.e. cases with sharply contrasting characteristics that highlight the differences with respect to the research question at hand. In our case selection we have chosen to follow a combination of the first and third approach. This implied that we were trying to identify a case company with regard to a number of sampling criteria that was put up before contacting the potential participants.

To be able to determine the possibilities for applying lean principles in a face-to-face setting the ideal would be to identify a case company that claim they have been applying lean principles in an organizational transformation. Further on the effects of these changes would have been analyzed to examine its results. We would then have had a more evident connection between the variables and the effects which indeed would have resulted in a more explanatory study. However, as the possibilities for identifying such a case were limited we focused on identifying such characteristics that according to interpretations showed similarities to the concepts of lean.² Having gained a deeper understanding of the concepts and the evolution of lean emphasis was put on achieving an empirical foundation to build upon and by web searching³ and a pre-study interview⁴ we developed a good understanding of different methods of working within the industry. Based on the theoretical as well as the empirical knowledge a number of sampling criteria was set up that were constructed with prior research on the subject of lean in mind, such as Womack et al (1990).

- The potential case companies should have analyzed their operations thoroughly and carried out organizational changes aiming at rationalizing their processes.
- There should exist distinct differences, e.g. in terms of process design and/or service delivery, in their way of working prior to and after the implementation of these organizational changes.
- The potential case companies should have been adopted a flow oriented system characterized by a team approach, in the dental industry referred to as delegated dental care.

² If we had identified such a case company we would basically have been able to exclude the first part of the purpose and instead analyzed how such a company had chosen to apply lean principles.

³ Websites such as; www.privattandlakarna.se, www.praktikertjanst.se

⁴ Pre-study Interview, Dentist Bengt Myllenberg, 2005-03-20

- As we saw a reduction of the throughput time as one of the main possibilities for eliminating waste in face-to-face service operations the potential case companies should have increased the number of processed customers substantially.

Our choice of case

During the pre-study interview we received recommendations of companies and people to contact that had been involved in organizational changes. We then contacted two dentists who were described as modern ones in their way of working. The organizational changes that had been undertaken stretched over the entire value creating activities of the practices. Foremost the practices had focused on the creation of a flow oriented system enabled by the increased autonomy of the workforce. Their current way of operating also stood in stark contrast to how they had been working historically. Having consulted our tutor and concluded that they were representative with regard to the sampling criteria they were asked to participate in the study, both was positive to attending.

2.3.3 Research Model

Case research often results in vast empirical data why the importance of a well defined research question must be stressed, a clear focus is crucial and the case study method should not be an excuse for “industrial tourism”. A good research question also help specify what organizations to be approached and hence what data to be collected. Eisenhardt (1989) states that strictly inductive research should be characterized by the researcher being as close to no theory as possible. Our interpretation of this is that it becomes very hard to create well defined research questions without finding some important variables to look at based on previous research. Because of this abduction has been chosen allowing us to construct a theoretical framework on the basis of previous theoretical and empirical findings on the subject of lean. Based on the theoretical framework we then enter the field choosing cases that are likely to be fruitful with regard to the research questions at hand. As illustrated by the research model below a number of sampling criteria has been set up to help identify such cases. Given the theoretical framework constructed we then aim to answer whether the service process could be considered a lean one or not. Furthermore we aim to analyze its potential effects on productivity.

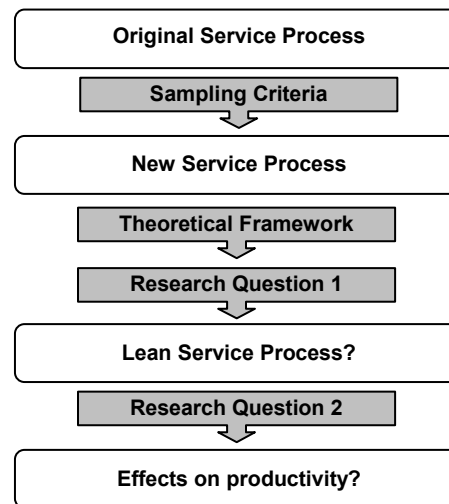


Figure 2.3.3.1 The research model

2.3.4 Data Collection Methods

As mentioned, one of the main benefits of the case method is the fact that the researcher can use virtually any kind of data gathering methods. The use of both quantitative and qualitative data gathering methods is hence possible which could be valuable since the quantitative ones often are used for discovering relationships whereas the qualitative ones are more powerful when it comes to understanding these relationships (Eisenhardt, 1989). However, even though our initial thinking was to carry out a quantitative survey of the customers' perception of the value creation before and after the transition to a more modern practice we soon realized that this would be hard to capture due to the retrospective nature of the study.

The case method also allows the researcher to employ both of the two sources for data gathering, which is; primary (new information) and secondary (already gathered information) (Arbnor and Bjerke, 1994). Prior to entering and choosing the cases we focused a lot on collecting secondary data through various websites⁵ to help us picture the situation at a dental practice as well as getting a feel for the development of the industry. When it comes to the primary data collected we have primarily been working with qualitative methods. In the interaction with the dentists and other personal such as dental nurses and dental hygienist then most of the material has been collected through the use of semi structured interviews with standardized

⁵ Websites such as; www.privattandlakarna.se, www.praktikertjanst.se

questions. To enhance the validity in these interviews a interview guide (see appendix 1) has been used structured according to the funnel principle (Yin, 1994), i.e. where the interview questions gradually are becoming more and more precise.

In the empirical parts of the thesis we have been trying to illustrate the empirical findings as objectively as possible keeping it free from our own thoughts and interpretations. Since the empirical material is vast we have chosen to present only extracts of what has been discussed. This implies that a subjective element enters that perhaps could affect the possibilities for evaluating whether or not our analysis and conclusions are reasonable. However, this is something that we have been having in mind when determining what empirical data to present, hence striving for finding a balance between pros and cons that is representative for the empirical data. We also believe that the collected material is sufficient for answering the purpose of the thesis.

2.3.5 Conducting the field research

The actual field research was carried out by interviewing two dentists from here referred to as Dentist 1 and Dentist 2, owners of the dental practices being studied. These interviews were followed by one with a dental nurse and one dental hygienist. When choosing whom to interview we considered that informants are prone to subjectivity and bias, hence we thought it was important not to rely on one respondent only but to strive for multiple viewpoints and different functional background. More importantly, collecting data from multiple sources will increase the reliability in the findings. All interviews have been taped and even though we don't consider the exact words as that important taping has allowed us to return to the interviews when in need of clarification. We hope that the thesis have benefited from this just as the use of more than one investigator in general. By complementary insights and different views the chances for seeing different things increases just as it enhances the creativity process while conflict keeps the group from jumping into too early conclusions (Eisenhardt, 1989). Throughout the collection of empirical data field notes i.e. running commentary have been taken both regarding the empirical findings as well as the initial analysis. As there inevitably is an overlap between data collection and data analysis in case research there is always a risk of jumping into too early conclusions. To counteract this field notes referring to the empirical findings and the ones for the analysis have been held apart. We have also been trying to look for cause and effect relationships, convergence and clarification as well as questioning and/or seeking other sources of data to clarify when differing and incomplete views have emerged.

2.3.6 Analyzing the case data

In order to avoid jumping into premature of false conclusions we have been striving for keeping the empirically generated data as descriptive as possible. The actual analysis of the data has then been carried out in two phases. We started out by analyzing within case data from the interviews separately and were then moving on to looking for cross patterns between these interviews. By looking at the data in many divergent ways we tried to analyze the cases by going beyond the initial impression.

2.3.7 Synthesis

Having analyzed the empirical findings we aim to reconnect to the theoretical framework created in order for us to determine its relevancy. Furthermore the framework will be refined and revised in order to make it more accurate with regard to the patterns we have been able to discover. A key component of this process and of abduction in general is the comparison of these findings to what has previously been written. This is important for two reasons; (1) if we ignore it the confidence in our findings will be reduced, (2) conflicting literature creates an opportunity for gaining deeper insights as well as it helps defining the boundaries for the generalisability of the research findings (Eisenhardt, 1989). Hence the synthesis includes the theoretical contributions from the research carried out and more importantly what practioners can learn from the findings.

2.4 Validity and Reliability

2.4.1 Construct Validity

Construct validity is to what extent the operational measurements that are used are correct according to the concepts that are being studied; hence the question to be answered is if the chosen measurements actually are measuring what they are aiming to measure. When using a case study method it is important to acknowledge the subjective biases in all empirical findings. The risk is that subjective judgments influence the data gathering as well as the direction of the research and the conclusions. We have continuously throughout the study considered this risk and taken actions to remain as objective as possible. We have used three procedures stated by Yin (1994), which aim to increase the construct validity:

1. Yin emphasizes the importance of using multiple sources of data during the data collection, in order to cross check the data and to assure the quality. During the data collection we used secondary data to confirm that the data gathered from the interviews

were reasonable. Examples of such sources are Privattandläkarna's Addera program⁶ as well as the work carried out by numerous consultants within the industry⁷.

2. Yin also states that a chain of evidence is crucial to obtain a high quality of the data. To establish a chain of evidence we subsequently reviewed the newly gathered data to secure that there were consistency in the findings.
3. The final consideration that Yin points out is to have a draft of the case study reviewed by key informants; this was done once during the study a couple of weeks prior to handing in the final version by having one of the dentists reading it.

2.4.2 Internal validity

Internal validity is concerned with finding and explaining causal relationship between a set of variables and an outcome, e.g. event X and Y led to result Z and so on (Yin, 1994). Hence the question of a study's internal validity is primarily connected to explanatory studies of deductive nature where it is clear that such relationships can be identified and tested. When it comes to explorative research however internal validity is always regarded to be low why we can conclude that internal validity is not an issue given the qualitative nature of our study.

2.4.3 External validity

External validity is concerned with the issue of knowing whether the findings can be generalised beyond the immediate case study (Yin, 1994). There is always a trade off between using multiple cases with the risk of lack of depth in the data gathering and using just one which might harm the possibilities for generalizing from the results. Due to our choice of one industry and the explorative nature of the study, and to explorative ones in general, it is however hard to establish high levels of external validity. Even though we believe that similar conclusions could have been drawn from studies of other dental practices there is no evidence that these findings could be generalised to other face-to-face service industries.

⁶ http://www.tandvard.praktikertjanst.se/templates/Page_____276.aspx, 2005-08-06

⁷ Such as Gordon Meland among others

2.4.4 Reliability

Reliability indicates dependability, stability, predictability, consistency and accuracy and refers to what extent which a measuring procedure yields the same result (Yin, 1994). We have taken several actions to obtain a high reliability. During the interviews we used a tape recorder to assure that no data was missed. The content was then reexamined several times individually after which we compared our interpretations of the data. As mentioned earlier the thesis has also been reviewed by one of the dentists being interviewed.

We feel confident that the results from the thesis have high reliability and that the study could be repeated with the same results if carried out again. Note however that this study is retrospective in its nature which means that we have entered the case at a point in time where the organizational changes they have been undertaken have had the opportunity to mature. This implies that the initial difficulties that the dental practice might have experienced have been given time to overcome, correct or compensate for. Hence, if we had been entering the case companies in the middle of the change process we might have experienced other answers to our questions as well as differing opinions regarding its outcome.

3. Theoretical Background

The purpose of this part of the thesis is to present the relevant theories and empirical findings that will constitute the foundation for our theoretical framework and analysis. Our focus will be on the latest theories within lean thinking but to understand these theories to its full we will describe the evolution of the lean concept from its starting point; lean production. We touch upon the links between service and manufacturing industries with regard to lean throughout this description but look more thoroughly into the fundamental differences between manufacturing and services in the later parts.

3.1 The rise and spread of lean

The concept of lean production was first introduced by Krafcik (1998) but it was not until Womack, Jones and Roos's book *The Machine That Changed The World* (1990) that the concept gained widespread attention in the western world. The Japanese car manufacturing firm Toyota was the focus of this book and its performance was compared to other players within the industry. As Toyota's operations outperformed most of its competitor's interest arose in understanding Toyota's way of manufacturing. Following research highlighted the innovative ways that the Japanese had developed due to the scarcity of resources in their business environment. Concept like just-in-time (JIT) production systems, the kanban method of pull production, respect for employees and high level of employee problem-solving/automated mistake proofing were stressed (Womack & Jones, 1996). The similarities of these concepts were their objective of eliminating waste which by definition was everything that did not add value to the end product e.g. inventories and defects. Hines et. al. (2004) discusses the development of lean in general by dividing its evolution into four stages. As can be seen in picture 3.1.1 below we have been trying to illustrate these four stages and we can see how the concepts of lean gradually have widened over time.

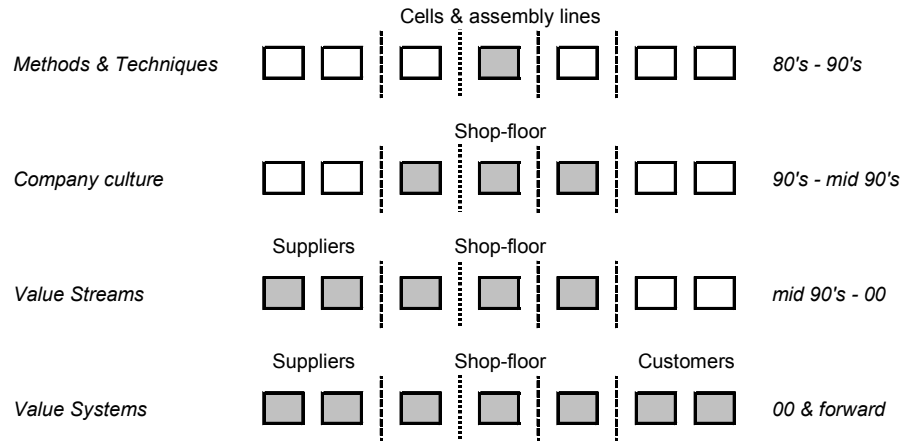


Figure 3.1.1 The evolution of lean

At the first stage the organization believe that there is a best way of doing things, hence a company at this stage is closely related to the thoughts of scientific management proposed by Max Weber and Frederick W. Taylor. The lean concepts in these settings were highly prescriptive in its nature and focused around certain methods and techniques within single cells or assembly lines. During the second stage there was still a strong focus on best practices but the scope of lean had now been widened. Besides methods and techniques it also incorporated a strong company culture built around some of the core values within lean such as employee empowerment, Total Quality Management (TQM) as well as the strive for perfection by small incremental improvements. This factor that was considered a main explanation why lean production failed to succeed to anticipated levels when implemented in western world companies as they failed to acknowledge the importance of these human aspects (Hines et. al, 2004). During the third phase the unit of analysis stretched even further and now individual value streams including supplier activities as well brought the attention. Attempts in finding ways to make lean concepts more generally applicable to a wider range of businesses were carried out by Womack & Jones (1996) through the introduction of lean principles which aimed to explain how lean initiatives should be put into practice. The increased focus on value was also stressed but critics argued that these considerations seldom moved beyond specific business processes. Because of this the fourth stage addresses the shortcomings of the scope of the value stream by focusing on value systems. It advocates approaches that actively capture the true customer needs which could be employed by the use of several tools stemming from various management practices such as lean manufacturing, agile manufacturing, marketing, revenue management etc.

3.2 Lean Production

Above we have been trying to describe the evolution of the lean concept over time on a rather general level and it's obvious that the concept gradually has widened its scope. A transition of the scope of lean from the shop-floor to merely every activity that companies undertake makes the concept much more complex in nature. The most distinct difference between early lean studies and later ones is the increased focus on value (Hines et. al., 2004). With the evolution of the lean concept in mind let us now move into a more detailed look of these concepts individually. We start out with the foundation; lean production, and will later move into lean thinking and its lean principles which are focusing on value to a much larger extent.

3.2.1 The seven principles to lean production

Within the manufacturing area there are seven principles that define lean production (Ahlström, 2004). These were the ones that were developed at Toyota and hence it has its roots in the manufacturing industry. In order to examine the applicability of these principles Karlsson, Rognes and Nordgren (1995) carried out several case studies. We have chosen to exemplify the principles with empirical findings from one of these case studies where the principles were applied to a hospital. The reason for this is that the nature of the operations is somewhat similar to the one in the dental industry.

Elimination of waste

This is the most fundamental principle of lean production. Waste or muda is anything that do not add value to the product, in general terms; anything that the customer would not be willing to pay for (Monden, 1983). Examples of waste that could be identified in the operations of the hospital were over usage of materials, unnecessary surgery and over treatment of patients.

Zero defects

To be able to have high productivity with lean production it is important that the products are fault free from the beginning. This principle has a proactive approach and focus on preventing error before they occur. To assure this, quality is a responsibility of everyone instead of a specialized part of the workforce (Wheelwright, Bowen, 1996). Striving for zero defects was of course of highest importance in the hospital case study and e.g. by achieving stringent procedures and processes as well as assuring the quality of materials and drugs helped preventing errors occur.

Pull instead of push

This principle targets the material flow in the manufacturing process. The starting point of the production is when the customer places an order. The order is then pushed backward and eventually parts are pushed upwards in the chain. This principle help minimize inventories throughout the process. In the case the flow of patients could be said to be based on a pull principle as the patients need arises. But since not all treatments are urgent the hospital aimed toward as mixture of both pull and push where the push was done by scheduling and queuing of the patients (Karlsson, Rognes and Nordgren, 1995).

Multifunctional teams

Members of the workforce are assigned to teams and each member of a team have the competence to perform a majority of all tasks within the manufacturing process (Wheelwright, 1981). The concept of multifunctional teams was well developed in the hospital. The research showed several types of teams; surgical teams, nursing teams and care taking teams. Even though the different professional roles have legislated differences in responsibility there were still some flexibility of which employees could perform the different tasks (Karlsson, Rognes and Nordgren, 1995).

Decentralization

The responsibility and authority is decentralized to be as close to the production process as possible. In the case, empowering the staff close to the patients was important and regarded as value creating for the patients by avoiding delays and wait (Karlsson, Rognes and Nordgren, 1995).

Vertical information systems

With decentralized responsibility, direct information flow to the relevant decision makers is a prerequisite. The system keeps the multifunctional teams updated with performance and operational objectives as well as information for problem identification and solving (Wheelwright, 1985). In the case vertical information system enabled information sharing throughout the whole organization, creating a better flow of patients in the hospital (Karlsson, Rognes and Nordgren, 1995).

Continuous improvements

Elimination of muda, i.e. waste, is said to be the most fundamental principle of lean, and second is kaizen. Kaizen, is the constant and never ending strive for perfection through small incremental improvements (Imai, 1986). In the hospital there were meeting held to discuss and to work with continuous improvements (Karlsson, Rognes and Nordgren, 1995). According to Ahlström (2004)

however such meetings do not guarantee that the creation of an environment and culture of continuous improvement is established.

3.2.2 The waste concept - seven wastes

As stated the most prominent characteristic of the lean concept is the elimination of waste (Hines, Holweg, Rich, 2004). Waste has a broad meaning and its definition has evolved over time but the most common definition was stated by Monden (1983), who defined waste as “anything that does not add value to the product”. At Toyota seven types of waste had been identified (Womack & Jones, 1996).

Over production is considered as one of the most serious types of waste. The consequences are not just large inventories but long storage times that may cause that defects that are not detected fast enough. More importantly there is always a risk that products deteriorate or remains unsold due to changes in customer demand. The principle of pull is a way to overcome this problem.

Wait is a waste that occurs when time is used ineffectively, foremost when resources are not producing or when free time is not used for training, maintenance or kaizen activities. According to lean principles the ideal state is when there is a constant flow in the production process, keeping the transforming resources occupied at all times.

Transport occurs when goods are being moved around. Unnecessary transport is a result of poor layout and can result in damaged products and interruption of flow. The distance may also result in poor communication and lack of follow up on poor quality products.

Over processing is a waste that can be found in overcomplicated processes where only simple procedures are necessary. An example of over processing is when large more complex machines are used when smaller ones could be used to perform the same tasks. The result of large investments can encourage employees to overproduce in order to recover the large investments. Over processing could also emerge as the production process becomes too extensive in the sense that it goes beyond what the customer really is in need of e.g. in terms of quality etc.

Unnecessary inventory is clearly a waste which tends to increase lead time, prevent rapid identification of problems and increases the need for space, all contributing to higher costs.

Unnecessary movements involve the ergonomics of production; the operators are uncomfortable during the production which could reduce productivity and in some cases also lead to quality problems and wear damage.

Defects are the final waste, as these are a direct cost that occurs. From a lean production perspective defects should be regarded as opportunities for improvement rather than just something bad. Solving the underlying problem to prevent these defects reappearing in the future is stressed rather than simply correcting the mistakes already made.

3.3 Lean Thinking

Lean thinking takes the next step in the evolution of lean by refocusing the concept of value to the perspective of the customer. Some researchers have stressed the importance of distinguishing between the value stream (see figure 3.1.1 for a recap), where the customers need is taken “for granted”, and the value system which more actively tries to capture the true customer need. This means that the previous value concept generalized and assumed that different factors would be perceived as value adding by the customer, example; higher quality will generate a higher value for the customer. However, the essence of modern lean thinking is to create the specific value that is perceived and valued by the customer, hence not taking for granted that some factors by nature are value creating. Lean thinking is concerned with delivering exactly what the customer needs and is willing to pay for. If the customers need is fulfilled from a quality point of view, increased quality could be a case of over processing and can yet be considered as waste.

With regard to this Hines, Holweg and Rich (2004) have developed a framework that defines the relationship between cost and value creation. A market offering that is positioned on the line in the cost-value equilibrium in figure 3.3.1 below provides exactly as much value as the customer is willing to pay for. The frame defines two ways to increase the overall value, hence positioning the outcome above the cost/value-equilibrium. The first way is the well established view of lean production; as internal waste is reduced the overall value proposition is increased as an effect of the cost savings passed on to the customer by lowering the prices (1). The new dimension, i.e. the post 1996 lean thinking, includes additional features that add value in the customer's perspective (2). An example of this could be a shortened delivery cycle or small delivery batches, which doesn't add any cost, but still might be perceived as increased value in the eye of the customer (Hines, Holweg, Rich, 2004).

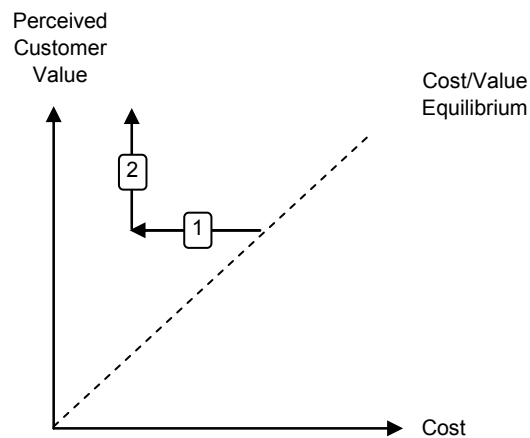


Figure 3.3.1 The cost-value equilibrium

The focus on truly understanding the value of the chosen customer segment also adds a strategic perspective to operational decision making. (Hines, Holweg, Rich, 2004). The strategic perspective is crucial to evaluate and prioritize those operational improvements that will provide the highest value in order to develop the operations in the right way.

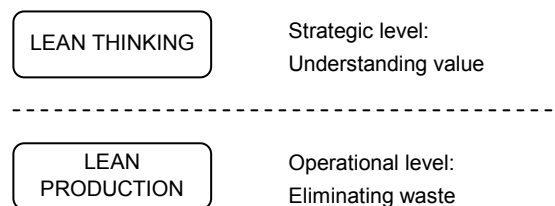


Figure 3.3.2 The strategic level of lean

3.3.1 Lean principles

The underlying principles connected to the emergence of lean thinking are its corresponding lean principles that transform the conceptual lean thinking paradigm to concrete actions and functions. The strength of the lean principles is that they are in fact a series of steps to implement lean thinking (Haque & James-Moore, 2004).

1. Specification of value

The fundament of this principle is to identify the specific value of the end customer in terms of the most important features of the market offering. The complexity of this principle is that there might be slightly contradictory perceptions of value within different market segments. Failure to exactly identify the value might result in highly inefficient operations that are not fully delivering there right value and as a result of this are undertaking non value adding activities.

2. Identify value stream and eliminate waste

The value stream is constituted by all the specific actions required to create and deliver the market offering. According to Womack and Jones (1996) the value stream start at the service launch and reach until the service has been fully experienced by the customer.

3. Create flow

This principle is focusing on process design and the establishment of capabilities that enable continuous movement throughout the process with no wait. To avoid sub-optimization companies need to consider the entire value stream which usually requires introductions of new processes and technology.

4. Create pull

To deliver only what the customer wants only when the customer wants it is crucial for the elimination of waste. Letting the customer pull the production through the value stream, by a produce to order logic, eliminates inventory and keeps the company from overproduction.

5. Pursue perfection

In order to maintain lean production there need to be a constant strive to identify an even more precise definition of value and a continuous alignment of the company processes to meet that value proposition. It is only by continuously improving the value specification, challenge the steps in the value stream and increasing the speed in the flow that hidden waste can be identified and eliminated.

3.4 Lean Services

3.4.1 Development of lean in service industries

As the service sector have gained ground and increased in importance research were made on the applicability of lean principles to services. The results from these studies show that some of

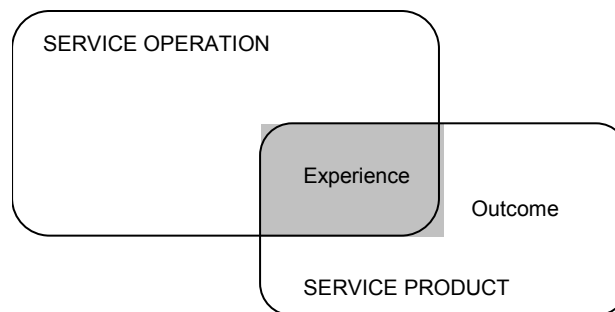
the principles were even more suitable for a service process whilst other was significantly more complicated to apply. Ahlström (2004) stated that the lean principles need to be translated and interpreted according to the nature of the service. The principle of elimination of waste and zero defects are two principles that needed fundamentally different interpretations in service processes. Something that in a manufacturing perspective might be regarded as waste, might on the other hand add value in the experience of the service delivery. According to Ahlström zero defects is a principle that is very hard to achieve as the customer is a part service process, the focus of this principle should instead be on recovering failure. He also states that the principle of pull is easy to apply as services are impossible to store, therefore services are pull by nature. The principles of multifunctional teams, decentralized responsibility and continuous improvement are unaffected by the translation, whereas the use of vertical information system is even more applicable to a service process than a manufacturing process (Johnston and Clark, 2001). Due to the nature of the service as being produced as it is consumed, centralization is impossible and the need for sharing information is increased.

The research up to date regarding the applicability of lean principles in service operations have to a very large extent been focusing on back office and remote interface (internet, telephone) front office operations. Several such studies has been presented e.g. by Ahlström (2004) and Swank (2003) who analyzed the implementation of lean in a full-service life insurance and annuities company. Other examples are Bowen and Youngdahl (1998) who looked into the operations at Taco Bell who successfully split the front and back office operations gaining substantial better back office performance. In those cases, and as Bowen and Youngdahl concludes, the use of modern technology have had a profound role in making the application of lean to services operations possible. They also conclude that the processes taking place in back office operations do not differ that significantly from manufacturing operations why the success in the transfer of these logics to service operations may not be that surprising. In fact they see a trend towards a common industrial paradigm where the traditional service and manufacturing logics are coming together. Service logics are transferred into manufacturing as companies try to differentiate their market offerings with service features and service operations are trying to improve their performance e.g. by the application of lean. In general such operations also makes the costumers role as service specifier, quality inspector and co-producer become more evident (Johnston & Clark, 2001).

3.4.2 Productivity in face-to-face services

Producing a service creates new challenges for the operations, and as a consequence of these new requirements, fundamental operational concepts such as productivity have been forced to be

reconsidered. Martin and Horne (2001) stress that adaptation of productivity measures needs to be carried out when they are to be applied in service operations. The reasons for this are an effect of the fundamental differences when dealing with either services or goods. When it comes to face-to-face services the customer is present and sometimes even a co-producer of the service putting it in direct contact with the service provider (Duclos, 1995). In contrast to manufacturing firms service firms are also producing something rather intangible, an action or performance. Its intangible nature makes it impossible to store services and since the quality of the service offering cannot be checked prior to its delivery the perceived quality will be highly dependent of the customer's expectations. Because of these characteristics the service product, that is the primary reason customers are paying for, are often divided into two components (see figure 3.4.1 below); the service experience and the service outcome. The service outcome is known as the end result of the service to the customer whereas the service experience is the customer's direct experience of the service process and the way that the customer is being dealt with by the service provider. It is on the basis of these two components that the quality and hence the perceived value of the service is determined by the customer (Johnston & Clark, 2001).⁸



Johnston & Clark (2001, p.8)

Figure 3.4.2.1 Service experience and service outcome

Hence, translating productivity measurement to a service implies a complexity in the definition of productivity i.e. the definition of the input and output factors. To exemplify; one could consider the customer as a resource and hence co-producer of services. From a service productivity perspective, defined as output over input, this might be regarded as a benefit since increased productivity could be gained through a decreased need of operational resources, e.g. in self-service restaurants (Johnston & Clark, 2001). But as the experiences from the service process is

⁸ Normally one should avoid references to textbooks but due to the pedagogic nature of figure 3.4.2.1 we have chosen to make an exception

a major determinant of the perceived customer value this raises an important question regarding the service productivity which according to our interpretations of the lean concepts organizations should be trying to increase. They conclude that existing literature concerning service productivity measures have been focusing on internal rather than customer or client productivity. But when the customer has such a profound role as in services with a dominating front office character there are several reasons for examining customer productivity as well since (Johnston & Jones, 2004);

- the customer often plays a dual role as both customer and co-producer of the service
- customer productivity can have a significant impact on the quality of the service and overall productivity
- understanding customer productivity adds a layer of complexity

The fundamental characteristics of services mean that it is difficult to objectively define and to translate service outputs into productivity. Despite these difficulties Johnston & Jones (2004) are making an effort to come up with a definition of service productivity that contains both the company and the customer perspective. The resulting terminology is operational and customer productivity. Customer productivity could be described as a function of the customers input of time, money and effort to their output such as outcome, experience and perceived value whereas operational productivity output are revenue, customers, used resources over materials, staff etc.

$$\begin{aligned} \text{Operational productivity} &= \frac{\text{revenue, used resources, customers, ... (output)}}{\text{materials, staff, costs, customers,... (input)}} \\ \text{Customer productivity} &= \frac{\text{experience, outcome, value,... (output)}}{\text{time, effort, costs,... (input)}} \end{aligned}$$

Johnston & Jones (2004, p.206)

Since Johnston & Jones separate these productivities a relationship between the customer and operational productivity is created which not always drives in the same direction i.e. what is higher operational productivity might be regarded as lower customer productivity. Let us consider a case when these two kinds of productivities might contrast each other.

According to lean principles an operation should strive for flow and gradually increase the speed of its operations as well as finding other areas for improvement. However, when we are

considering productivity in the way stated above a faster flow that increases operational productivity may actually decrease customer productivity. As the customer is processed faster the customer may find the service experience less appealing and customer productivity decreases. The question and the biggest challenges are what the objectives of the business are and how to balance among various choices as they do not always drive in the same direction, something that could have possible impact on the prerequisites for the application of lean principles in face-to-face characterized services.

4. Theoretical Framework

Since the purpose of the thesis is to look at how existing theories can be applied to a new setting there is a need to explore and to translate these theories with regard to the nature of face-to-face services. Because of this we are now moving into the creation of our theoretical framework which could be described as how we have chosen to interpret the theories, concepts and models described in the theory section. Furthermore this framework will be used as the foundation for our empirical investigations, analysis and conclusions. The theoretical framework will be our first contribution to existing theory, and by applying this framework when entering and analyzing the empirical findings we hope to find answers to our two research questions specified in the table below.

Source	
Theory	<u>Creation of a Theoretical Framework</u> The translation of lean principles and lean production principles with regard to the characteristics of face-to-face service operations.
Empirical findings	<u>Research Question 1</u> It is possible to identify organizational changes in face-to-face service operations that correspond to lean principles?
Empirical findings	<u>Research Question 2</u> What effects, in terms of productivity, can we identify as a result of those organizational changes characterized as lean?

4.1 Introduction

Looking back at the evolution of lean and how it has developed over time it might seem a little confusing with all the various principles and practices. The most distinct differences between early lean and lean today is the incorporation of the value perspective but besides this our interpretation is that the foundation of the concepts with respect to waste still are quite similar. This has much to do with the fact that we think that lean and its corresponding principles and practices exist on different levels of abstraction and hence when creating our theoretical framework it is inevitable that we are going to work on these different levels. Lean principles could be seen as a complete methodology when it comes to implementing lean initiatives. Furthermore lean principles lies on a high level of abstraction i.e. a conceptual level that one might find difficulties in putting into practice. Thus, in order to achieve these principles or capabilities various organizational change need to be undertaken, changes that correspond to a lower and more concrete level of abstraction. Our interpretation is that such changes are more closely related to the original lean production principles. In relation thereof we consider it necessary to translate

both lean production principles and lean principles as well as to analyze the relationship between these two lean concepts. Therefore we will begin with the translation of lean principles followed by a similar translation of lean production principles. We will then move on to defining and motivating the choice of productivity as our measurement before presenting our final theoretical framework.

4.2 Empirical Background

In order for the reader to follow our reasoning and the translation of the lean concepts with regard to the characteristics of the chosen case we start out with a brief empirical background. Even though we anticipate that the process is well known to the reader we have been trying to picture our interpretation of such a service process below. Basically it contains the different stages that a patient passes even though it in practice is constituted with a larger number of more specific activities.

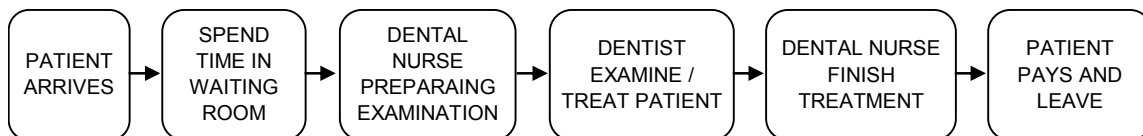


Figure 4.2.1 The dental care service process

The persons involved in this process then normally are; a dentist, a dental nurse or dental hygienist as well as a patient. Besides this we have dental technicians and specialists who are often working on a stand-alone basis. Hence, three levels of competencies can be identified in a typical dental practice; the dentist, dental nurses as well as dental hygienists.

In modern practices the dentist often has a leading and consultative role deciding what kind of treatment is necessary and who is to be taking care of the patient. Some treatments are carried out by the dentist such as repairing, root-filling and surgical operations whereas other treatments can be performed by a dental nurse or a dental hygienist.

The dental nurse's tasks vary a lot between different practices but for several years there has been a trend towards widening the areas of responsibilities giving the dental nurse a more profound role rather than just standing by the dentist. Traditionally the nurse has been present throughout a treatment and has primarily been responsible for the preparatory work as well as

booking new appointments etc. Nowadays however it is much more common that the dental nurse is higher educated enabling the dentist to delegate some tasks such as giving local anaesthesia, taking x-rays and making various filling etc.

Another trend is that there is much more emphasis on preventing dental care today compared to the focus of the dental care historically. This has also increased the importance of the dental hygienist as their main task is to engage in preventing care. Even though this is very much the patient's task the dental hygienist consults the patient with tips on how to take care of its mouth, what to eat and not based on saliva, bacteria and nutrition tests. The dental hygienist also examines the patient's tooth status and hence cleans the teeth from plaque, tartar and discoloration.⁹

With this in mind let us continue with our interpretation and translation of the lean concepts with regard to the characteristics of face-to-face services in general and the dental industry in particular.

4.3 Translating lean principles into face-to-face service operations

As we have stated above lean principles can be seen as a complete methodology or roadmap in the process of leaning operations and by undertaking various organizational changes operations create capabilities and competences that are aligned with lean principles. However, as these principles primarily have been applied in manufacturing settings the question is whether they can be applied to face-to-face services?

4.3.1 Specification of value

Due to the nature of a service and the impact of customer expectations face-to-face services have a challenging task in specifying what is considered as value. Our interpretation is that this principle should be just as valid to face-to-face services as in manufacturing businesses. However since the value is a subjective perception of each individual customer we believe that the process of creating a profound understanding of the perceived value could be even more complex in face-to-face service industries.

⁹ Pre-study Interview, Dentist Bengt Myllenberg, 2005-03-20

4.3.2 Identify value stream and eliminate waste

The identification of the value creating activities should be equally important in a face-to-face service operation and once these activities are known one can also pinpoint non value creating ones i.e. wastes. Regarding these wastes however the heritage from manufacturing are significant why an interpretation of the seven wastes must be carried out with regard to the nature of face-to-face services, we will return to this interpretation later on. Still, we can easily conclude that applying the concept of waste to face-to-face services would be as relevant as doing it to manufacturing operations.

4.3.3 Creating flow

The aim with the principle of flow is to achieve a continuous pace that permeate the operational processes and eliminate sub optimization. Underlying the establishment of flow could be various organizational improvements such as increased decentralization for reducing abruptions etc. But when considering the principle of flow in face-to-face services its stands in stark contrast to flow in manufacturing operations, there simply exist different prerequisites for establishing flow in these settings. One difference is to what extent face-to-face service operations could be exposed to flow. The impact of flow in manufacturing industries in general stretches over a broader range of processes whereas the flow in a face-to-face service basically only incorporates the service process.

The characteristics of a face to face operation also affect the levels of flow that can be achieved. In manufacturing industries tangible or transforming resources as well as the company's processes often set the limits for what levels of flow that can be achieved. In face-to-face services on the other hand the impact and importance of non-human transforming resources might not be that significant and instead the limitations could rather be an effect of the company processes as well as the skills of the employees. However, there is another dimension that needs to be considered as well. By decreasing throughput time a larger number of customers can be processed given the same resources. Because of this lowering throughput times might be one of the most important principles to work with in order to increase productivity in face-to-face service operations. However, as stressed under 3.4.2, we must not forget the components that constitute perceived customer value, outcome and experience. By continuously lowering throughput times it is likely that this will affect the customer experience factor as well as the experience of the personnel carrying out the tasks. Hence, there might exist a point were service companies find no benefit of lowering the throughput time as that could imply a decreased number of customers interested in their services, as well as difficulties in attracting and keeping good personnel.

4.3.4 Creating pull

The pull principle is fundamental for the elimination of waste in the terms of finished goods inventory, in process inventory, defects etc. In manufacturing industries the pull is started by a customer whose order is sent downwards in the supply chain. But as face-to-face services are produced and consumed simultaneously a service is characterized by pull per definition. Holding the overall objective of lean fixed, i.e. to eliminate waste, we think that the pull principle in face-to-face service operations needs to be reconsidered. Provided that the input resources are fixed in the short term, i.e. that the flexibility of the operational capacity is limited, face-to-face service companies who want to maximize their operational productivity should employ methods of working that are rather characterized by push logic. Emphasis must be put on either trying to take active control over the demand by e.g. scheduling, discriminating pricing etc. Hence, the principle of push in face-to-face services should be regarded as a crucial prerequisite for the elimination of waste in general. Because of this we have chosen to replace pull by push in the following parts of the thesis.

4.3.5 Strive for perfection

Small incremental improvements, kaizen, and the never ending strive for perfection is a principle that is universal in the sense that it can be applied in virtually any kind of business. In face-to-face services it could embrace the flow of the service process or the competencies of the employees to better cope with specific tasks etc.

4.3.6 Conclusions from the translation of lean principles into face-to-face service operations

Having carried out our interpretation and translation of lean principles we can conclude that it appears to be highly relevant to employ these concepts with regard to the characteristics of face-to-face services. Most of the principles can be easily translated into these settings whereas the creation of pull requires a different interpretation. Due to the fact that a service per nature could be said to be characterized by pull the concept loses its relevancy. In the light of the fundamental objective of eliminating waste as the foundation for our translation we advocate that pull should be replaced by push logic. Hence face-to-face services companies should try to maximize the outcome of the resources they employ through various push methods as well as trying to match the capacity of the operations to the current demand. By achieving the capabilities needed for establishing flow we also believe that face-to-face service providers should be able to decrease throughput times and hence process more customers.

Lean principles	Possible to translate in face-to-face services;
Specification of value	Yes
Identification of valuestream and elimination of waste	Yes
Creation of Flow	Yes
Creation of Pull	Yes, as push
Strive for perfection	Yes

4.4 Translating lean production principles into face-to-face service operations

As described above we regard lean principles as a method for leaning organizations but in order to fulfill these principles i.e. to reach certain competencies and capabilities organizational changes must be undertaken. Our interpretation is that such changes correspond more closely to the seven original lean production principles why we intend to make a similar translation of these with regard to the characteristics of face-to-face service operations.

4.4.1 Elimination of waste

Over production

Overproduction is defined as excess production that is impossible to sell. As a service is consumed as it is produced, this type of waste per definition does not exist in a face-to-face service operation and furthermore we have chosen not to study it in our research.

Transport

Transport is a waste that is concerned with moving goods in the service process. In service operations this can be translated to the physical movement of the individuals during the service process. The most common example of such movements would be at a hospitals where there can be long distances between the value creating activities and different departments e.g. from x-ray to orthopedic. The translation is valid but when looking more specifically at the chosen industry we interpret the distance of transportation as irrelevant in this perspective why we will exclude it from our research.

Movements

Movement is concerned with the ergonomic layout in the service process. The basic idea is that if the employee is uncomfortable during the service delivery the operational productivity will reduce either by decreased efficiency or by sick leave etc. As we interpret this waste it has a potential affect in a long-term perspective whereas the short term effects might not be that evident. Still it would be valid to address this kind of waste in face-to-face services. An example of this waste in the chosen case could be the layout of the rooms where the dental procedures are performed, however we consider this factor to be of less importance.

Inventory

Inventory is defined as the use or need of excess material and/or resources during and after the production process. In manufacturing industries inventories are typically found as in-process and finished goods inventories but in services it is not obvious where such inventories could arise. One might argue that there are materials used in the services process that are binding capital and that such unnecessary storage would reduce the operational productivity. However, in face-to-face service operations in general we believe that inventories such as in-process material are of less importance. Another interpretation of inventory could be that the company's transforming resources in general constitute an inventory but we have chosen to define this as wait instead.

Wait

Wait in the service operation implies excess time that is not used to produce the output at hand. Our interpretation of wait is that it could be the company's transforming resources in general, that is; both employees and facilities that are not fully utilized. As mentioned this could also be interpreted as inventory but when translating these terms with regard to what reality looks like we find no logic in that the objective would be to minimize the inventory but rather to maximize the utilization of the fixed resource by eliminating wait. Thus, wait include not only the time when employees are not occupied with value creating activities but when the company's fixed resources, e.g. facilities etc., are not generating revenue. This is indeed one of the most serious types of wastes since the possibilities for these resources of generating revenue would be gone forever, hence we believe this factor to have high importance in the case study.

Over processing

Over processing is the result of overcomplicated process or unnecessary processing of the product/service. Examples of overcomplicated processes could be excess flexibility in the production process. In our case an interpretation could be that the competencies needed for carrying out a specific task should be well matched with the capabilities of the service provider i.e.

the dentist, dental nurse or dental hygienist. Hence, when the capabilities exceed the requirements over processing could occur since these capabilities at least in theory could be used for more demanding task while the others could be performed by less expensive resources.

When it comes to unnecessary processing it is a result of over enhancement of the product/service. In the dental industry this waste occurs when a dentist or a dental nurse spend more time than necessary to either treat the patient or to e.g. carry out preparatory tasks etc.

4.4.2 Zero defects

This principle has a proactive approach and focus on preventing error before they occur. Defects are a waste that is easily transferable into face-to-face service industries. Even though the customer might have difficulties in determining the outcome of the service one is definitively able to conclude whether the treatment obviously is defect or not. When this occurs defects seldom create any value for either party. Hence, there lies a major challenge for face-to-face service companies to eliminate defects since; the customer often is a co-producer, and the customer's expectations might determine what should be regarded as a defect.

4.4.3 Push

As we have been discussing above a face-to-face service is pull by definition. Hence we concluded that it is more relevant to talk about push logic in these settings. Service providers should strive for high levels of utilization e.g. through the application of demand management techniques. In the dental industry we consider demand management to be about having a full schedule as a result from well functioning processes of booking, rebooking and finding patients able to fill cancelled appointments on short notice.

4.4.4 Multifunctional teams

All members of each manufacturing team shall have the competence to perform all tasks within the manufacturing process. This principle can be directly translated into the service industry. As we have interpreted wait as being connected to the utilization of transforming resources and over processing as inadequate resource allocation, this principle becomes a prerequisite for the establishment of a lean service process and we expect it to have high relevance in the case study.

4.4.5 Decentralization

The responsibility and authority is decentralized to be as close to the production process as possible. We interpret this principle as of great importance to face-to-face services operations. In order to deliver a high quality service, employees need to be able to take full responsibility for the

quality of the service, hence having the authority to make immediate decisions that facilitate the creation of flow.

4.4.6 Vertical information systems

Vertical information systems combined with decentralized multifunctional teams create an environment that facilitates the establishment of flow and decreased throughput times. The staff performing the procedures needs full information regarding what actions to undertake why this principle becomes an important prerequisite.

4.4.7 Continuous improvements

Continuous improvements is synonymous with the lean principle of striving for perfection and as mentioned earlier this is a principle that could be applied in virtually any setting why a translation isn't necessary.

4.4.8 Conclusions from the translation of the lean production principles into face-to-face service operations

When summarizing the translation of lean production principles we can conclude that almost all principles could be translated into face-to-face operations. The one exception is the waste of overproduction which is a waste that does not exist in face-to-face service operations.

Lean production principle	Possible to translate in face-to-face services;
Elimination of Waste	Yes
- Over production	No
- Transport	Yes
- Movement	Yes
- Inventory	Yes
- Wait	Yes
- Over processing	Yes
Zero Defects	Yes
Pull	Yes, as push
Vertical Information System	Yes
Multifunctional Teams	Yes
Decentralization	Yes
Continuous Improvement	Yes

4.5 Productivity

As we have translated the existing theories of lean with regard to face to face operations, we also believe that we need give our viewpoint of; 1) why we have chosen productivity as measurement and 2) how we interpret this measurement with regard to the characteristics of the studied setting.

There are two specific reasons for choosing productivity as measurement; The first reason is the fact that productivity can be applied on different levels in an organization, i.e. it can be applied to a limited part of an operation as well as to an entire chain of activities. As our main interest lies in understanding the possibilities of increasing operational productivity our scope incorporates all the activities which the dental practices undertake. The employment of the productivity measurement with regard to this could also be seen as appropriate in a study of lean since one of the main contributions of lean when being acknowledged was its focus on all of the value creating activities of an operation. By emphasizing a wider focus of attention sub optimization could be avoided and by extending the unit of analysis lean suggested that better result could be achieved.

The second and perhaps more important reason for the choice of productivity as measurement is that productivity can be considered from different perspectives. As our interest lies in understanding lean principles full effect in face-to-face organizations we want to capture such effects primarily using an operational perspective. However, when it comes to services Johnston & Jones (2004) emphasises that it is not just the operational perspective that need to be considered but the customer one as well. A fact we consider highly relevant due to the presence of the customer in face-to-face services. The nature of such services implies that operational productivity cannot be directly separated from the consumption of the service. In manufacturing industries however these activities are much more separated and the perceived customer value generally is not affected by the production process itself. When it comes to services and particularly face-to-face ones the situation is totally different. The actual service process will to a very large degree determine the perceived value of the service just as the decentralized nature of the service process emphasizes the role of the individual employee's contribution to the value creation. In order to secure a high quality output we believe that there is an increased need to manage and develop the human resources to establish a quality focus culture as well as keeping the employees motivated. As a consequence of this the HR-perspective has a very important role, especially as the employees actions are what constitute the service. Because of this we believe that it is important to define a reliable operational measurement that incorporates the more qualitative elements of the employee and customer perspective. The importance to consider such qualitative aspects has e.g. been stressed by Kaplan and Norton's (1992) balanced scorecard.

Furthermore, the use of productivity as measurement allows us to employ these three perspectives and it is on the basis of these stakeholders that we are to examine the effects of lean initiatives carried out by the chosen case. Hence we have chosen to extend Johnston & Jones's (2004) separation of customer and operational productivity with an employee perspective as well. You will also see that our definitions of productivity differ from the ones presented under 3.4.2. This is due to the fact that we don't feel confident about the definition proposed by Johnston and Jones as their input and output factors to a large degree are overlapping.

4.5.1 Operational productivity

The operational productivity measurement that we have chosen is similar to the well established definition of operational productivity. *The input factors* are defined as *time* and *resources* and the output factors as; *number of processed customer* and *fee per customer* i.e. price. By time we are referring the throughput time needed to complete the service process. Resources are all resources, fixed and variable, needed to produce the outcome.

$$\text{Operational productivity} = \frac{\text{\# treated customers} \times \text{Fee per customer}}{\text{Time} \& \text{Resources}}$$

4.5.2 Customer productivity

The first principle is to identify and specify a value within a chosen customer segment. The complexity in this principal lies in the fact that the perceptions of value might differ among individuals and might also evolve and change over time. We have chosen to divide the definition of customer productivity, i.e. value, into customer input; *time* and *money*, and the output; the perceived experience and the actual outcome of the service. *Experience* is defined as the perception received during the service process. Example of an experience in the dental service process could be the encounter with dental personnel or the comfort during the session. *Outcome* is the actual result of the service delivery. Examples of the outcome are the result of the dental procedure, e.g. the durability a fixed tooth or the level of pain felt after a treatment is finished etc. *Time* is defined as the total time the customer spends to pass through the entire service process. *Money* is the price that the customer pays for the service.

Compared to Johnston and Jones's definition we have chosen to exclude effort as a customer input factor due to the nature of dental services. Our definition of customer productivity implies that as the output/input ratio is positive, value is indeed created.

$$\text{Customer productivity} = \frac{\text{Experience} \quad \& \quad \text{Outcome}}{\text{Time} \quad \& \quad \text{Money}}$$

4.5.3 Employee productivity

In face-to-face service operations the role of the individual employee has a much more profound role in contrast to a regular manufacturing process. Motivated employees that are willing and able to deliver a service experience that matches or exceed the individual expectations of the customers is crucial for achieving high customer productivity. Employee productivity is also directly linked to operational productivity as time factor to a large extent is employee driven.

$$\text{Employee productivity} = \frac{\text{Experience} \quad \& \quad \text{Money}}{\text{Time} \quad \& \quad \text{Effort}}$$

Our definition of employee productivity is similar to the customer productivity measurement. The input factors are time and effort. Where *time* is the number of working hours and the *effort* is the physical work load and the mental stress the tasks are requiring. The output factors are *experience*, i.e. the personal development and satisfaction that the employment offers, and finally the salary i.e. *money*.

4.6 Theoretical Framework

We have interpreted the concept of lean principles as a conceptual model that lies on a high level of abstraction. Our interpretation is that lean principles constitute a methodology or a roadmap for the implementation of lean initiatives. Compared to lean production principles it also incorporates

the customer value perspective into the operational development. However, our interpretation is that the lean initiatives or changes that are actually undertaken by an organization more clearly correspond to the original lean production principles, which then rather become characteristics of an operation. When analyzing the principles in more detail we see clear relationships between them, which have been illustrated in the matrix below. The first lean principle, *Specification of value*, does not correspond to any lean production principle. Still this principle should be of high importance to all businesses and we intend to study if and how the practices have been working with the determination of value. The second and fourth principles of lean are directly transferable whereas the lean production principles of *Multifunctional teams*, *Decentralization* and *Vertical Information System* contribute to the *Creation of flow*. *Continuous improvements* and *zero defects* correspond to the fifth lean principle that e.g. could be achieved through the creation of a company culture characterized by quality consciousness as well as forums stressing and reinforcing these values.

Furthermore we anticipate that some of these factors will have greater impact on the productivities than others. We have identified wait and over processing as the most serious kinds of waste in a face-to-face service. Through demand management techniques we believe that face-to-face service companies can increase their operational productivity by increased output and utilization of resources. It is however not likely that this will affect the customer productivity but there is a risk that employees will experience an increased workload negatively. Furthermore we believe that the establishment of flow can lower the input per transaction, first of all through decreased throughput times enabling more customers to be processed but also by matching the competence level of the service deliverer to the task at hand. Naturally these changes would have positive impact on the operational productivity but we find it hard to determine its effects on the employee productivity. Regarding the customer productivity however decreased throughput time will most likely affect the experience factor and the perceived value of the service.

Lean principle	Lean production principle	Theoretical Prediction
Specification of value		Prerequisite for reducing waste
Identification of valuestream and elimination of waste	Elimination of Waste	Highly relevant
Creation of Flow	Multifunctional Teams, Decentralization, Vertical Information Systems	Reducing throughput time most important
Creation of Push	Push	Demand mangment for high utilization
Strive for perfection	Continous Improvements & Zero Defects	Highly relevant

5. Empirical findings

Below we will describe the organizational changes undertaken in the two studied dental practices in a rather straightforward matter. The aim is to present a chronological development on a higher level, starting with an introduction and a description of the starting point, a state we have called “The traditional practice”. The focus of the empirical findings will however be on the specific organizational changes carried out when moving from the traditional practice to the state called “The peak”. Finally we will briefly describe the current trend of the operational development and as one of the practices has chosen to once again change their way of operating we have referred to this as the “Finding balance” state.

In this first empirical part we will describe the organizational changes by using a “language” as employed within the two practices. When going deeper into the operational changes we will structure the empirical findings in specific factors that are of highest importance to the more modern way of operating.

5.1 General Background

Back in 1995 the two dentists decided to build a brand new dental practice designed particularly to suit what has been referred to as *delegated dental care*. Based on the performance of a couple of other dental practices in the Stockholm region the objectives were to achieve higher productivity contributing to increased profitability. These practices had all participated in change management projects employed by an American organization called The Pride Institute. The Pride Institute has helped re-designed the traditional operational processes of numerous dental practices, changing the daily work of the individual dentist radically. The cornerstones characterizing The Pride Institute’s way of operating the businesses are;

- *shared practices* among dentists working in separate shifts; contributing to making the service offering more attractive by extended opening hours and more importantly enabling significant reductions of the fixed costs due to the share of facilities etc.
- *delegated dental care*; an alternative approach of undertaking the daily operations by relying solely on a team oriented way of working

Though the building of a new dental practice was an important prerequisite for enabling the new methods of working the employment of delegated dental care required significantly different

competencies among the staff. One of the dentists uses the metaphor of an American football team to describe what delegated dental care is really about. Basically the dentist has the role of the quarter back signaling where to run and what to do given a certain situation. To make a play work successfully this does not only require good timing but highly skilled players as well. In relation thereof, educating the staff was a key component in enabling this new way of working as it implied that the dental hygienists and dental nurses should perform the bulk of the procedures of a treatment. Securing that these competencies were acquired among the staff was the focus of attention during the first courses held by The Pride Institute. An extensive team management education plan was set up that not only covered the actual treatment procedures but all parts and processes of the dental operation e.g. how the customer is received or handed over between the various steps in the service process, or how to manage the purchase of material etc. The implementation of this new way of working has both been a matter of a radical change as well as a continuous process of education, refinement and calibration of the day to day operations. As can be seen from the figure below the capacity of the practices have been significantly increased along with a substantial increase in revenue. As mentioned three states have been identified; "The traditional practice" that is representative for the point in time when the two dentists decided to implement The Pride Institute's way of working. A second stage, "The peak", which represents the state when the practices were carrying out everything "by the book". However, we have also identified a state called "Finding balance" which represents Dentists #1 way of operating whereas Dentist #2 still operates in a way that is much more similar to the "The peak" state. We will now move on to describing the most affecting changes of the transition from the first to the second state, and even though the outcome of this transition in general has been described as highly successful we will also see that it has some shortcomings. In relation thereof we will end this chapter by pinpointing these weaknesses along with the description of how the two are trying to cope with them today.

Turnover MSEK

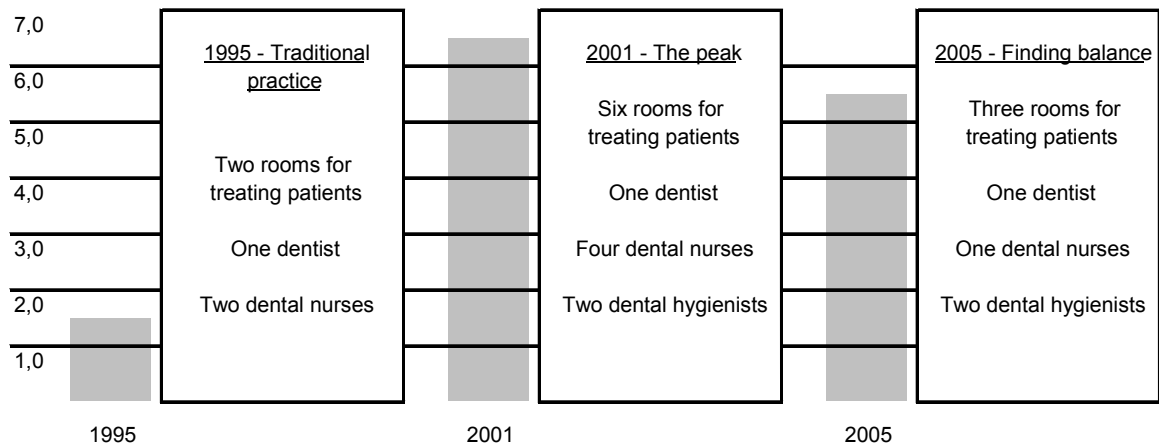


Figure 5.1.1 The different stages of the operational development

5.2 Organizational changes undertaken when moving from the “Traditional Practice” to the “The Peak”.

5.2.1 Resource allocation

Both of the practices have undertaken the same organizational changes in their striving for creating more productive operations. One of such changes is the gradual employment of a larger number of dental nurses, dental hygienists as well as increasing the number of available rooms being used for treating patients. Illustrated in the figure above we can see how the capacity of Dentists #1’s operation has changed over time. The upsizing of the operations has been made step by step at the same time as the dentists successfully has been able to share the fixed resources i.e. facilities and machinery with Dentist #2 by working in two shifts, one team working between 7am and 13pm and the other one between 1pm and 7pm.

Enabling such increase in capacity is the new role of the dental nurses as well as the employment of dental hygienists. The underlying logic is that the dependency of the dentist as the critical resource must be decreased. From a resource perspective there are three important reasons for this; 1) dental hygienists and dental nurses constitute cheaper input resources, 2) if certain tasks can be moved from the dentist to be performed by hygienists and nurses the total time used for a

treatment can be decreased and 3) the freed time for the dentist can be used to process more customers, as illustrated below, provided that a the capacity of the operation is increased.

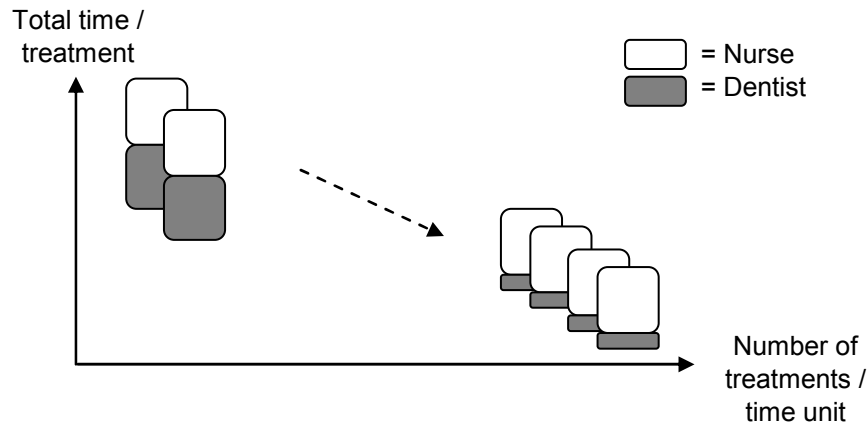


Figure 5.2.1 The difference between “The Traditional” and “The Peak” practice

This implies a new role of the dentist as both of a leader who supports the dental nurses and helps them with diagnosis, i.e. determining what treatments to undertake for a specific patient, as well as still being a person carrying out treatments in practice. This requires totally different competencies and capabilities of the dental nurses compared to a traditional practice where the role was more a matter of simply assisting the dentist. These changes were however not appreciated by all dental nurses and during the first years of the transition the atmosphere has been described as somewhat turbulent. A couple of the nurses were not all that positive to changing their way of working. Due to this some personnel needed to be replaced and much emphasis has been put on finding and educating employees that are willing to take a more profound role in the treatment of patients. Those who have found this attractive have benefited from an increase in salary of approximately 20% combined with other incentives such as profit sharing. In this the new role description of the nurses the responsibility is significantly more decentralized and the dental nurses now perform the bulk of the procedures earlier only carried out by the dentist.

In this way of dividing the areas of responsibilities the dental hygienists also play an increasingly important role. This has to do with the increased emphasis on preventing care in general and as many of the customer's teeth status have developed positively due to the emphasis on preventing care there is seldom any need for seeing the dentist once a year. Instead the customer can meet with a dental hygienist every other time and the dental hygienist is then examining and treating the patient without any involvement of the dentist.

Getting these changes to work successfully in practice was however a great challenge, not only during the implementation but continuously as well. As the system is highly dependant upon the performance of the individual employees the operational risks are increasing as more people than the dentist becomes a crucial component for delivering the service. In case of absence the high competencies of the dental nurses create difficulties in finding qualified stand-ins, a fact that has also been described as a problem when it comes to recruiting new personnel. Both dentists also expressed that even if these competencies can be found there are always a period of calibration where the nurse need to adapt to the operations. The “codes” and “languages” takes some time to learn and before one gets it to work smoothly considerable effort need to be put in to it. During the initial implementation these facts were continuously stressed by the consultants from The Pride Institute. No one should expect the new processes to work overnight but the practices would rather experience high levels of frustration from time to time. This was indeed exactly what happened an even today there is still a need of continuous calibration and refinement of the operation and its processes.

Despite these vulnerabilities there seems to be a consensus that the results from these changes have had positive effect; the nurses who choose to stay and the ones that were employed have experienced their increased areas of responsibility and accountability as very positive. They also feel that they have a much stronger and personal relation to the customers compared to before. However, when starting out with these new ways of working, although implemented gradually, there were customers who commented on not seeing the dentist as much as they were used to. Today such comments are rare which is explained by the fact that the customer now seem to have built a similar relation to the nurses and hygienists. Some customers have even expressed that they feel an increased trust for the practice as they know that there are more than one person competent enough to treat them. Prior to undertaking these organizational changes there were situations when customers experienced wait between the different steps in the service process as well as during the actual treatment. From a customer perspective this wait has been said to have a clear negative impact on the perceived value of the service. Even though some procedures may have mandatory waiting time, for instance waiting for anaesthesia to have effect, the dentists believes it to be important that the customer do not perceive this to be an interruption of the service process. Nowadays such delays seldom occur due to the increased competence of the employees and the decreased dependency of the dentist as the critical resource. Hence fewer procedures require the involvement of the dentist as the more skilled dental nurses could perform a majority of the procedures, creating more flexibility needed to cope with any situations during the service delivery. However it is also a result of more clearly defined processes and a better understanding of how much time each procedure take combined with the fact that only treatments known in advance are the ones carried out and for other treatments the patient need

to book a new appointment. One of the dentists has however experienced the reduction of customer interaction as negative and found some problems in being both a leader and taking part in the practical tasks simultaneously.

5.2.2 Standardization, planning and scheduling

Standardizing the procedures is another factor that has had significant attention during the change process. In both practices the procedures now follow tight process descriptions that have been carefully designed. Since all dental nurses work in exactly the same manner employees know exactly how long various treatments should take. To increase the efficiency and quality of treatments preparatory work is now also a mandatory part of the daily routines. By preparing the sets of tools needed for all the specific treatments that should be carried out during a day focus can be put on the patient during the service process. The use of trays pre-packed with the tools needed for a specific treatment further facilitates the service process since employees know exactly what procedures to undertake given a certain set of tools. The physical layout of all the rooms as well as the tools and furniture in it also look exactly the same in the whole practice.

When examining the differences in throughput time as a way of leaning the operations both of the dentists experienced some reductions compared to the total throughput time in the service process prior to the organizational changes. However these reductions, approximately a couple of minutes per treatment, are not that dramatic and there are no signs pointing at the customers being negatively affected of it. The reduction could be explained as an effect of the increased standardization of the processes and by strictly sticking to these routines employees can perform a procedure with increased efficiency. Reduced disturbance in the workflow due to better planning is another explanation to the reduced throughput times. The scheduling of patients have however not been changed from a customer perspective as they are still supposed to come every whole or half hour but there is no longer any need for planned time buffers as some regular preservation work can be taken care of during the number of minutes that has been set free by reducing the throughput times.

The principle of finding new appointments when finding e.g. cavities in a patient's teeth has been a way of controlling the demand. These routines are an important contributor for being able to create flow by avoiding interruptions in the service process. Hence, much tighter planning can be undertaken where the occurrence of possible but not planned for treatments can be eliminated for later appointments and hence there is less need for scheduling for time buffers. Following these routines allows the practice to optimize the scheduling of the treatments, an area that is of great importance for the possibilities of making the decentralized way of working function in practice.

This is done by finding a suitable mix of treatments that will fit with the schedule of the dentist which still could be said to be regarded as the critical resource. For example when drilling is needed only one drilling treatment can be planned for within a time unit. Furthermore the appointments are scheduled to meet the production goals of the operations. The goals are to reach a daily revenue target, by trying to maximize the usage of the dentist while striving for maintaining a steady workload throughout the week. This mean that there are a number of combination of treatments that the operation will be able to handle whereas having e.g. three drilling treatments scheduled at the same time will not work in practice. Hence, knowing exactly how long every procedure should take is a prerequisite for creating such a tight schedule which further is enabled by the elimination of variations through knowing exactly what treatments to undertake for every specific patient.

Another factor contributing to the improved performance of the practices is their way of handling the materials needed for their services. Historically the costs of these materials have reached about 8-10% of the early turnover and hence constitute a considerable cost. By standardizing the choice of materials through continuous evaluation by the staff inventory management has been improved. Nowadays a fewer number of materials known by experience to meet the quality standards are the ones in stock and by making adjustments to these materials a smaller number of them can be used instead of having one material for every specific need. This has not only reduced the inventory levels because of the reduced need for numerous materials but most of all resulted in less obsolescence since the turnover of needed materials have increased substantially. Such changes have been undertaken in both of the studied practices and the results are a 25-30% cost reduction.

5.2.3 Daily meetings

One of the most important factors in the quality improvement work is the increased number of staff meetings. Earlier the general opinion among the employees was that there was no time for having regularly meetings but nowadays meetings are held prior to every work day. The focus of the daily meeting is to prepare the team for the coming day and to discuss deviant situations in order for the staff to be better prepared for dealing with such situations in the future.

Determining the quality and outcome of dental services are in general difficult for the patient to evaluate. Due to lack of knowledge and possibility to examine the results the only way to detect a defect is if the customer experience pain or if the durability of the treatment is poor i.e. if the function of the treatment is not satisfying. Hence following up such situations and its underlying causes is an important task in order to improve the performance of the operations. Regarding this

the daily meetings play an important role and the aim has been to let all employees contribute to coming up with solutions to prevent particular problems from occurring in the future. It is important to note however that the meetings only are not enough but they contribute to the establishment of quality awareness and eventually a quality culture among the staff. Since the dental nurses are the ones performing the actions it is extremely important to reach this state since they are the only way to secure the quality of the service process. In both the studied practices a reduction in the number of defects has been achieved which is explained by decentralized responsibility and increased accountability of the dental nurses. The regular staff meetings constitute the natural forum to discuss these issues and the general opinion now seem to be that the time spent in these meetings is well invested as it increases the quality of the work as well as contribute to a proactive and more positive atmosphere.

5.2.4 Demand Management

Both practices use a recall system to book patients. These types of systems are standard within the industry and depending on the nature of their last treatment customers are rebooked according to an individual treatment plan which often span from every one to third year. This is indeed a way of trying to control the demand and as a complement to the booked appointments a short notice list is used where customers able to come in on short notice can stand in queue to take the place for customers that have cancelled their appointments. Being able to come in on short notice, within two days, also implies that the customer could benefit from price reductions. Such price reductions has indeed been appreciated by some patients who have the flexibility to come on short notice at the same time as the practices have been able to decrease the number of vacancies. Emphasis has also been put on achieving high capacity utilization by informing patients about the fact that they are to be debited even if they are not showing up, something that have contributed to a reduction of the number of people not showing up.

5.3 “*Finding Balance*”

Despite being satisfied with the performance achieved through the application of these operational methods in general, the empirical findings show that this way of working indeed have some shortcomings. However the dentists have chosen to react to these issues somewhat differently; Dentist #2 works similar to what has been described above whereas we will see that Dentist #1 has a different setup. The main reason for this lies on the personal level as it comes down to what role in the daily operation the dentist would like to have. Because of this one of them has been trying to balance “The peak” state by reallocating the competencies and reducing

the capacity of the practice. There are several reasons for this development; both from a human resource perspective as well as from an operational perspective.

“The peak” setup implied that the only treatments that were actually performed by the dentist were drilling ones, this fact and the monotonous work day it resulted in have been hard to accept for one of the dentists. The strong focus on maximizing utilization occasionally lead to deviations from what was planned as procedures where squeezed into the schedule. In many cases these unplanned procedures required more time than what was available, which caused wait for the next patient. There were also situations where the deviations were unplanned, i.e. an unexpected problem occurred. Due to the lack of time buffers in the scheduling this directly caused a disturbance in the daily plan. These situations increased the level of stress among the employees and consequently had a negative effect on the customer experience.

From an operation perspective the practice became much more dependant of a number of employees as well as their high level of competencies that wasn't always easy to replace both in the short and long term. As both the capacity and efficiency of the operations increased much more emphasis was put on achieving a constant inflow of patients. But if the demand goes down the operation is stuck with overcapacity and as the case shows the practices have found it harder and harder to maintain high levels of utilization.

To deal with this problem Dentist #1 gradually downsized his operation to maintain high levels of utilization. With the cost structure of “The peak” setup the practices had a revenue target of 5500 SEK/hour. To be able to lower this target Dentist #1 choose to sell 50% of his practice implying that there are now two teams working on one six hour shift but the remaining six hours are still operated by Dentist #2's team. Due to fewer fixed resources the revenue target could be lowered to 4000SEK/h enabling a reallocation of the tasks within the work force. Foremost this enabled the Dentist #1 to reduce his level of stress and to once again take a more active part in the treatment of patients, combined with weakening demand these factors has been described as the most important reasons for downsizing. In this new setup there are two hygienists instead of one. The reason for this is that they have concluded that the hygienists could take care of a larger portion of the patients as a majority of all procedures indeed can be handled by them. When the patient is in need of further treatment then a new appointment is scheduled with the dentist and the dental nurse. Even though this setup implies that the dental nurse has taken a step back the reduced stress clearly outweighed the negative side of reduced responsibility and the compensation of the nurses remain the same. To achieve flexibility the practice is continuously

educating the hygienists in order for them to be able to alternate between the dental hygienist and the dental nursing role.

6. Analysis

In the theoretical analysis we determined that it was possible and relevant to apply the lean concepts in a face-to-face service operation. In this chapter we will move to the next step in our research model and analyze the empirical findings to give answers to the two research questions. Starting with research question one, we will determine if it is possible to identify organizational changes that correspond to the lean principles. If this is possible, we will then continue our analysis by going deeper in to each organizational change and evaluate the effect that each specific change has had on the different productivity measurements.

Source	
Theory	<u>Creation of a Theoretical Framework</u> The translation of lean principles and lean production principles with regard to the characteristics of face-to-face service operations.
Empirical findings	<u>Research Question 1</u> It is possible to identify organizational changes in face-to-face service operations that correspond to lean principles?
Empirical findings	<u>Research Question 2</u> What effects, in terms of productivity, can we identify as a result of those organizational changes characterized as lean?

6.1 Analysis Research Question 1

Is it possible to identify organizational changes in face-to-face service operations that correspond to lean principles?

Below we will try to determine to what extent the operational changes carried out in the dental practices correspond to lean principles. Given that we will be able to identify such relationships we will then concretise and specify such initiatives in order to evaluate their effect on productivity i.e. research question number two.

6.1.1 Decentralization and Multifunctional Teams

As we interpret it one of the most important factors that have had significant impact on the performance of the dental practice is the increased decentralization of responsibility to the dental nurses. This change can in our opinion be related to the lean production principles of *decentralization* and *multifunctional teams*.

6.1.2 Continuous improvements

Another important organizational change that has been undertaken is the significant increase of the number of meeting hours. By discussing quality improvements on a regular basis the practices have been able to create high quality awareness among the staff. This implies that quality improvement have become a natural part of all employees daily work. We believe that such a quality focused culture correspond to what Imai (1986) defined as kaizen, the continuous strive for perfection. We therefore believe that this change can be related to the lean production principle of *continuous improvement*.

6.1.3 Vertical information systems

A *vertical information system from a lean production principle perspective* is a system that keeps the multifunctional teams updated with information about performance and information about potential problem and solutions. Our interpretation of the empirical findings is that such a system existed in the case. The use of information system made it possible to control the demand and to plan and prepare for the coming procedures, which enabled an increased flow in the service process.

6.1.4 Push – Demand Management

The empirical findings show several initiatives that in our opinion contributed to proactively influencing demand by establishing push logic. As we have seen from the case the planning and scheduling of the daily work now also play a much more important role than earlier. In order to maximize utilization the use of a recall system is the base of generating new appointments, this is then complemented with appointments for new patients as well as patients in need of acute treatment. The establishment of a short term waiting list combined with offering patients interested in such appointments a price reduction have not only created an attractive market offering for some patients but more importantly enabled the organization to achieve higher utilization through reduced vacancies. By informing and emphasizing patients of the fact they are going to be debited even if not showing up has also been contributing to noticeable differences in the number of vacancies. Given our interpretation of demand management and the empirical evidence, we conclude that the practices clearly employ demand management techniques.

6.1.5 Elimination of wastes and defects

Transport and Movements

Regarding transport the relevance of this waste seems to be minor in this kind of business. Movements however have had some attention as it is concerned with the ergonomic layout of the processes. The layout of the rooms as well as the placement of furniture, tools, computers etcetera contribute to a standardization of the processes.

Inventory

As finished goods or in process inventory per definition does not exist in face-to-face service operations the focus have been on looking on the materials needed for treating patients. This area has proved to be significantly more relevant than what we had anticipated. Both dentists have been able to reduce the number of different materials needed for treating patients. Using a fewer number of materials has increased the turnover of the stock and far less materials are nowadays forced to be thrown away due to expired due dates. These costs have historically been equaling 8-10% of the turnover and have now been successfully decreased by 25-30%.

Over processing

Two types of over processing have been identified, one type where unnecessary procedures are performed during the treatment and another type where a procedure that could be performed by a dental nurse or dental hygienist is carried out by the dentist, hence inadequate resource allocation. The cases show that the first type of over processing rarely occurs except for in esthetical dental surgery where a perfect visible result is the objective rather than just the functionality of the teeth. When it comes to non-esthetical treatments however each procedure has been clearly defined and is nowadays performed in the exact same way each time leaving no time for over processing.

Regarding the second type of over processing one could say that in traditional dental practices this is a well established kind of waste. In such operations the majority of the procedures are carried out by the dentist and the dental nurse has the role of an assistant. In the practices this type of waste has been significantly reduced as the responsibilities of the dental nurse's have been extended and basically all procedures except drilling can be performed by them. However we also know that one of the dentists to some degree has chosen to return to performing tasks that could be handled by the dental nurse.

Wait

The new role of the dental nurses has also had positive impact on wait within the service process. We have identified wait in a service operation as time that is not used to produce the output at hand. Hence our interpretation of wait is that it could be the company's transforming resources in

general, that is; both employees and facilities that are not fully utilized. The gathered findings show that prior to the organizational changes there were more occurrences of unnecessary wait in the service process both in terms of unused human and transforming resources.

We interpret this to be a result of a combination of lean initiatives that all have contributed positively to the elimination of waste. The main reasons are the more clearly defined processes and a better understanding of how much time each procedure requires combined with the achieved flexibility characterizing the multifunctional workforce. The rule of only carrying out treatments known in advance is important in the respect that flow is established yet eliminating wait that previously arose due to unnecessary frictions within the process.

To sum up, given our interpretation of wastes and the empirical findings, we believe that we have identified inventories, over processing and wait as the most important types of waste.

6.1.6 Zero Defects

The empirical findings show a strong focus on reducing the number of defects in the outcome of the operation. Emphasis has been directed towards standardizing the procedures of the operation as well as finding high quality materials with correct characteristics both concerning the durability and the possibilities of using it for more than one type of treatment. The improvement work has been successful with regard to this as the number of guarantee treatments has been reduced; in fact they seldom occur at all. Our interpretation of “Zero defect” is that, it is not only about reducing the defect but also working proactively with softer cultural aspects, making quality everyone’s concern.

6.1.7 Evaluating the first research question

From the discussions above we can see that we have been able to identify all of the proposed components of our theoretical framework in the case study. Furthermore we believe that we have sufficient empirical evidence to give an answer to the first research question. Hence we believe that it is reasonable to conclude that the organizational changes undertaken correspond to lean production principles and lean principles as these are connected in our theoretical framework.

The empirical findings show that it is possible to identify organizational changes in the studied face-to-face service operations that correspond to lean principles.

As can be seen in the matrix below we have also identified the individual organizational changes that in our opinion correspond to these lean production principles. Furthermore we will continue by analyzing the effect of these changes in terms of the chosen productivity measurements.

Lean Production Principles	Organizational Changes
Decentralization and Multifunctional Teams	Increased competence enabling nurses and hygienists to perform the same procedures as the dentist
Vertical Information System	Recall system, Production planning
Push	Production planning, Price discrimination, Short notice queues, Fee information, Extended opening hours, Recall system
Continuous Improvements	Quality improvement meetings and quality awareness permeating the organization
Zero Defects	Standardized procedures and preventive actions
Elimination of Waste	Improved planning and preparation

6.2 Analysis Research Question 2

What effects, in terms of productivity, can we identify as a result of those organizational changes characterized as lean?

Given the organizational changes that we have identified we will now analyze the effects of each change from an operational, customer and employee productivity perspective. Our approach in this analysis is to identify empirical findings that have had positive or negative impact on any of the factors in the productivity measurement formulas (4.6.1 to 4.6.3). Given this impact we will assume that all other factors in the formula are constant and hence determine if the change affects a specific productivity positively or negatively. In this analysis we will also consider whether the change has direct impact on the productivity or if it is more of an enabler for the other changes.

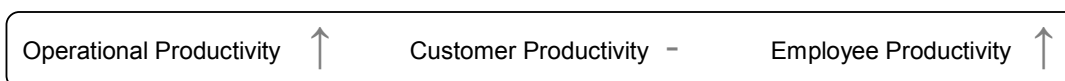
6.2.1 Increased competence enabling nurses and hygienists to perform the same procedures as the dentist

The fact that the dental nurses now can perform a majority of the tasks characterizes the practices as multifunctional where each member has the mandate and competence to take full responsibility in delivering a high quality service. This overlapping in competence has contributed

to increasing the flexibility of the operation and the practices of today do not depend on the dentist as heavily as before. Furthermore these changes and developed capabilities have enabled the usage of a larger number of rooms that have increased the scale and the output of the operations. The practices have not only been able share the costs of the fixed resources but more importantly decreased the input resources per treatment. This is a fact as the aggregated time per treatment has been decreased, foremost by decreasing the dentist's time per treatment. As both the customer output factor in the productivity function increased more than the resources put in did we find it reasonable to say that the result is increased operational productivity, furthermore we see these changes as the most prominent ones with regard to its effects on the performance of the practices.

When analyzing the customer productivity we know that the experience factor was reduced immediately after the transition to the new way of working due to the fact that the customer perceived the lack of contact with dentist as negative. But the empirical findings also show that the customer got used to the new resource allocation and started to build a relationship with the dental nurses and the dental hygienists. Furthermore it is hard to determine whether this have had positive or negative effect overall why it is reasonable to assume that the customer productivity has been rather unaffected in the long term.

The increased competence of dental nurses as well as their increased influence in the organization gave them a sense of personal development and importance in the organization, hence an increased sense of control over the individual working conditions. We assume that there is a causal relationship between personal development and employee satisfaction; hence we find it reasonable that this has resulted in an increase in the employee satisfaction. As the new responsibility included a higher salary we can relate this to the employee productivity model and assume that the employees have experienced an increase in both of the output factors, experience and money.



6.2.2 Production planning and the use of a Recall System (Vertical information system)

The recall system made it possible to maximize the utilization of the fixed resources. However, as such an information system had been used before it has not increased nor reduced the input factors. In our opinion the characteristics of this factor makes it a prerequisite for the creation of

push. The system itself has had no direct effect on the operational-, customer- or employee productivity. In our opinion this factor is an important enabler and prerequisite to achieve other principles such as flow and pull.

Operational Productivity – Customer Productivity – Employee Productivity –

6.2.3 Production planning, price discrimination, short notice queues, fee information and extended opening hours

The empirical findings indicate that minor adjustments such as price discrimination, short notice queues and usage of penalty fees for not attending an appointment has had a significant impact on reducing the number of vacancies both in terms of un-booked appointments as well as occasions where the customer does not show up. Since this change increased the overall utilization of the resources it is reasonable to say that operational productivity increased. However, the empirical findings do not show any strong evidence for an increase in neither customer- nor employee productivity even though extended opening hours and short notice queues might have affected customer productivity positively.

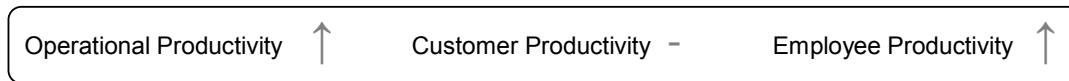
Operational Productivity ↑ Customer Productivity – Employee Productivity –

6.2.4 Quality improvement meetings, quality awareness permeating the organization

We believe that the planning and quality improvement meetings are one of the most important factors in increasing the operational productivity in the practices. The meetings are in our opinion a key enabler for reduced defects and the elimination of waste by continuously improving the processes and choice of materials. Consequently this reduces guarantee treatments which implies that less resource are put into work that do not generate revenue. Given this, we believe that is realistic to conclude that the operational productivity has increased.

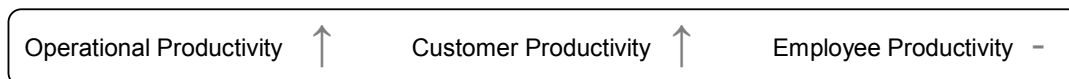
Analyzing the customer and employee productivity we cannot find sufficient empirical evidence that support a direct increase. Still we could say that the daily meetings were a forum for the employees to make their own voices heard, to present constructive solutions to problems etcetera and to influence important decisions in the practices. In this perspective it could indirectly have contributed to an increase of the employee productivity. Similarly we believe that the meetings

indirectly have had a positive affect on the customer perceived value due to the customer focused discussions where the staff would share their customer experience and learn from each other. In our opinion, this created a greater understanding of the customers' need which made it possible to deliver a greater customer experience.



6.2.5 Standardized procedures and preventive actions

As mentioned above, the regular meetings increased the knowledge about defects and how to prevent future defects to occur. Preventive actions in combination with standardized processes have reduced the number of defects, freeing more time that can be put on revenue generating treatments. Due to this we believe that it is reasonable to assume that the operational productivity has increased. A reduction of defects would, in our opinion, likely increase customer experience, hence also increase the customer productivity. However we cannot find any evidence that could be interpreted as improving the employee productivity.



6.2.6 Improved planning and preparation

Despite having a more flexible operation in general careful planning is needed in order to achieve an optimal mix of treatments that fit the competence mix of the operation given a certain timeframe. Even though the dentist does not constitute as critical resource as before it is still on the basis of the availability of the dentist that a day is scheduled. Lower throughput times haven't directly increased the number of people being processed since the way of planning per time unit is still the same. Indirectly however a larger number of customers can be processed since a larger share of a workday now can be used for treating patients. Hence the new way of scheduling is a central task in the operation of today.

Consequently we can see that the operational productivity has been increased as a result of these changes. In regard of the other productivities we have not found sufficient evidence to determine any effect on these measurements.

Operational Productivity ↑ Customer Productivity - Employee Productivity -

6.2.7 Evaluating the second research question

To sum up the discussion above we believe that it is reasonable to say that all the mentioned changes, except the recall system, have had a positive effect on the operational productivity. The customer productivity was, in our opinion, increased due to the effects of the preventive actions and the reduction of wait. The employee productivity was increased by new role and the increased influence of the nurses.

Organizational Changes	Effect on Op. Prod.	Effect on Cust. Prod.	Effect on Empl. Prod.
Increased competence enabling nurses and hygienists to perform the same procedures as the dentist	↑	-	↑
The use of Recall system (Vertical Information System)	-	-	-
Production planning, price discrimination, short notice queues, fee information, extended opening hours (Push)	↑	-	-
Quality improvement meetings, quality awareness permeating the organization (Continuous Improvement)	↑	-	↑
Standardized procedures and preventive actions (Zero Defects)	↑	↑	-
Improved planning and preparation (Elimination of Waste)	↑	-	-

7. Synthesis

The purpose of the synthesis, which is the final part of the thesis, is to take a step back and compare the theoretical predictions, i.e. our theoretical framework, to the empirical findings. Furthermore we aim to revise this framework and present our conclusions, both on the theoretical level as well as of its relevancy to practioners.

7.1 Empirical findings vs. theoretical predictions

Initially we expected to be able to identify all of the lean principles in the studied case companies but as the empirical findings, and the matrix below, shows this was not the case.

Lean Principles	Theoretical Framework	Revised Theoretical Framework
Specification of value	Prerequisite for reducing waste	Not necessary to employ for reducing waste
Elimination of waste	Highly relevant	Yes, but eliminating inventory important as well
Flow	Reducing throughput time most important	Resource allocation contributing to operational scalability is a key success factor
Push (Pull)	Demand mangment for high utilization	Highly relevant
Strive for perfection	Highly relevant	Highly relevant

Regarding the principle of specification of value we did not find that it had the same guiding role as in the established theory and as anticipated in our theoretical framework. We can conclude that there seems to have been a lack of customer perspective throughout the change processes in the studied cases.

The principle of identification of value stream and the elimination of waste had indeed received considerable attention in the case companies. By e.g. redesigning and standardizing the processes face-to-face service providers can indeed increase their operational productivity. Still we see a discrepancy in the relevance of the different wastes. The most deviant finding compared to the theoretical framework was the fact that inventory indeed had a significantly more important role than we had predicted. In our model we argued that the fixed costs of the facilities as well as the labor costs needed to be highly utilized. There is strong evidence that this is indeed the case but inventory is still a relevant waste to study.

We also found evidence that the creation of flow have been of great importance to the dental practices. Even though we have only identified minor reductions in throughput time flow have

been established by the increased competencies of the employees, reducing the dependency of the dentist i.e. eliminating bottlenecks in the service process. This new way of allocating resources has lowered the operational resources per treatment and increased the scalability of the operations, key factors in achieving higher operational productivity.

The fourth principal was, after a fundamental translation, possible to apply. Push techniques were indeed employed by both dental practices but the differences in how they worked with these procedures prior and after the organizational changes were limited. Our conclusion is that it should be regarded as an enabler for high levels of operational productivity. If face-to-face service providers fail to recognize this they probably never be able to fully reap the benefits from their lean initiatives.

It is hard to find a situation where strive for perfection could not be applied. In the cases the emphasis on continuous improvement has contributed to a reduction of defects as well as a gradual refinement of the processes, changes that directly affects the productivities positively.

We have also concluded that it is impossible to look solely on lean principles when considering the implementation of lean initiatives. Instead it is necessary to consider such initiatives that correspond to a lower level of abstraction, i.e. the lean production principles. When considering these we can conclude that the majority the of principles did correspond to our theoretical framework.

7.2 Theoretical implications

7.2.1 Theoretical contributions

We argue that there is little difference between applying lean principles or lean production principles to a face-to-face service process compared to a manufacturing process. The main argument is that all principles except for pull can be applied without any fundamental differences in its interpretation. Ahlström (2004) has already stated the lean production principles can be applied to a service given that the concepts are translated with regard to the characteristics of the service, which argue for our statement. However when analyzing the theory and the empirical findings on a higher level of abstraction that goes beyond the specific principles we see differences when it come to face-to-face services.

The most significant difference is that a manufacturing process can be improved by identifying non-value adding parts of the process and simply eliminating them (Hines and Rich 1997). We think that such a cost cutting or bottom line oriented approach which often characterizes lean implementations in manufacturing industries is harder to apply to face-to-face services, and instead we advocate top line growth. Hence, achieving the same results by mapping a face-to-face service process might not be that easy, not only because of the presence of the customer and the often limited scope of the process but from other factors as well. We want to emphasize that a face-to-face service process must be considered as a complete system of functions that need to interact in order to avoid sub-optimization and to achieve higher productivity. One example from the case study is the reduction of throughput time which might have had sufficient importance in a manufacturing process but which had only marginal effects on the productivities in the dental practices. In the case this freed time was partly used for the daily meetings and the establishment of quality consciousness among the staff, incorporating the human resource perspective into the operations. Another example could be marketing's role in face-to-face services. Unless face-to-face service providers can achieve flexibility in their capacity and resources high levels of utilization is needed to be able to eliminate waste. Hence our first theoretical contribution is that one needs to analyze a face-to-face service process from a higher level of abstraction to see how the service process is related to other functional areas such as human resources and marketing. If this broader perspective is ignored there is a risk of undertaking changes that will not only create sub-optimization but more importantly will limit the possibilities of taking full advantage of the lean system.

Johnston (1999) emphasizes the integration of human resources and marketing as the latest step in the evolution of operations management. However, he would also like to see a return to the basic operational management theories while incorporating some of the aspects of these other disciplines. Hence, our second theoretical contribution is the productivity measurements that have incorporated the more qualitative elements of these disciplines as well. Foremost it is the employee productivity measurement that is a new contribution, whereas the customer productivity can be found in previous theory (Johnston & Jones, 2004).

Another important contribution is the previously mentioned translation of pull into push. Our definition of pull is tightly connected to the employment of demand management techniques given the nature of a face-to-face service operation. We believe that this translation is an important contribution to the concepts of lean as the research up to date has ignored to acknowledge the perishable nature of face-to-face services. Our translation of pull into push implies that the principle gets a totally different meaning to the two kinds of settings. In a manufacturing process the pull principle is of greatest importance as it has significant effect on the creation of lean

operations. Such operations are keeping inventories at a minimum and in the most extreme cases the entire vertical structure and its systems is built around a make to order logic. However, as most wastes in a face-to-face service process have been identified in the transforming resources, the push principle should be regarded as more of a prerequisite for reaping the benefits of the lean way of working by maximizing utilization of the fixed resources

Finally one of our main arguments throughout the thesis has been that the difference between lean principles and lean production principles is that the first mentioned is a methodology to implement the later ones. The advantages of lean principles, according to previous theory and us, are that lean principles, by the incorporation of the specification of value, assure that the strategic value perspective has a guiding role in the operational changes being undertaken. However, the empirical findings show no support to existing theory regarding the specification of value from a customer perspective. Yet lean principles could be implemented with positive effects on operational productivity despite lacking the value perspective on the higher strategic level. This fact forces us to question the relevance of the principle of specification of value to practitioners.

The conclusion that we draw from this is that the two sets of principles seem to differ from each other on a theoretical level only whereas when they are to be applied to real operations their result might as well be the same. Given this, we conclude the new novelty of the value perspective in the lean principles may be argued on a theoretical level but we can not find any support for this in the studied practices.

7.2.2 Criticism

In the methodology part we have already been describing how our choice of research approach will affect the possibilities to generalize from the conclusions beyond the immediate case study. However, it might be relevant to return to these discussions.

We concluded that it is irrelevant to talk about internal validity in an explorative case study but still we have been trying to analyze and find causal relationships between the organizational changes carried out and its effects on the three productivity measurements. However, due to the nature of our research approach it is impossible to interpret our findings as truths but they should rather be seen as a set of hypothesis of how lean principles can be applied by face-to-face service operations as well as what the likely results from such an application could be.

Regarding the external validity then the disadvantage of choosing one case only is that the possibilities for generalizing from the results are limited. Even though we believe that we throughout the process have had sufficient empirical evidence to make logical and reasonable

interpretations there is always room for questioning them as well as the reliability of the analysis and the conclusions. Still we believe that it is reasonable to conclude that the findings indicate that it is possible to apply lean principles in face-to-face service settings but we cannot determine this after having looked at one case only. To come up to such conclusions sampling based on a population is often required but as we have been carrying out a case study aiming at illustrating a certain phenomena replication logic has been employed to maximize the utility of the single case. An ideal choice of such a case would also have been one that claims they have been applying lean principles. We would then have been able to look at the independent variables as opposed to now when we are focusing on the dependant ones. This was of sampling on the outcome is indeed not unusual but has been employed e.g. by Ahlström (2004) and Karlsson et al. (1995).

Furthermore we can say that each time a theory is being translated into a new setting there is always a risk that the relevance of the theory is reduced. When we, in our analysis, have argued that there is a logical relation between two different theoretical concepts, we generalize the theory and directly expose ourselves to a risk of reducing the relevance of the empirical findings. This is indeed a natural aspect of choosing abduction as research approach since it is inevitable that such an approach forces the researchers to be constructive as well as objective.

7.2.3 Future research

It would have been interesting to make a similar study to a case that claims they have been applying lean principles in an organizational transformation. Would they have interpreted the concepts of lean similarly, and what was the outcome of their implementations? Besides the question of finding interesting cases several areas have emerged during the writing of the thesis that could serve as a foundation for future research. One such question is the one regarding the relationship between the length of the service process and the perceived customer value. Our opinion prior to entering the empirical phase of the thesis was that this relationship indeed was one of the most interesting factors to look into when trying to determine whether lean principles could and should be applied to face to face service operations. As we saw it back then, reducing the time spent per customer should be one of the most powerful ways of leaning a face to face service process. However, even though the case companies have been able to decrease throughput times marginally the key success factor for improving the operational productivity has been the new role of the dental nurses, first of all by increasing the number of treatments carried out and by lowering the resources used per treatment.

This implies that one of the most interesting questions remains unanswered. Is it possible to achieve higher operational productivity by reducing the throughput time substantially, i.e.

processing more customers while keeping the outcome constant. Or if we put it differently; what are the possibilities for leaning operations to become more profitable by changing the customer's experience radically?

7.3 Managerial implications

The study shows that lean principles can be interpreted with regard to the characteristics of face-to-face services. It has also been proven that the potential effects of such initiatives indeed can have positive impact on the performance of dental practices. Does this imply then that lean implementations can become successful in any face-to-face service? Both practioners and academics have evaluated the usefulness of lean principles in manufacturing and back-office character service companies. However, even if the application of these concepts in face-to-face service operations is new to our knowledge our opinion is that lean principles could be seen as rather universal. The key however lies in translating the concepts with regard to the characteristics of the operation at hand. By holding the main objective fixed, i.e. the elimination of waste, we believe that it is possible to translate and apply the principles and concepts of lean to virtually any kind of setting. Just as this constitutes a risk that the concepts could be regarded as too general it could also be interpreted as one of the main strengths with lean. Looking more closely into the key performance drivers in the dental practices we think that face-to-face service providers shall ask themselves three questions;

1. Does our workforce consist of different level of competencies and how do the costs of these resources differ?
2. Can we reallocate these resources to ensure that each person create the highest value possible?
3. Can we take advantage of such changes either by lowering the input resources or by increasing the output by selling more?

Provided that the answers to these questions are yes we are confident that lean principles can play an important role to face-to-face service operations. One could say that lean highlights some core questions, namely; what value are we, I, and the company creating? These fundamental questions are as simple as they are powerful and yet we fear that they are not asked often enough.

We would also like to emphasize that in order to successfully implement lean principles; managers need to acknowledge the fact that different functional areas are increasingly becoming more and more integrated. Operations management in face-to-face service industries need to work with both human resources and marketing issues in a long term perspective to be able to achieve and maintain high operational productivity.

- Human resources: Since the decentralization requires more skilled employees, securing that the right competencies exists in the company becomes more critical to lean face-to-face service operations compared to “non” lean ones. Hence, working with employee satisfaction and competence development issues need to have a higher priority and a more long-term perspective in order to reduce the operational risks.
- Marketing: We believe that a continuous specification of the customer perceived value is a prerequisite for assuring that there is an alignment with the lean operational processes. We also believe that is necessary to take the value alignment on step further by proactively working with influencing and setting the expectations of the customers. As expectations change over time we see a need to control fluctuations in expectations which can be done by clearly communicating the market offering towards the customers.

Managers who take notice and understand the importance of these issues will, in our opinion, better their chances of achieving successful lean implementations contributing to improved operational productivity.

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Interviews

Bengt Myllenberg

Dentist, Tandläkare Myllenberg

2005-03-20

Dentist 1

2005-08-23

Dentist 2

2006-01-04

Dental Hygienist

2006-01-17

Dental Nurse

2006-01-12

APPENDIX 1 – Interview guide

Intro

- Describe your background and history within the practice?
- What are your main tasks and responsibilities?
- What services are you offering?

Process

- Define "service process"
- Which activities are included in the process? Has this changed over time? In what way?
- How long time does the different activities take to perform? Has this changed over time? In what way?
- How are the resources allocated in the service process? Has this changed over time? In what way?
- Which of these activities are most important for the quality of the service? Has this changed over time? In what way?
- Which of these activities are most important for the customer's experience of the service? Has this changed over time? In what way?

Elimination of waste and defects

- Define waste: Over production, Transport, Movements, Inventory, Wait, Over processing, defects
- Are the situations where wastes occur? In which parts of the service process did they occur? Has this changed over time? In what way?
- What where the reasons for this? Where there any specific reason for the waste to occurs in the specific activity? Has this changed over time? In what way?
- What where the challenges to eliminate the waste in the traditional practice and in the new practice.
- How does the waste affect the customer ? The employees? The operations? Has this changed over time? In what way?

Push/Pull/Demand Management

- How often do the customers not show up at the appointment? What are the reasons for the customers not to show up? Has this changed over time? In what way?
- Do you take actions to assure that the customer would show up at the appointment? Has this changed over time? In what way?
- How do you work scheduling of the customer? Has this changed over time? In what way?
- Do you take actions to steer the customer towards certain hour during the day? Has this changed over time? In what way?

Flow

- Are there any parts of the service process that took more time than necessary? What where the reasons for this? Has this changed over time? In what way?
- Where there any unexpected situations that caused a delay in the activities? Which? What where the reasons for this? Has this changed over time? In what way?
- How would you describe the workload during the day? Has this changed over time? In what way?

Multifunctional teams and Decentralization

- Describe the different roles and responsibilities for each role? Has this changed over time? In what way?
- What are the possibilities for one role to perform the task of other? Has this changed over time? In what way?

- What where the main reason? Vilka är anledningarna till arbetsfördelningen mellan tandlänkaren/sköterskan? Has this changed over time? In what way?

Vertical information systems

- Do you use information systems to support you work? Has this changed over time? In what way?
- During which activities in the service process do these systems provide support? Has this changed over time? In what way?

Continuous improvements

- How to you work to reduce the defects in the service process?
- Has this changed over time? In what way?
- How do you work to create quality awareness in the practice?
- Has this changed over time? In what way?