Measuring lean

– An evaluation model for GRS

Abstract

The aim with this study is to develop an evaluation model for assessing the maturity grade of Gamma Retail System, GRS, in Gamma's service workshops. GRS is a lean concept that will be broadly implemented in Gamma's workshops during the spring and summer of 2009. Despite the fact that numerous lean literature exists, no best way of measuring lean has yet been agreed-upon. Most attempts to assess lean have also been conducted in manufacturing firms and the research in the service area is still limited. This study attempts to make a contribution to fill that gap in research. By studying three pilot workshops that have worked with GRS for some years and comparing these with two that have not, we have attempted to assess what characterises the maturity of GRS from a lean standpoint. On the basis of these findings, an evaluation model is developed. This evaluation model will serve as a hands-on tool to measure the maturity of GRS/lean in a service workshop context.

Keywords: lean, service, workshops, maturity grade, evaluation model

Authors: Tomas Ahlmark and Karin Eklund

Tutors: Pär Åhlström, Malin Holm

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Discussants: Idha Bergström and Julia Grünewald

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1. Introduction

This study focuses on how to find a way to measure the maturity grade of Gamma Retail System (GRS) in Gamma's workshops, and to identify the challenges involved. Gamma Retail System is inspired by and developed from the concept of lean.

1.1 Framing the study

The company, hereafter called Gamma is a global manufacturer of industrial products, with operations in all continents except North America and Antarctica. Gamma workshops are an integrated part of the Gamma value chain with the purpose of providing a wide range of repair and maintenance services to the manufactured industrial products, with the same quality standards that the rest of the company maintains. Worldwide, Gamma has 1400 service workshops.

Since the mid-1990s, Gamma has worked with an efficiency concept in its production facilities called Gamma Production System (GPS), which is based on the world renowned Toyota Production System (TPS) – the predecessor of all lean concepts. In 1995, a group of Gamma managers went to Toyota's automobile factory in Kentucky, USA to learn about TPS, and their experiences from that trip were the starting point of the formation of Gamma Production System (GPS). GPS is a production efficiency concept using lean principles, and it is used in all of Gamma's production facilities around the world. During the nearly fifteen years it has be employed in the production facilities Gamma Production System has proven to be a very successful way to improve efficiency, quality and employee satisfaction.

After the success of GPS in its production facilities, Gamma has set out to implement a similar concept in its workshops. This concept has been named Gamma Retail System, GRS, and it is adjusted for the conditions in the sales and service market of the industrial products produced in Gamma's production.

The work with GRS started in 2006 in the form of pilot projects in some workshops in Belgium. These workshops are now considered to be models for the rest of the workshop network in Gamma in terms of GRS. Some of these workshops have been visited as a part of this study

along with some that have not started to work with GRS. During the spring and summer, an extensive GRS implementation programme will be undertaken, both in Sweden and internationally, starting with a two-day management education course followed by introductions in workshops.

1.2 Problem statement

One of the reasons why Gamma has requested a measurement tool for GRS is that Gamma currently does not have a satisfactory way of evaluating GRS in different workshops. Today, only the education level of workshops, and some simple evaluation tools are used for GRS evaluation. The problem is that these do not capture how the GRS concept changes workshops processes and mindset.

1.3 Purpose of thesis and research question

The purpose of this thesis is to develop an evaluation model, which assesses the grade of maturity of GRS in Gamma's workshops, and can be used to compare different workshops to one another. More specifically, it should assess how well the GRS concept is integrated in the different workshops. The primary users of the GRS evaluation model should be GRS office and the individual workshops and the model should be simple enough to be used in practice. The research questions are:

How can an appropriate evaluation model for assessing the maturity grade of GRS look like?

A second question that also needs to be examined in order to successfully find an answer for the first question is:

What are the main challenges with developing this evaluation model?

1.4 Delimitations

This thesis only focuses on the design of the evaluation model and not on the implementation of this model. Time constraints, the size of this thesis and the fact that GRS is not yet implemented in Sweden make it impossible for us to test the model in practice.

It should be noted that GRS is also used in the Sales part of Gamma, which sells industrial products to customers, but our focus will only be on the service and repair part of GRS. For the purpose of this thesis, the service and repairs of industrial components will not be treated either, because these are repaired in specialised workshops and these workshops have not been visited for this study. These limitations have, however, no implications on the understanding of GRS as a concept.

1.5 Disposition of the study

First of all, the method used for undertaking the study is described and motivated. Then, in order to answer our questions we first look at several theoretical frameworks necessary to construct our model, including lean theory, different evaluation methods and some measurement performance literature. Thereafter, the empirical findings are presented. These include a description of what a workshop is, an account of what GRS is and how it is measured today, and at last a description of how the different workshops visited work. In the analysis, we first discuss and announce what evaluation method we should use. We also analyse the workshops in relation to lean theories on order to find key determinants for developing a model. After that we discuss the components the model should be built upon. Finally, we construct and present the model.

2. Methodology

This chapter describes the methodology used in this study. As a starting point we will describe our research approach and next our research strategy applied. Then we will move on to describe the methods used to collect our data and in the last part of the methodology we will also test the quality of our research.

2.1 Research approach

The type of study conducted

To measure lean performance and maturity it is conceivable to use a quantitative approach. For example, Shah and Ward (2007) have developed a model in which leanness is evaluated through statistical evaluation. However, that approach is only appropriate if for one, it is possible to discern clear variables to evaluate, second, it is possible to find a large enough sample, and third, it is clear what characteristics and variables that are sought for. Thus, in order to only have a quantitative approach it is necessary for the researcher to control what to look for before the study is undertaken (Holme and Solvang, 1997 p.14). Since our study attempts to find out how to measure a lean concept that has not yet been fully implemented in a service context – which has been less studied for lean purposes than manufacturing – little information on what relevant variables to use exists. The sample size is also small due to the fact that the concept has only been tested in some pilot workshops. Thus, it has been necessary for us to first find out how the workshop industry works and then assess what can be considered lean in that context. Therefore, to conduct a qualitative research approach has been necessary.

Unsurprisingly, the practices of workshops for industrial products and GRS are not described textbooks, so a case study with an explorative research approach including interviews with involved people and actual visits to workshops has been called for in order to gather relevant facts (Yin, 2003 p. 6). In addition, since Gamma has requested an assessment tool for leanness in the workshops based on the findings from the explorative research, the outcome of the study is also clinical in its nature (Månsson, 2001). The study aims to enhance the present knowledge and visibility of GRS in Gamma. Applying a clinical approach has likely facilitated access to

information since at the same time as writing an academic report we have helped the company to produce something that can be used in their practices.

According to Holme and Solvang (1997 p.51), there are two different methods that can be used for a research study. One method is the deductive approach where the theory is used as a starting point and the empirical findings then are tested against these theories. The other approach is the inductive method that instead has its starting point in the empirical findings. The theories used in an inductive approach, are instead chosen during the process, in parallel with the collection of the empirical findings. Due to the fact that little research has been made earlier in the area and that our research is of an explorative nature, we have chosen to use an inductive method for our research, where we connect our empirical findings to relevant theories.

2.2 Research strategy

A case study

As implied by the nature of the research question and the research approaches just described, the study is case based where five workshops, two in Sweden and three in Belgium, have been thoroughly investigated by direct observations and interviews with people working there. These five workshops form the basis for our understanding of what workshops are and how they work. For reasons of confidentiality we have anonymised these workshops and henceforth we refer to them as A, B, C, D and E.

In addition to the workshops, people working with GRS development and coordination on different levels in the organisation, have been important sources of information. For the same reasons as with the workshops, all the persons interviewed are also anonymised. Worth to mention is that our objective with investigating the chosen workshops was to find some determinants implicating the grade of maturity of GRS. Consequently, our objective has not been to actually measure the maturity of GRS in the workshops. To do that is an endeavour of future research.

Choice of purpose of study

From the initiation of the study, after the first contact with Gamma, the purpose to develop a maturity evaluation model for GRS in Gamma's workshops was clear. This was decided upon in conjunction with our project assignor, who has a background in both Gamma and Stockholm School of Economics, after we had expressed our interest in looking at some aspects of lean implementation at Gamma. Although the goal of the study was determined early on, the nature and constitution of the model and the evaluation approach was entirely up to us to decide, as long as it, in an appropriate way, measured the maturity of GRS in the Gamma workshops.

2.3 Data collection and empirical sources

Theoretical framework

Since only limited research has been made in the area of transferring the principles of lean from a manufacturing context to a service context (Bowen and Youngdahl, 1998), and even more limited in measuring lean progresses in a service context, an extensive literature research for finding valid theories has been necessary.

Due to the purpose of the thesis, both relevant operations- and accounting literature have been examined to find good answers to the research questions. First it was necessary to get an understanding of what constitutes lean in order to be able to explore the characteristics of GRS. Second, since there are not yet any agreed best way to measure lean (Shah and Ward 2007), the most common ways of measuring lean had to be investigated. As most evaluation models found are based on assessing lean in a manufacturing context these theories had to be adjusted to fit in a service context. It was also found necessary to have supporting theories with what to take into consideration when designing a performance measurement system, in order to avoid common errors. Therefore the third part in the theoretical framework describes common pitfalls and recommendations when developing a measurement system.

Who we have interviewed and what places that have been visited

Gamma is a company with presence in different markets worldwide and with about 35000 employees and net sales of approximately 89 000 MSEK in 2008 (Annual report 2008). Due to this fact, it is a big organisation. To know who to talk to, and get access to these people could

because of this be rather difficult, especially since neither of us had prior experience of working with the company. Luckily our project assignor laid out a plan of what places to visit and people to talk to. This has been valuable for us since she had a better insight into the organisation. If the study had been undertaken without the help of our project assignor, the choice of people to interview had perhaps been different, especially since it is possible that the accessibility of the organisation had been lower.

The research plan has been followed during the course of the study. It has included interviews with people working at the GRS office responsible for the GRS concept, as well as people working with the similar Gamma Production System (GPS), at the Gamma GPS office.

The research plan also included visits to the five workshops chosen for our case study, two of them in Sweden and three in Belgium. The workshops in Belgium have, as mentioned earlier, been part of a pilot project for GRS and worked with the concept since a few years back. In the Swedish workshops we have interviewed and been guided around by the workshop managers. In Belgium, we were driven around to the three workshops by a GRS coordinator responsible for Western- and Southern Europe. In these workshops we interviewed the local GRS coordinators, while being guided around. In one of the workshops two people responsible for the warehouse were also participating in discussions.

Along with visits in the workshops we have also made three visits, with interviews included, in Gamma's production facilities in order to see how work with the older and more integrated GPS concept is carried out in a manufacturing environment. There, we either had an interview with a person and then were shown around the facility or the other way around.

In addition we have interviewed the executive manager for Gamma's Swedish workshops and a person responsible for KPI collection at the Gamma headquarters. Apart from interviews and direct observations, we have also taken part of some written internal documents for describing GRS, where the most useful has been a brochure that describes the GRS concept and model in general. Since the concept is new, all material on GRS that has not been included in that brochure has by people at the GRS office been expressed as unofficial, personal opinions about GRS. In particular, it has been hard to find written material that is updated and that reflects the current thoughts and work with GRS in Gamma. Therefore, in order to understand what GRS is

and how it is perceived in practice, the interviews and direct observations have been all the more important for the study.

Procedures during interviews and direct observations

During the interviews that have been conducted in separate conference rooms, offices, and also in a car (during our tour in Belgium), extensive notes have been taken. After the interviews notes have been cross-checked by the authors and if any questions have remained the interviewee has been contacted again. During direct observations, note-taking has not been possible to be as detailed as during interviews. This is because of the nature of direct observations, that they are more visual, with details that have to be explained, and that they have included a lot of walking around in workshops and production facilities. However, after each direct observation, written summaries of the impressions have been produced individually by the authors and then cross-checked in order to assure that there are no inconsistencies. If any inconsistencies have been found, the underlying information has either been disregarded, if deemed not important for the study, or checked with the contact person for the direct observation. At the workshops and production facilities, when possible, photos have been taken in order to better remember the details shown. This is in line with recommended procedure for gathering information through interviews and direct observations (Yin, 2003 p. 93; Bell 1995, p. 95). Audio recordings have however not been made, except during one interview, primarily because of practical reasons. First, it may cause people to be overly conscious about what they say because they know it is being recorded (Bell 1995, p. 99). Second, and more important, audio recordings are, as we have discovered, not a well suited way of recording facts when walking around in workshops and production facilities. This is because these places are noisy and difficult to get a good recording quality in, and it is also difficult to understand what is being said without actually seeing what is talked about. In addition, process observations are more about the understanding of what is happening and how things are done rather than keeping track of the exact wording of what people have said.

The questions asked during interviews and direct observations

Similar, although not identical questions have been asked during different interviews and direct observations. The questions have revolved around the research question. Freedom has been

given to interviewees to develop their thoughts on the subject in order not to constrain the information received by our pre-conceptions of the subject and the interviewee's knowledge about it. At the same time, our questions have attempted to keep interviews focused and on subject (Holme and Solvang 1997, p. 101). The interviews have thus been of a semi-structured nature. With many questions we have tried to get answers on how GRS is constructed and used in practice and if, and in that case how, it is currently measured. Another question we often asked is what has been important to think of when implementing GPS and GRS. As the study progressed, and depending on whom interviewed, questions turned from being of a descriptive nature of GRS to implications of measurements and difficulties of finding out maturity for GRS. During direct observations, questions have been asked in a more ad hoc manner as a response to what has being shown or seen in workshops and production facilities.

As been seen, the approach used follows the principles of data collection described by Yin (2003 p. 97) when conducting interviews and direct observations. This implies using multiple sources of evidence, detailed documentation and creating a chain of evidence.

Delimitation of data

Much of the facts and insights received in the production facilities about how GPS has been used, have been crucial for our understanding of GRS, but not necessarily suitable as parts in this thesis. Therefore, explicit explanations and comparisons to the working practices in the production facilities and GPS have been left out almost entirely in this thesis in order to make it as focused and relevant as possible.

2.4 Implications of the quality of research

In order to certify that we have fulfilled the purpose of the study and delivered a research of high quality, it is of great relevance to assess the validity and reliability of our research by assessing the study against certain criteria. According to Yin (2003 p. 34) four tests are commonly used for this purpose.

Construct validity

To pass the test of construct validity the research must be sure to have "establishing correct operational measures for the concepts being studied". (Yin, 2003 p.34).

To meet the requirements of this test, the research must cover two steps. First it must provide a specification of the phenomena selected for the study, and second, it must demonstrate that the selected measures indeed reflect these phenomena. (Yin 2003, p.35).

In our research we argue that we meet the first requirement because we have clearly defined and delimitated what we are going to study; the phenomenon we have studied is how to assess the maturity grade of GRS in a workshop. We also argue that we meet the second requirement because we clearly justify why the evaluation method chosen when assessing the maturity grade of GRS is the most appropriate way to reflect the phenomena studied.

Internal validity

This test concerns the establishment of causal relationships where certain causes are shown to lead to certain effects. (Yin, 2003 p.35).

The model has been constructed on the basis of the findings as to what defines a mature workshop. Thereby causality between what is found and the construct of the model exists. However, the model needs to be tested before causality between the model and any financial results can be established, but that has not been the area of investigation in this thesis.

External validity

Testing the external validity concerns the extent to which the findings from the case study can be generalised i.e. if they are applicable to other situations outside the case studied. (Yin, 2003 p. 37). Since GRS is built on the concept of lean, we argue that the findings in our research also can be used by others, outside the organisation studied. Although, our results and findings need to be adjusted for other specific contexts, the way of thinking and the evaluation model developed can provide a guide and a foundation for others who want to measure lean progresses in a service context.

Reliability

This is the last test and the objective with applying this test is to be able to argue that the operations of a study can be repeated and arriving at the same results. The goal of reliability is to minimise the errors made, and therefore documentation of the procedures taken is vital. Without proper documentation it is also impossible to repeat the work done. (Yin, 2003 p. 37).

The reliability of direct observation and interviewing is always difficult to assess, especially when doing direct observations, since it many times made it impossible to take detailed notes or in other ways record the happenings and the utterings. However, we have done our best to assure that what we say in this thesis is correct, by first of all writing down our immediate reflections after the direct observations and interviews and then discussing our findings amongst each other. After that, we have written down summaries on what has been said. A good complement to our notes have also been the photos taken in the workshops in order to document and remind ourselves about what actually happened in the workshops. We have also consulted with our project assignor if any ambiguities have occurred, since she has a good knowledge about Gamma, and to avoid simple mistakes. Naturally, even with these precautions, there is a possibility that what we have written sometimes may have been misinterpreted or in any other way is faulty. As far as it has been possible for us we have tried to avoid that, and if any such faults have occurred on our behalf, they are likely to be of a minor matter, due to the precautions just mentioned.

There is also a risk that the information provided to us during the interviews has not been correct or based on personal opinions rather than what would been perceived as true within the rest of the organisation. This type of fact mistakes are much harder than the previous one to avoid, but whenever possible we have tried to interview more than just one person in each function in order to easier sort out personal opinions from more established truths. Therefore we can argue that the study conducted also fulfils the requirements of reliability.

3. Theoretical Framework

The theoretical framework constitutes of three parts. First, an understanding of the concept of lean production is established. Second, different types of evaluation models for lean concepts are presented. Third, we address the challenges of developing an appropriate evaluation model.

3.1 The origins of lean production

The origins of lean can be traced back to Japanese manufacturers and especially to innovations at Toyota Motor Company (Hines et al., 2004). Lean production arose from and is frequently used as a proxy for Toyota Production System (TPS) (Shah and Ward, 2007).

After World War II, Toyota wanted to go into full-scale car and truck manufacturing, and seeing the success of its American peers, it wanted to implement mass production techniques at its plants. The production manager at Toyota Motor Company, Taiichi Ohno therefore went to study mass production techniques at Ford´s plants in the U.S. However, due to capital constraints and a small domestic market that demanded a wide range of vehicles he concluded that mass production would never work in Japan (Womack and Jones, 2007 pp. 47-50). Therefore he began to experiment with methods that were less capital intensive than those of mass production. This was the beginning of the development of the concept of lean production (Holweg, 2007).

Krafcik, a researcher at Massachusetts Institute of Technology (MIT), coined the term lean manufacturing after comparing automotive practices around the world (Bowen and Youngdahl, 1998). Krafcik's research was later continued by the International Motor Vehicle Programme at MIT. The findings where described in the best-seller book *The machine that changed the world* co-authored by James Womack and Daniel Jones in 1990, which has formed the basis of the lean concept (Holweg, 2007). In particular, lean is a term that stands for "doing more with less", that implies making improvements of the utilisation of organisational resources (Abdi et al., 2006). The pressure to reduce costs, increase flexibility, raise quality and shorten lead-times has, especially in recent years, led to that many organisations have implemented the concept of lean (Abdi et al, 2006).

After its introduction the lean concept has also been extended to other areas outside the production industry. Much research has lately dealt with how the lean production concept can be transferred to the service industry. A fundamental difference from adapting lean concept from a manufacturing context to a service context, is that the latter takes place in the presence of and in collaboration with the customer, whereas manufacturing usually does not (Bowen and Youngdahl, 1998). However, as research such as the findings of Åhlström (2004) and Bowen and Youngdahl (1998) suggests that lean concepts can, with some consideration to the very nature of services, be applied in service contexts, it follows that lean evaluation models originally developed for a manufacturing context also can be applied in services.

3.2 The principles of lean

An important contribution of the book *The machine that changed the world* by Womack and Jones, was that it tied together and systemised many seemingly unrelated principles of what had been observed in the 1970s and 1980s in some Japanese companies in general and Toyota in particular into a single comprehensive concept (Kollberg et al, 2007; Holweg, 2007). By taking Womack and Jones's description of lean production, Karlsson and Åhlström (1996) have categorised the lean concept into nine principles. In short, these nine principles are what characterise a lean organisation.

Elimination of waste

The elimination of waste is the most fundamental principle of lean production (Åhlström, 1998). Waste is something that in the end does not add value to the customer and therefore is something that he or she does not want to pay for. By eliminating everything that does not add value to the product or service the firm can lower its costs. In total, seven wastes are usually identified (Bhasin and Burcher, 2006):

- Over production
- Waiting
- Transportation
- Inappropriate processing
- Inventory
- Unnecessary motions
- Defects

Continuous improvement

The second most important principle of lean production is continuous improvement, which means to constantly strive for better performance and never be fully satisfied with the current state of affairs. The constant strive for perfection is called kaizen, the Japanese word for "ongoing improvement involving everyone". Involving everyone is often accomplished by having quality circles where employees gathered in small groups that come up with suggestions for improvements. This is tied to routines for implementing suggestions, rewarding employees and feeding back information on the status of the suggestions (Karlsson and Åhlström, 1996).

Zero defects

To be able to achieve high productivity it is essential that the products and parts that are produced have zero defects from the beginning. It is important to prevent defects before they occur, by discovering errors in the processes that can eventually lead to defects. Thus, instead of reactive work it is necessary to implement more proactive work.

When working with lean, everyone is responsible for the quality assurance. The identification of defective parts is the responsibility of every worker, not the quality department (Karlsson and Åhlström, 1996). It is vital to solve the problems from where they come, to trace them back to their roots so that they can be eliminated once and for all. A common way to find sources of errors is to ask why-questions. This is formalised by the five-whys made famous in the Toyota Production System, as explained in Womack and Jones (2007, p.56).

Just-in–time

To achieve just-in-time deliveries, it is essential that the parts and products received have zero defects. The principle of just-in-time is to create regularity within the system; a system offering what the customer wants, in the right amount and at the right point in time. The goal is to create a state called flow, where resources arrive in time and only when needed (Karlsson and Åhlström, 1996). Fast, frequently recurring deliveries and standardised times for different activities are almost prerequisites in order to achieve this (Rother and Shook, 2003).

Pull instead of push

Related to the just-in-time principle is the principle of pull instead of push. Pull processes means to respond to demand and only produce what the customer actually wants instead of producing ahead of, and predicting, demand (Karlsson and Åhlström, 1996).

Multifunctional teams

By organising employees into small working groups, multifunctional teams, the employees will be able to perform different tasks and the number of job classifications decrease. When tasks are rotated in the team there will be increased flexibility and each employee will perform different tasks throughout the duration of the day, allowing for better process understanding and making them better at detecting areas of improvement (Karlsson and Åhlström, 1996).

Decentralised responsibilities

Another principle that also characterises a lean organisation is the decentralisation of responsibilities. Each multifunctional team is responsible for, and is expected to perform tasks formerly performed by the foreman. The result is that the number of hierarchical levels in the organisation can be reduced. The team leadership should rotate among employees (Karlsson and Åhlström, 1996).

Integrated functions

This principle is also related to the multifunctional teams and implies that tasks previously performed by indirect functions should be integrated in the tasks performed by the multifunctional team. Tasks such as quality control are integrated in the daily work for the multifunctional team and the work content of these teams is thus increased. As a result, support functions become less important, and the number of indirect employees can be reduced (Karlsson and Åhlström, 1996).

Vertical information systems

The objective with vertical information systems is to continuously and directly provide real time information in the flow of production. In order to facilitate for the multifunctional teams to perform their tasks according to the goal of the company, there is a need of vertical information

systems. The content of this vertical information can be divided into two types; the more strategic information concerning the overall performance of the company, and the information of a more operational type concerning the performance of the team (Karlsson and Åhlström, 1996).

3.3 A five-step process for implementing lean

In *The Machine that Changed the World*, Womack and Jones identified the characteristics of lean just described above. In their book *Lean Thinking*, the thoughts about lean were developed into a five-step process, in an attempt to establish the different steps that need to be taken in order to become lean (Shah and Ward, 2007). These steps are shown below. Because the steps were first described for manufacturing companies, they have here been adapted into a service context. This has been done in Abdi et al (2006) and, where appropriate, their findings have been integrated in this description. Similar step-by-step approaches for lean implementation have been provided by for example Nightingale and Mize (2002) and Rother and Shook (2003).

1. Specify value by service. This is the first step and also the critical starting point for lean thinking. Value is created by the producer of the good or service. However, value is very hard for the producer to properly define. Only what is value-adding to the customer should be provided, anything else is waste (Abdi et al., 2006). Yet, many companies fall back on simple formulas such as lower costs, increased customisation and instant delivery for establishing value (Womack and Jones., 1996 p. 31). In service organisations it is essential to form a clear view of what the customers' needs and expectations really are and consequently the service provider should act and customise the service offer according to these needs and expectations (Abdi et al., 2006).

2. Identify the service value-stream. The service value-stream is the set of all specific actions required to bring a specific service to the customer, and by defining the entire value-stream substantial opportunities for eliminating waste often materialise (Womack and Jones, 1996 p. 20). It is necessary to understand all process activities and then optimise the value-stream in regard to the customer. Creating a value-stream map starting from the customer is essential because it helps to identify three critical kinds of activities: those which actually create value as perceived by

the customer, those which create no value but are currently required by the service process, and those actions that do not contribute to create customer value and therefore can be eliminated immediately (Womack and Jones, 1996; Rother and Shook, 2003). The value-stream in a service context also implies learning to see and understand what other people are doing, and together identify where waste can be eliminated. This suggests that all parts of the organisation should get involved in the service provided. If people do not communicate and just focus on their own work, the value-stream continues to be riddled with wastes (Abdi et al., 2006).

3. Make the service flow. After specifying value and identifying the value-stream, the next step is getting the activities that are value-adding to flow without interruptions. This implies removing all impediments to the continuous flow of the specific good or service (Womack and Jones, 1996 p. 52). Conversely, establishing a flow and removing waste work in parallel; creating a flow in the process enables organisations to discover problems and also to take quick corrective actions (Rother and Shook, 2003). According to Abdi et al (2006), to create flow in a service context implies behaving in a way that minimises delays or stoppages in the work performed by others. Common practices that cause delays include contradictory or ambiguous communication. Managers must therefore be clear in communicating with his or her employees and any form of inconsistent behaviour should be eliminated (Abdi et al., 2006).

4. Supply at the pull of the customer. When the value-stream flows smoothly, the firm should make sure that it produces goods or services that people really want, and at the time they want them (Womack and Jones, 1996 p. 67). The principle of pull means to respond to the demand of the customer. In a service context this means designing operations able to respond to changing requirements of customers (Abdi et al., 2006). A pull strategy in a service context is built into the production of the service, in the interaction with the customer, and therefore cannot be stored. The quality of the service from the customer's perspective indicates the degree of pull strategy. (Kollberg et al., 2007).

5. In pursuit of perfection. This is the last principle in lean thinking. The other steps are pointless unless the firm does not constantly strive for perfection. Perfection is the complete elimination of waste. At this point every activity creates value for the customer. This is a journey

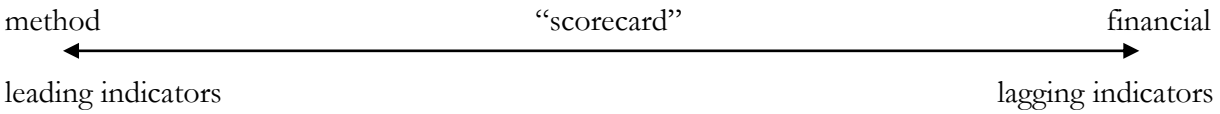
of continuous improvements based on intolerance for maintaining a status quo. If an enterprise can do the first four steps well, then all activities become transparent as on what to do next (Abdi et al, 2006; Womack and Jones, 1996 pp. 25-26). This enables people to easily identify and eliminate waste, and focus on improving activities that create value. The systematic elimination of waste will reduce the operating costs and fulfil customer needs by creating maximum value for lowest price. (Abdi et al., 2006).

3.4 Commitment and support as critical success factors for implementing lean

In addition to the five-step process of lean, Achanga et al. (2005) identify two critical factors for achieving a successful implementation of lean: management commitment and the creation of a supportive organisational culture. Both these serve as prerequisites for a successful implementation of lean. To achieve management commitment, it requires that the manager has understood the concept and feels enthusiastic for it. In order to create a supportive organisational culture, the manager must also be able to act as a driving force and create a sustainable motivation for it among the employees. According to Flinchbaugh (2008), "lean is more than just tools". The author argues that it is important to establish an understanding of the concept, a way of thinking among the employees, and to involve everyone, in order to achieve a successful implementation. Thus, implementing lean requires strong leadership and management commitment.

3.5 Different types of evaluation models

Even though there are numerous of researches, books and articles written about lean, academics and practitioners have not yet agreed upon, or come up with a best way to measure lean (Shah and Ward 2007). By reviewing existing lean literature along with performance measurement literature, we have identified three major ways of evaluating the performance of lean concepts. These are categorised into financial evaluations, scorecard-based evaluations and method-based evaluations. These are depicted on the next page.



3.5.1 Financial evaluation

Financial evaluation is the classical and traditional type of performance evaluation and achieving good financial results is in many ways the very meaning of conducting business activities. Thus, the fundamental question "how well are we doing?" that every manager needs to have an answer for has traditionally been expressed in financial terms (Fitzgerald., 2007 p. 223). Examples of financial performance measures traditionally used include profit or sales growth, gross and net profit margins, return on investment (ROI), return on capital employed (ROCE) and so on (Neely et al., 2002 p. 17).

Weaknesses of financial evaluations

While financial measures are interesting for shareholder and investors they are usually too blunt and appear too late to capture the complexity of many operations (Kaplan and Norton, 2005; Neely et al, 2002 p.16). In particular, financial measurements are not well-suited to derive feedback on operations from, as they only provide abstract information. Many times, this makes it difficult for employees to understand how operational activities, their daily work, affect and influence the financial performance measures (Seminar on Balanced Scorecard, 2008). Another weakness with financial performance evaluation is that there is a risk of short-sightedness if units are evaluated by, for instance quarterly performance. Due to this, the benefits of lean are not obvious when only using traditional financial measures (Bhasin, 2008). A third weakness is that traditional financial measures can encourage dysfunctional behaviours if the rewards for managers are based on assessments of these measures. This could lead to principal-agent problems, with managers maximising their own returns at the expense of the organisation (Fitzgerald, 2007 p. 223; Tuomela, 2005).

3.5.2 A Scorecard-based evaluation

Originally based on Kaplan and Norton's writings about the need for more sophisticated evaluation methods than only financial ones, scorecards have received a substantial response in the business community as many businesses use them today (Kaplan, 1984; Norreklit and Mitchell, 2007 p. 175). The reason we have included scorecards in our description of different evaluation methods is that their purpose is to connect methods with financial results. Thus, in a sense, scorecards are in between methods and results.

The key to establish a balanced scorecard is to find causal relationships between non-financial and financial measures evaluated because it uses the non-financial measurements as predictors of future financial outcomes (Norreklit and Mitchell, 2007 p. 183). If this is accomplished, it is argued that business managers will be well equipped to take better strategic decisions than if using only traditional financial measures (Kaplan and Norton, 2005; 2007; Ittner and Larcker 2003).

Weaknesses of the Balanced Scorecard

Even though a balanced scorecard has a number of strengths by combining financial measures with non-financial measure, there are also some commonly described weaknesses related to the model. First, a time reference is not included in the scorecard. This is problematic when a time lag is supposed to exist between the cause and the effect, because the effects on financial results of some improvements and efforts will occur almost immediately while others may improve very slowly. Hence, it is difficult to assess exactly when the financial effect will occur and long-term improvements may not at all be captured in the short-term financial results. Second, when measuring the effects of actions for new and complex activities in an organisation, it can be almost impossible to establish performance measures for activities that the organisation has little or no experience of at all. Therefore, measuring effects is difficult in organisations that constantly have to adapt to new situations and where innovation is an important part of competitiveness. Consequently, assumed causal relationships between method and outcome may prove much more difficult to establish in reality, as opposed to what is suggested in scorecard literature (Norreklit and Mitchell, 2007 pp. 181-185).

In a lean context, establishing cause and effect relationships is especially difficult. The concept's inherent focus on continuous improvements and strive for perfection, which makes it multifaceted and complicated, also make causal relationships hard to establish (Shah and Ward, 2007). The authors identify, in line with Norreklit and Mitchell (2007), that the time-lag between long-term improvements and short-term financial performance can, in the light of the concept's complexity, can be problematic when adopting a scorecard approach for measuring performance in a lean context. Bhasin (2008) also suggests that the real benefits of lean in themselves can be difficult to quantify and measure.

3.5.3 Method-based evaluation

A method-based evaluation focuses on the actual, operational methods that should be used to conduct business activities, rather than actively trying to connect practices with results. Results are implicit as a consequence of the right model being used or are regarded as a future point of investigation. Shortened lead times are often used as a proxy for positive impact on results. Much literature has been written about the methods of lean, its implementation and the performance factors that are indicative for a high degree of leanness or implicate success of working with the concept. A few examples include Abdi et al. (2006), Achanga et al. (2005), Farris at al. (2008), Goodson (2002), Karlsson and Åhlstöm (1996), Nightingale and Mize (2002), Rother and Shook (2003) and Womack and Jones (1996; 2007). A method based evaluation can be made in different ways.

On a more *detailed level*, there are often a number of criteria that reflect the characteristics of the method drawn up. The units that are to be evaluated are then assessed whether they fulfil these criteria or not. Karlsson and Åhlström (1996), Womack and Jones (2007) and Goodson (2002), all exemplify a detailed method approach.

On a *sequential level*, illustrated by Abdi et al. (2006), Rother and Shook (2003) and Womack and Jones (1996), leanness is described on the basis of different sequential steps taken in order to implement and work with the concept. In particular, by assessing what steps and actions the organisation has taken in the process of implementing lean, it is possible to assess the leanness of

the organisation. Depending on what actions are required towards becoming lean, a comparison between one service provider against another can be made.

Detailed method based evaluation

A lean evaluation based on the nine fundamental lean principles, described earlier in the theoretical framework, would be an example of this type of more detailed method based evaluation. To the nine principles, Karlsson and Åhlström's (1996) have defined a number of determinants that can be used to assess the leanness of each principle. Increased productivity and shorten lead times are the main outputs that these determinants should capture. The purpose is to find measurable determinants that reflect the important changes towards lean production and the desired performance in each of the principles. An example of identified determinants for the principle continuous improvements by Karlsson and Åhlström (1996) follows below.

Determinant	Continuous improvement	Lean
Suggestions	• Number of suggestions per employee and year • Percentage of implemented suggestions	↗
Organization of improvement activities	1. Quality circles 2. Multifunctional teams, and spontaneous problem solving 3. Formal suggestion scheme 4. No explicit organization	↕

Notes: ↗ – Should increase
↕ – Practice should change in this direction

Goodson (2002) provides a similar type of detailed evaluation, although this is contained to only assess observations and visual characteristics of lean. The author argues that a quick visit in a production plant is sufficient to make a solid evaluation of the leanness of a company's operations. An evaluation model called "The Rapid Plant Assessment Process" (RPA) is developed exemplifying this standpoint. The RPA consists of eleven categories for assessing the leanness of a plant. In order to evaluate the processes, a rating sheet with the different categories and associated questions is shown. The rating sheet assesses each one of the categories on a scale from "poor", giving only one point, to "best in class" that gives 11 points. At the same time as the RPA sheet is filled in, a questionnaire should also be answered. The questionnaire provides 20 simple yes- or-no questions related to the different categories are used as a check for assessing if the plant uses best-practice in these categories. In conjunction, these two simple RPA tools give

"a fairly accurate assessment of a plant's efficiency" and make it "almost impossible to fake a lean operation" (Goodson, 2002).

Sequential method based evaluation

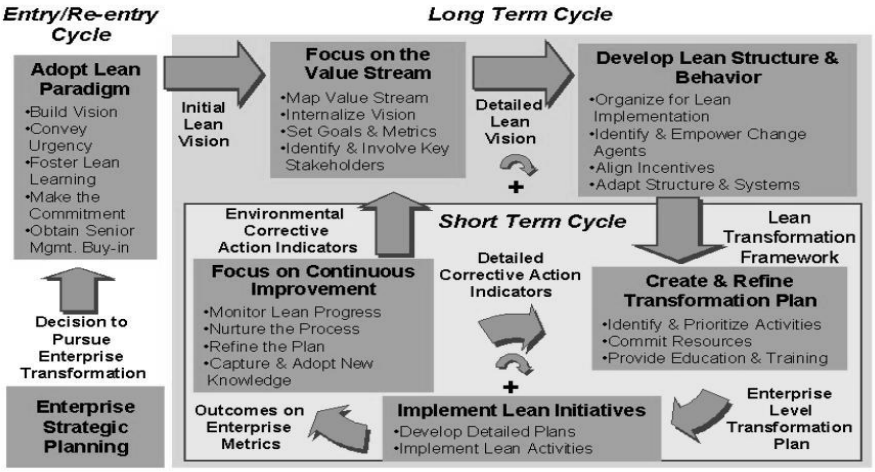
Sequential method based descriptions of lean are perhaps the most common. The five-step approach of Womack and Jones's (1996) *Lean Thinking* that has been examined above, and those of Rother and Shook (2003), and Nightingale and Mize (2002) provide examples of models that can be used for a sequential method based evaluation. Depending on what steps the organisation has taken, it is possible to assess how far they have come towards implementing lean.

Weaknesses of method based evaluations

Traditional financial performance measurements may prove inappropriate in assessing lean progresses because they do not shed much light on progresses toward achieving behavioural changes or the effects of working with an improvement strategy. This is better captured by using a method based evaluation (Nightingale and Mize, 2002). Conversely, when using a method based evaluation, it is unclear how the method really affects the end result of an operation. There may be reasonable guesses about what outcome they will yield, but how much and when are often hard to determine.

The main weakness with detailed lean frameworks is that they do not provide a clear roadmap on what actions to take to become leaner. This is better described by sequential lean frameworks (Womack and Jones, 1996 p. 9). However, due to the fact that lean implies a constant strive for perfection, the transformation to become lean includes a never ending loop of continuous improvements. Thus, after the initial adaptation of the organisation to some of the more fundamental properties of lean, such as establishing a service flow or working with a resource pull from demand, it may become difficult to assess how lean the organisation is. As Nightingale and Mize's (2002) "enterprise level roadmap" illustrates below, a firm that has come some way on the course of becoming lean will continuously perform small improvements on the different components of a lean strategy, making it difficult at any point in time to evaluate performance by a sequential model as all steps occur in sync. Hence, the problem with a sequential method-based evaluation, and detailed method evaluations for that matter, is that lean frameworks in reality

need to be implemented both in parallel and in sequence and therefore are hard to measure (Åhlström, 1998).



A visualisation of the never-ending loop of continuous improvement, as a result of the constant strive for perfection. (Nightingale and Mize, 2002)

3.6 The challenges concerning the development of an appropriate measurement system

Simons says that a good measurement system should be objective, provide clear guidelines about what outcomes are desired, be complete by capturing all relevant actions and behaviours, be responsive, and, reflect the efforts or actions of the individual (Simons, 1995 p. 76). To achieve this ideal state, some general questions and considerations need to be taken into account.

A common view, represented by Kaplan and Norton when motivating the need for a multi-dimensional performance measurement tool, is; "What you measure is what you get" (Kaplan and Norton, 2005). However true the statement is, as Neely et al point out, the problem in many organisations when it comes to measurements is that they often choose to measure what is easy to measure, rather than what is right to measure. This means that measures that do not capture important aspects of performance or capture aspects that are not meant to be captured are often used (Neely et al., 2002 p. 34). In addition, even if measures themselves are consistent with what they are supposed to measure, many organisations only focus on performance measures related

to the internal processes, without ensuring that there are strong linkages between the processes measured and the customer needs (Bhasin, 2008).

Another challenge to overcome when developing a measurement system is that it is common that the employees are "gaming the system". By purposely game measures in order to evade blame, "the real purpose of the measure is lost without trace" (Neely et al, 2002 p. 34). Therefore it is important to carefully consider the design of the measures, in order to avoid ending up with measurement systems that encourage undesired behaviours. Otherwise there is a risk that the organisation gets what it measures but not what it wants (ibid).

According to Simons, "building slack into targets", is yet another impediment to avoid when developing a measurement system. Due to the fact that measurements of performance draw attention to results below standards from senior managers, participants in the operations may want to create and adjust standards so that they are easily attained (Simons, 1995 p. 82).

In summary, to decide what and how to measure, to develop measurements that encourage the right behaviour, and at the same time avoid the challenges and problems concerning measurements described above, may in itself prove to be a major challenge.

4. Empirical background

In this chapter we first want to establish a general understanding of what constitutes a workshop and define the different activities that take place in a workshop. Second we will provide a detailed description of the GRS concept, and then will continue with how the GRS concept is measured today. In the last part we will go through and systemise our findings from the workshops studied.

4.1 Workshops and the operations to be evaluated

What a workshop is and what it does

The main tasks of the workshops are to conduct maintenance services and repairs on industrial products built by Gamma. However, as mentioned in the delimitation section, workshops repairing industrial components will not be treated in this thesis. Workshops vary in size, from units of five to units of fifty technicians, with a capacity of working with 2-3 to 25-30 industrial products at the same time, depending on the size and layout of the workshop. The workshops visited in this study were all but one of a medium size with a capacity of repairing approximately 15 industrial products at the same time. One workshop, workshop E, was substantially larger with a capacity of about 25-30 industrial products at the same time. This workshop was also the newest workshop of the ones visited.

Planned –unplanned services and repairs

The existence of both planned and unplanned services and repairs makes demand more unpredictable than in production contexts. This is one of the biggest challenges for GRS, which many interviewees have pointed out. Gamma has an official goal of always being flexible towards customers and be able to assist them in case of breakdowns, which causes workshops to have some spare capacity in order to meet unexpected demand. A goal in the organisation is to have at least 85 percent of available time utilised. This is achieved by some shops and not by others. The planned services and repairs are relatively easy to estimate the duration of and what parts and other resources that might be needed, since customers are interviewed on beforehand by a time-booker who usually has some technical skills on what needs to be done. In contrast, the

unplanned emergency repairs and customers showing up at the workshop with a broken industrial product are harder to anticipate the demand of and what resources that are needed.

Warehouses

The warehouse is the area where inventory is stored in the workshop. The size and nature of the warehouses differ between different workshops. In some, the warehouses have been rebuilt so that technicians pick up the spare parts they need themselves, but in others spare parts are picked out and handed to technicians by warehouse staff. In the past, there were no self-pick warehouses. The self-pick warehouses have several advantages in comparison to traditional warehouses as they reduce the number of warehouse employees necessary without increasing stock values or the time taken for technicians to check out spare parts. The latter is true because technicians no longer have to stand and wait for the warehouse staff to be able to assist them.

Pricing strategy

Gamma's workshops positions themselves as providers of high quality service, speedy processes and high accessibility, which makes them charge somewhat higher prices than many smaller local competitors. The pricing formula used usually consists of a charge for the spare parts used and a charge for the number of hours the technician has spent working on the industrial product, with profit margins included in these charges. This traditional way of pricing is still the most common. Some of the more standardised works on the industrial products, such as certain services that should be done after specific mileages, are sold in packages where the price is predetermined and estimated on a standard time that it should take for a technician to complete the job. Gamma attempts to increase the number of packages sold and include more standard times and fixed prices. This way of pricing seems to have come somewhat farther in the Belgian workshops than in the Swedish workshops visited. A third pricing model used is a subscription-based one where customers pay monthly fees in return for all the services and repairs that they might need. This type of payment agreement consists of an estimated 10-15 percent of the total business, and results in, as with the service package deals, that the workshops take on a higher risk if the processes take longer than the standard time or that the industrial products break more than what is expected.

Quality and improvement work

Regarding quality assessment of services performed, Gamma Sweden has set a process goal that no more than 1.5 percent of total turnover in the shops is allowed as reworks cost. Thus, there is currently an emphasis of doing the job right the first time and on time. Today, the work with quality and improvements differ between different workshops. The number of structured improvement sessions and formal quality meetings also differ between the different workshops.

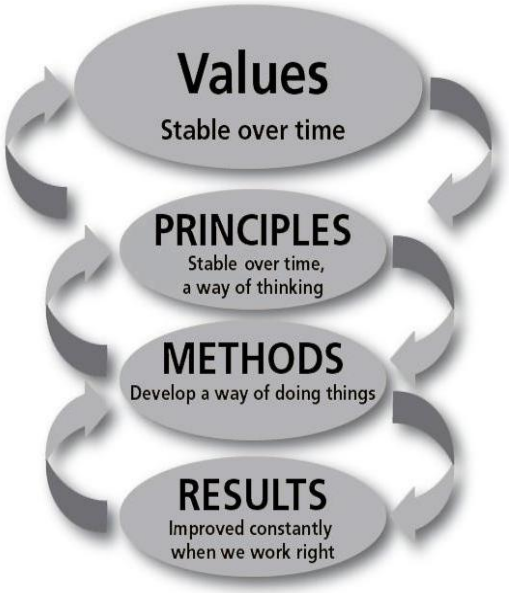
Nature of the work

Generally, a repair or a service in the workshops is carried out on a one-industrial product-one-technician basis. If there are major faults on the industrial products, or the service or repair needs to be completed very quickly, there are sometimes two people working on it. After the customer has booked a service or repair, the employees in the reception start by producing a working instruction order. Then, when the industrial product has arrived, a technician picks up the working instruction order and goes to the warehouse. There, he takes what he needs and registers it, or gets it from the warehouse staff, if he knows what the problem is and how to solve it. Otherwise, he first goes to the repair guide database to find out what tools to use and what parts are needed, before going to the warehouse. After this stage, the technician gathers his tool-trolley – everybody has their own – where he has the most common tools used, then finds the special tools needed to do the work and sets off to the industrial product to start the repair or service. When the repair or service is done, the industrial product is moved out of the shop to be picked up by the customer, and the technician is ready for the next job.

4.2 A detailed description of GRS

4.2.1 The GRS Framework

The Gamma Retail System is developed from the concept of lean and is based on some general core values and principles, which should guide working methods and lead to the desired outcomes. The supposed relationships between these are shown in the graph below:



The way that these relate to each other is to be understood in the following way according to the official documentation of GRS: "We share certain perceptions (values), agree on basic ideas as to how the work should be carried out (principles) and can therefore work in a uniform way (methods). We achieve sustainable outcome which we continuously improve (results)" (Gamma Retail System, 2008, p. 5-6).

The core values and the principles are basically the same in GRS as in GPS, with only minor changes included, but the methods used to achieve these have experienced more changes, as a result of the different business conditions that workshops and production facilities exists in. The values, principles, methods and results of GRS, as explained in the official documentation, are described below (Gamma Retail System, 2008).

Values

The *Core values* of GRS are Customer first, Respect for the individual, Quality – elimination of waste.

Customer first. Everything that Gamma does should focus on creating added value for its customers.

Respect for the individual means recognising and utilising the experience and knowledge of everybody in the organisation. By doing this, employees can influence their work and workplace, which should help to ensure higher quality, efficiency and job satisfaction.

Quality -Elimination of waste. By keeping quality high and getting rid of all that is unnecessary, customer satisfaction and profitability should be the result. Further on, high quality comes from continuously improving the processes and by acting on deviations that are found.

In addition to these core values, something called *Dedication and leadership* is also part of the GRS framework, and constitutes, together with the core values, the foundation of the framework. *Dedication and leadership* stresses responsibility by the individual, attention to both details and the overall process, a simultaneous ability to act in real time and to think long-term, to build know-how through continuous learning and to stimulate commitment through involvement.

Principles

The *Principles* of GRS are Normal situation, Right from me, Continuous improvement, and Customer value driven output. These principles should be seen as guidelines on how to think and provide guidance for what methods that should be used.

The principle *Normal situation*, aims at creating a workplace and working methods that are based on the currently best known practices for those tasks. From the normal situation, deviations can be noted and be corrected. Thus, a normal situation is the basis for achieving continuous improvement in the workshops. Due to its fundamental importance in the GRS framework this principle also consists of some sub principles. The sub-principles related to the principle Normal situation are Real time, Planning, Standardisation and Visual. These sub-principles can be seen as enablers for achieving a normal situation.

Real time means that information should always be updated and problems should be handled once they occur. With *Planning*, Gamma aims to assure reliability in delivery and also to facilitate flexibility by being able to cope with variation in customer demand. For example, when booking a customer, the customer should be interviewed as to what the problem that needs to be fixed is. By planning, work becomes more predictable, which enables improvements in efficiency, reliability, and customer satisfaction. *Standardisation* means that workers should use the best

known working method, in order to assure consistent quality and the time it takes to finish different tasks. Also, standardisation can mean standardising and organising the layout of the workshop in order to ensure that the same type of task can repeatedly be conducted in the same way. Therefore, deviations and wastes can be detected, which can then be removed by continuous improvements. The *Visual* sub-principle aims at making information easily accessible, which includes everything from having planning boards were work can be distributed and evaluated to the layout of the workshops so that they provide an easy overview of the work conducted there. By visualising the workshop, it will also be easier to maintain a standard situation and be able to make continuous improvements.

Right from me denotes that "it should be easy to do things right". It also means that deviations should be noted and mended as soon as they are detected, so that problems can be solved when they are still small and the quality of service always can be maintained.

Continuous improvement means that workers and the rest of the organisation should always try to find better ways of conducting business. The organisation should never be content with the current state of performance and continuously improve by trying to eliminate waste in the processes. Continuous improvements is also described as a "turbocharger in GRS" and its central importance for GRS is elaborated on in the statement: "the most important success factor in GRS is therefore work in the improvement teams" (Gamma Retail System, 2008 p. 22).

Customer driven output refers to delivering customer value. Customer value then is understood by providing "what the customer wants, when he wants it and where he wants it" (Gamma Retail System, 2008 p.11). High customer uptime and low transport costs are also important parts of this principle, as the workshops should be looking at services and repairs through a customer perspective.

Desired outcomes

The desired outcomes, the aims of working with the GRS framework, can be found in the focus areas of: gross profit growth, capacity, lead time and efficiency. Why these variables should be focused on, is however not discussed in the official documentation of GRS.

4.3 How is GRS measured today?

As mentioned in the section describing the GRS framework, the desired outcomes of applying the GRS concept in the workshops are gross profit growth, capacity, lead time and efficiency. However, when talking with people involved in GRS of what type of measurements they use to assess their results of working with the concept, no one refers to the desired outcomes that are described in the official GRS documentation. Instead, advances in GRS efforts are not measured in any uniform manner.

Currently, evaluation attempts of GRS are primarily based on visits made by coordinators to workshops. There, they talk with people and watch what improvements have been made and thereafter make a subjective evaluation of how far that particular workshop has come with GRS. The main problems identified with this approach is that it is time consuming, subjective and does not provide a good overview of the maturity of GRS across different workshops. To compare GRS advances between different workshops is therefore described as difficult.

At the GRS offices – a functional department responsible for the implementation of GRS in the workshops – the following overview of the implementation of GRS in different workshops is recorded. First, the steps of implementation in terms of what education different workshops have received is noted. If resources have been allocated and if regular improvement meetings are in place are also noted as implementation points. Second, at the GRS office the existence of value-stream maps of the different activities service, parts, sales, and support are recorded. Third, the usage of improvement sheets, so called A3:s, is also a point of evaluation, but so far no investigation on how many shops that use these has actually been done. Finally, the GRS office uses four measures grouped in something called realisation of benefits. The measures included are: right first time on time (RFTOT), lead time, efficiency, and customer satisfaction index (CSI). Any closer examination of the actual performance of workshops using these measures, or how many that are using them, has however not yet been undertaken. In order to understand what some of these measures stand for, a closer examination is provided below:

A3:s – In the workshops, suggestions for improvements are supposed to be written down on an improvement sheet template with the size of an A3 paper. Mapped on the A3 papers are: the background of the problem, the current situation, targets of the improvement, why the target is

currently not met, how to resolve the problem, an action plan for resolving the problem, and how the actions taken should be measured. All this information is kept on a single A3 sheet of paper in order to get a clear overview, a visualisation, of the whole problem, and to be able to keep track of the progress of the problem-solving. By counting the number of A3:s that each workshop produces and solves, an indication of the progress of GRS is thought to be seen.

RFTOT – Right first time on time is a measure that some workshops uses to keep track of how well they fulfil customer demands. It is measured by measuring the ratio of number of reworks the shop has to do in comparison to total number of works, the ratio of problems not solved, and the ratio of industrial products that could be picked up by customers on time. It is acknowledged that the on time measure could be tampered with by workshop by insisting on longer time frames than necessary when talking with customers. Therefore, it is the customers' preferred pick-up time that should be measured.

Lead time – The lead is the time taken for different processes. Total lead time is the time for the whole operation to service or repair a industrial product. This should include not only the actual time registered on the invoice sent to customers, but also the time taken to book the appointment, clean-up work, invoicing etc.

Efficiency – This simply measures the amount of output that can be handled given a certain amount of input, for example the number of industrial products that the workforce can service and repair during a day.

CSI – Customer satisfaction is measured at some workshops in a standardised manner, as the customers are asked to fill out simple forms as to how they thought their demands were fulfilled. However, this is not done at all workshops.

Consequently, these are the measures that are suggested to be used for GRS evaluation, but so far they have not been used in any uniform manner across workshops. This is of course mostly due to the fact that most workshops have not yet started to work with GRS.

Since the concept is so new there has been some resistance and questioning within Gamma whether there actually is a need to measure maturity of GRS at this point, and whether it is a good idea to compare workshops with each other. As one of the GRS coordinators put it:

"measurements can do more harm than good at this stage". He pointed out that if introducing a set of measurements for evaluation, the staffs at the workshops will only focus on achieving these measures and not grasp the underlying idea of GRS, namely looking at what creates value and through continuous improvements constantly cut waste and become leaner. The main point for this argument was, as the interviewee put it, "what you measure is only what you get".

4.4 Workshops in Sweden and Belgium

In Sweden, where the workshops still are of a quite traditional nature, we visited two workshops henceforth referred to as A and B. Workshop A had not yet started with GRS whereas workshop B started a year ago with some improvement works and is now developing it in line with the GRS concept. In Belgium, we visited three workshops, henceforth referred to as workshops C, D and E. All three have been parts of the GRS pilot project.

To summarise our findings from the different workshops studied, we have systemised these into four broad categories; the quality and improvement work; the warehouse; the customer relationship and planning for demand; and the internal communication. The categories chosen reflect the most commonly discussed things in the workshops regarding lean and GRS.

4.4.1 Workshops in Sweden

Quality and improvement work

Two years ago, workshop A started with some improvement work, but due to low involvement and motivation these initiatives eventually faded out. The main reason was that no one felt committed to take the leading role and drive the work with the concept. The employees felt that the initiated improvement meetings took up too much time and that they lost working time due to these meetings. In addition, workers found it hard to come up with improvements due to the new and modern layout of the workshop. As workshop A is quite a new workshop, the sentiment was that it is much easier in older workshops to find things to improve. Currently in A, only general staff meetings are held. These meetings are held on a monthly basis in the staff coffee room and concern all employees working in the workshop.

In the absence of dedicated quality and improvement meetings, whatever quality and improvement ideas that come up among the staff in workshop A, are instead ventilated in informal circumstances, such as during morning coffee before the shop opens, or at general personal meetings, if they are ventilated at all.

In workshop A, the technicians were encouraged to use their time in between different jobs to do cleaning or improvement tasks, but few actually did these tasks. The quality of work performed was not perceived as a problem, but Workshop A found it difficult to work according to the standard times set for the specific services, and the actual work time spent often took longer than expected. The reasons for this were not followed up in any detail, as the workshop did not experience any problems of shifting the costs for the extra time spent onto the customers.

Workshop B is an exception among Swedish workshops, as improvement meetings are held on a regular basis. Here, improvement meetings have been part of the operations for approximately one year, and are held once every two weeks. Many improvements have been made based on ideas from these meetings. Most of the improvements have been of an order and tidiness nature – the shop is from the 1970s and was a bit run down when the project started. Improvements have included: getting rid of or putting, old, unused equipment into storages so that the area in the shop is less cluttered, organising remaining tools and equipment, paint jobs making the shop more visually appealing and easier to overview, a rearrangement of the warehouse for easier access, putting up visual aids such as lines on floors and walls, and boards with action cards to facilitate an overview of process standards, process progresses and overall processes. The improvement suggestions are made on individual initiatives taken up on the general improvement meetings, as the workshop has not started to work in improvement teams. The work with improvement meetings has been described in positive terms, and employee motivation in the workshop is regarded as high. The workshop also experienced very low labour turnover. Recently, workshop B began, in a small scale, to use the A3-evaluation tool, in order to create routines for suggestions for improvements.

Warehouse

In the warehouse in workshop A there are approximately five full-time workers. The technicians pick up some spare parts by themselves, but most parts they need help to find and register by the

warehouse staff. In workshop A, the prediction of demand is found difficult. This often results in ordering more spare parts than needed, or in costly express deliveries rushed to the workshop by couriers or taxi if the parts are not in stock when needed. Otherwise, the regular delivery of parts arrives three times a day in workshop A.

In workshop B, during the last year better coordination between customer bookings and stock orders has made it possible to reduce the stock value in the warehouse. The warehouse was also recently rebuilt so that technicians can pick up all parts needed by themselves, but so far the number of employees has not been reduced. Express deliveries were, as in workshop A, quite common but the workshop manager found it of great importance to try to reduce these costly deliveries.

Customer relationship and planning for demand

Workshop A strives to be as flexible as possible towards customers and rarely refuses their customers when they show up unannounced. The flexibility was given as the main reason for the many express deliveries mentioned above. To further improve the customer relationship the workshop manager felt it was important that time was taken to sit down and have a coffee with customers or to go and visit them, bringing along a coffee cake.

As stated above, the manager at workshop A, felt that planning demand was an almost impossible task. The workshop has started to ask their customers questions about the problems, before they arrive with their industrial products, but currently the customers often shows up wanting more things to be served and repaired than discussed on beforehand.

In workshop B, the customer bookers interview customers over the phone in order to be able to set a diagnosis before the customers arrive at the workshop. These interviews also facilitate the pre-planning of spare parts that have to be ordered and also hopefully reduce the number of express deliveries. During our interview with the workshop manager, he stresses the importance of pre-planning and that the workshop is striving to make further improvements in this direction.

After a service or repair has been made, customers in workshop B are asked to fill out an evaluation form of the experience of the service, while it is not done in any structured way in workshop A. The evaluation in workshop B is done to assess the customer satisfaction, which

then can be used to improve future performance. However, the manager at workshop B also felt that it would be helpful not only to assess whether customers are satisfied, but also what can be improved if customers are not satisfied. This is not done at the moment, but will perhaps serve as a future GRS point of improvements.

Internal communication

In workshop A, very little information was visualised. Communication instead occurred informally when workers talked to each other during the day. The manager also pointed out that "the technicians are not particularly interested in numbers". Therefore, he found it unnecessary to put up and display any visual results or measurements, describing the current state.

In workshop B, in the conference room where improvement meetings are held, informative posters regarding the GRS concept have been put up as well as different mind maps and some A3 sheets. Some planning boards, displaying schedules for employees and customer bookings, along with improvement initiatives that have or should be undertaken and some financial information, have also been hung up in one of the passageways between the reception and the warehouse. The boards are visual and in a place where they cannot be unnoticed, although the information was not always updated. In the workshop, work has been undertaken to visualise information, such as making the workshop less cluttered and painting lines on floors and walls to denote standard places for tools and equipment.

Another tool of internal communication for the improvement work in workshop B is a document binder of photos taken before and after an improvement has taken place. This has been done for motivational reasons and to remember all the improvements that have been made.

4.4.2 The workshops in Belgium

Quality and improvement work

Workshop C started to work with GRS about two and a half years ago. Here, improvement meetings are held on a regular and frequent basis. The employees are divided into four different improvement groups and each employee participates in two groups. Each group has a meeting

every second week, so that every employee has one meeting every week to attend. The different groups are specialised in certain areas of the workshop, such as the reception and the warehouse. Workshop C puts much effort in assessing and evaluating if the right service and repair has been delivered and whether it has been done in time or not. Deviations are analysed and acted upon on a daily basis. A3:s are used for analysis and solving problems that have been detected by these deviations. The questions commonly asked are for example; why did not the customer receive their industrial product in time? Why were there defects? How can we do in order to avoid the problems? The workshop did not, however, do follow-ups on the number of suggestions of improvements that were made during improvement meetings and neither on how many of the suggestions that where implemented.

Workshop D started its GRS implementation one and a half year ago. Here, the employees are divided into two improvement teams. These improvement teams include employees from different parts of the workshop. The different groups have meetings two times a month which means that one improvement meeting is held every week. The GRS-coordinator in workshop D explained that since they started to work in teams, the communication between employees has become much better. "Now everyone is aware of what the other ones are doing". In contrast, before the work with GRS started the awareness of what other workers were doing was quite low.

In the beginning of the GRS implementation in workshop D, it was hard to motivate people to go to the improvement meetings. However, by making the meetings shorter and moving them down to the workshop floor, along with the boards for the meetings, people have been more motivated and involved in the meetings. Like in workshop C, the improvement work is based on A3 evaluations. The numbers of suggestions are counted but there are no follow-ups on how many of these suggestions that actual are implemented. So far, the employees have had many ideas and come up with many suggestions for solutions that improve their work, both smaller and more extensive solutions. Workshop D has not yet started with following up RFTOT on a daily basis, although deviations are discussed as a part of the improvement meetings.

In workshop E, improvement meetings are held on a weekly basis and improvement groups consist of employees from different parts of the organisation. The purpose of having mixed

improvement groups is to generate improvements in all of the different departments, through the whole service process.

Warehouse

The warehouse in workshop C has undergone a transformation from being quite isolated to a more open area where technicians go and pick up parts needed by themselves. An example of a very simple but successful improvement in the warehouse is a hole in a wall. By making a new entrance in one of the walls surrounding the warehouse, technicians save time by not having to go around half the warehouse in order to enter it.

The warehouse in workshop C is of a self-pick nature, with a barcode system for its spare parts, which the technicians scan when they take out something from the warehouse. The items are then registered in a computer system so that spare parts immediately can be sent for when the in-house stock reaches the reorder level. Much emphasis has also has been made to reduce stock values. Deliveries of new spare parts come once a day. Before workshop C started working with GRS, there were six full-time employees working in the warehouse. As of today, that number has been reduced to 1.8 workers. Workshop C also counted and did detailed follow-ups on its express deliveries.

One GRS-improvement that workshop C has done related to the warehouse is to have small stocks of necessities for different tasks allocated throughout the workshop at different working stations instead of in the warehouse. This way, technicians do not need to walk back and forth to the warehouse as much as before. These mini-inventories also have a barcode-system so that every item checked out is registered and an automatic reorder is done when the stock reaches the reordering level.

In workshop D, the warehouse has been rebuilt to be used as a self-pick warehouse and today there are no full time employees working there. Deliveries of spare parts come once every day. Express deliveries were neither counted nor followed up as far as the interviewee in the shop knew.

Due to the size of the workshop E, the warehouse has both a self-pick section and a section where warehouse staff pick up the parts for the technicians. However, by having half of the

warehouse as a self-pick part, the number of employees needed in the warehouse has been reduced.

Customer relationship and planning for demand

In workshop C, the number of unplanned services and repairs has been reduced from previous levels and it is appreciated that nowadays nine out of ten customers book an appointment instead of just showing up. However, the workshop still puts effort in always being available for unplanned customers, as it always has a standby technician in the shop to take care of those customers that do show up unannounced.

To be able to better understand their customer needs, workshop D held an improvement session where they arranged a meeting between technicians and customers so that they could discuss things that the customers wanted to improve, and if there were deviations between the work of the technicians and what customers defined as customer value. From the meeting, ten points for customer improvements were found and these are used as a road map for increasing customer satisfaction and shorten the total lead time of the service process in the workshop.

In order to better pre-plan and be proactive in the time scheduling, workshop E has started to call customers in advance when they see in the computer system that it was a long time ago since a customer had a service and ask if he wants to book one. Workshop E, as all the other workshops, put much emphasis on being flexible towards their customers. However, to be flexible they have realised that this can only be achieved by maximising operations efficiency.

Internal communication

In many different places of workshop C, boards have been put up, displaying visual information about the area concerned. Much of the evaluation is done on A3:s and these are also displayed on boards in order for employees to get a quick overview of what improvements that have been discussed and undertaken.

In workshop D, to mark the right place for everything and have clear communication that cannot be misunderstood, the employees have put pictures of tools and equipment over the place where these belong. On the boards there are also pictures showing the before and after results of the latest improvements.

In workshop E, by working in teams the internal communication between the different departments has become increasingly better and the number of conflicts have been reduced. By working in teams a better understanding of each others work has also been achieved and the different departments have become more integrated. The workshop has a lot of visual information placed on boards on the shop floor, and also the general layout of the workshop is visual. Like in workshop D, pictures of tools and equipments have been placed in the workshop to mark their right places. On one wall they have also displayed before and after pictures of improvements to remind the employees of the results of their solutions to improvements. In addition, workshop E has put stickers with the inscription "GRS" on all of the different improvements that have been done as a result of GRS work. By doing this the GRS-coordinator wants to remind the workers about the positive results accomplished by the work with GRS.

5. Analysis

We will in this chapter apply the theoretical framework to our investigations of Gamma workshops and GRS, in order come up with a proper measurement system for assessing the maturity grade of GRS. We start with first describing what type of evaluation method we have found most appropriate to use in this study. In the next section, which is divided into two parts, we discuss the differences between the workshops according to the evaluation method chosen, in order to distinguish the most important determinants of GRS. Then in the last section, we are summing-up the most important findings of what constitutes a more mature GRS workshop.

5.1 What type of evaluation method should we use?

To begin with, the question of what type of evaluation model to develop – a financially based, a scorecard-based or a methods-based – is dependent on who the user of the evaluation model is (Neely et al, 2002 p. 34). Since our primary users are the individual workshops and the GRS office, and we want to capture the maturity of GRS, we argue that an evaluation model that is method based is the most appropriate. A scorecard-based approach is tempting, since being able to connect methods with results is always desirable. However, since it would be difficult for us within the frame of this study to conduct a thorough cause and effect analysis between methods that are supposed to give certain results, and actual results – to make sure our assumptions are true – it is better to go more into detail with methods and simply assume that these methods will eventually yield positive financial results. Thus, our emphasis will be more on making sure that the measurement framework will be consistent with GRS and lean ideas, than on trying to connect our measures with actual, recorded results of the workshops. For this reason, that we assume causal relationships, the methods-based evaluation will not have the same strength as a controlling device and for resource allocation as a scorecard-measurement might have (Simons, 1995 p.11). Instead, the evaluation model here provided will aim at finding determinants that are indicative that people have understood the concept and are working in the right direction.

Another reason why a methods-based evaluation model is provided is that since GRS is such a new concept in Gamma, the methods used and the understanding of the concept are at least as important, if not more, as the actual results that the workshops show at this stage. As one

interviewee argued, "measurements can do more harm than good at this stage". In addition, it might be difficult to conduct a reliable cause and effect analysis required for a scorecard approach at this point, since the GRS concept has not been going on for a very long time, not even in the pilot workshops. This is also something that has been pointed out in literature as weaknesses with employing balanced scorecard approaches in new business environments (Norreklit and Mitchell, 2007 pp. 181-185) and in lean contexts (Bhasin, 2008).

Obviously, the evaluation model must relate to the values and ideas of the GRS framework. This is facilitated since GRS, is developed from a lean concept. Thus, from an analytical point of view, GRS is equal to lean. Therefore, measurement methods used in other lean contexts should provide a good foundation for an evaluation model of GRS.

5.2 A two-part lean analysis of our findings in the workshops

Having established that we will use a method based evaluation, it is necessary to analyse and discuss our findings of the empirical research in order to know what to evaluate in the model. To be able to capture the concurrency of working with and developing lean operations, which has been pointed out by Åhlström (1998), we have chosen to analyse our findings both through the principles of lean, a detailed method approach, and through a sequential method evaluation, the five-step process of lean. This is done in order to both be able to find examples of lean practices in the workshops that can be used as evaluation points, and, to discern why some of these lean practices need to be done before other practices.

5.2.1 An analysis through the principles of lean

The analysis of the workshops through the nine fundamental principles of lean has been done in order to in detail see what characterises lean performance in a workshop context. In particular, we have compared workshops in Belgium that have started to work with GRS to the workshops in Sweden, that are just in the beginning of adopting GRS, to see what differences that are most evident in each principle. By discussing differences between the workshops we hope to distinguish some important determinants that can create a foundation of what constitutes the maturity of GRS.

Elimination of waste

Generally, the workshops in Belgium have come further in working with elimination of waste than the workshops in Sweden. In a sense, all GRS improvements are in some way waste reducing since the very definition of an improvement is to make things in a better way, that utilises less resources per output produced. Examples of waste reducing solutions in Belgium are: smarter layouts of the workshops that have lead to less walking around, reduced number of items in the warehouses, and self-pick warehouses that have both led to reduced waiting time for technicians and less employees needed there to aid the technicians. With inventory management, the self-pick warehouses accompanied with barcode systems in Belgium have been used with great success to reduce both the number of employees needed and the time taken for technicians to check out inventory. It should also be noted that workshop B in Sweden has reduced some waste in the warehouse as well but in contrast, in Sweden the number of employees working in the warehouses is still high.

All the Belgian workshops have started to evaluate the quality delivered to customers, and two of them have also started to do some RFTOT follow-ups on a daily basis, in order to discover and reduce quality problems and better define customer value. Since everything that does not create customer value is waste it can therefore be eliminated. Quality problems are thus certainly waste. Also movement and process wastes have by several clever solutions, such as reducing movements to and from warehouses and across the workshops and by putting up garbage cans and in appropriate places, been reduced.

Continuous improvement

We observed that the workshops in Sweden, in contrast to those in Belgium, have not yet integrated the work with improvements in their daily business. The GRS concept was seen as something beyond their ordinary tasks. In the Swedish workshops the meetings take place in conference rooms or staff coffee room and due to that are held quite seldom they are often quite long and tedious.

In Belgium the meetings are held on a more frequent and regular basis and the attendance is higher than in the Swedish workshops. Meetings are also shorter and held in the workplace. Workshop D, for example, started with having meetings in its conference room, but due to low

attendance they moved the meetings and the boards to the workplace. They also shortened the time of the meetings and held them more frequently instead. The result was that more people came to the meetings and that the meetings now have become an integrated part of the ordinary work.

In workshop E the work with A3:s has successfully been implemented. Working with A3:s facilitates improvement work for the employees, because they provide a clear and structured way of thinking, from which many improvements have been made. The work with A3:s is overall very frequent in Belgium but in Sweden it has hardly started. In workshop B they recently started working with A3:s but so far only in a small scale.

In Belgium, in contrast to the workshops in Sweden, they worked in improvement teams. According to the coordinator in the workshop E, working in teams has made the employees more involved and motivated because they could discuss and develop ideas together.

Zero defects

In order to deliver high quality service and repairs to their customers, two Belgian workshops frequently followed-up on the measure RFTOT, so that problems and deviations could be found and directly addressed. In comparison, workshops in Sweden did not follow up RFTOT on a daily basis as problems occurred. Although workshop B in Sweden encourages customers to fill out an evaluation form, the follow up on these evaluations only occurred once a week. By not doing RFTOT evaluations, discovering problems and search for improvements, achieving zero defects is made much more difficult.

To achieve zero defects, and in order to truly solve a problem, it is necessary to find the root causes to why it occurs. This can be done by using the "five-why's" problem solving system (Womack and Jones, 2007 p. 56) that is incorporated in the A3 templates. For example, in workshop D in Belgium, during the meeting between the workshop technicians and some customers, deviations between the technicians' definition of customer value and actual customer value were detected. By using root-cause analysis the workshop was now trying to eliminate these deviations.

Just-in–time

To create a just-in-time flow in the process it is important to keep the standard times (Rother and Shook, 2003). The workshops in Sweden, especially workshop A, experienced several problems regarding this. There we observed that the work and processes in the workshops are of a somewhat forgiving nature. For example, the technicians experience difficulty to keep work within standard times, but because this is very common, it is more or less accepted as no follow-ups are made.

To keep standard times and be able to create a flow it is also important to arrange the tools and equipments in a go-order and to adjust the layout of the workshop. It is also important to have a clear communication so that everyone is aware of what happens (Abdi et al., 2006). These things were something that we noticed that workshops that have worked with GRS for a while had come farther with than those that have not.

Express deliveries in Sweden contribute to being able to be flexible towards customers and indeed have parts arrive just-in-time, but this is an expensive and a reactive approach to provide flexibility. Frequent and regular deliveries are better for achieving just-in-time. A better way yet is to try to manage demand, as Workshop E has done, and have parts arrive with the normal daily deliveries. The importance of managing demand will also be treated in more detail when discussing the creation of a resource pull. By managing demand, both just-in-time deliveries and flexibility can be achieved, as predictability in processes increases. To have just-in-time deliveries it is essential that the spare parts arrive in time and that the workshop never is out stock when a part is needed. This is of course a challenge since stock values should be held as low as possible, but it can be facilitated by using a barcode systems for the spare parts, as is done in Belgium.

Pull instead of push

The workshops in Belgium have put much effort in how to make unpredictable demand more predictable. For example, as mentioned earlier, workshop E has started to pre-plan and be proactive in scheduling customers by calling them when it was a long time ago since they served their industrial product. By doing this, workshop E transforms unplanned demand into planned demand, which then can be exploited both as better capacity utilisation and by keeping fewer parts in stock. Thus, by managing demand a better pull of resources can be achieved. In

workshop E, this also eliminated many unnecessary and unpredictable repairs since problems on the industrial products were discovered at an early stage. Thereby, unplanned repairs were further reduced which lead to even greater possibilities to maximise operations efficiency and keeping the stock levels low. Thus, being able to transform unplanned demand to planned, enables workshops to act on a pull of demand.

Multifunctional teams

This principle is of less importance in a workshop context due to that the technicians already are performing multifunctional tasks in their daily work. Instead, related to this principle and of more importance in the workshops is that the improvement teams consist of employees from different departments. In Belgium, by working in improvement teams including people from different departments, the employees have been able to make improvements in the whole service process. The communication and co-operation between workers from different departments is therefore improved in Belgium.

Decentralised responsibilities

In a workshop context, decentralised responsibilities means making employees more responsible for their own work by encouraging them to come up with better ways to perform their work, and not only taking orders. The workshops in Belgium have for instance noticed that people, after starting to work with GRS, are more motivated since they are more responsible for their own work. They have also become more active and involved during improvement meetings and come up with more suggestion points and solutions to problems.

Integrated functions

Due to that the technicians already performs multifunctional tasks, this principle is not of the same importance in a workshop context as in a manufacturing firm, although making technicians pick up parts in the warehouse, is an example of integration of different functions. When tasks such as picking up the parts and order new ones are integrated in the daily work for the technicians, theory suggests that the number of indirect employees can be reduced (Karlsson and Åhlström, 1996). This is also what has happened in Belgium, as the number of employees working in the warehouses has been drastically reduced.

Vertical information systems

In order to always have information in easy access for the technicians, a lot of information in the Belgian workshops is visualised in different places of the workshops. For example, A3:s are put on boards so that the results from GRS improvements are seen and before and after pictures are also provided to visualise these improvements. That way, the technicians can instantly assess how far they had come with their suggestions for improvements. This was mentioned as a reason for higher motivation and pride among employees for their work. In workshop B they also had pictures of improvements, but these were kept in a document binder in the conference room, away from where they can be seen in the daily work. However, also in workshop B workers were proud and motivated by the improvements that they have made. In comparison, in workshop A there are no routines for displaying results of achievements whatsoever because, as the manager pointed out, "technicians do not like numbers". The preconception that results only can be displayed in figures thus reigned.

The visual information, in Belgium, was updated on a regular and frequent basis. In the workshops in Sweden, the information displayed was old and outdated. Another vertical information system used in Belgian workshops are the visualised labels both for identifying and locating spare parts in the warehouses and also to show the right places for tools and other equipment.

5.2.2 An analysis through the five-step process of lean

To capture the fact that much lean theory point out that some steps when working with lean should be done before others (Womack and Jones, 1996; Nightingale 2002; Abdi et al, 2006; Rother and Shook, 2003), an analysis of our findings from a sequential point of view is also called for. To analyse through the five-step process of lean gives indications on how far the different workshops have come in their GRS processes and what is needed in order to continue developing the workshop leanness. The five-step process described in the theoretical framework is used for this. Although somewhat overlapping the analysis through the nine principles, it provides an understanding for what is important to think of when developing an evaluation model.

1. Specify value by service

The workshops in Belgium have obviously come farther when it comes to put the customer first, to rethink value from the customers' perspective. They have done researches in order to close the gap between customers' expectations and the service provided. From the deviations they constantly do follow-ups and search for improvements of the process. In the Swedish workshops they have a more fixed mental model of what constitutes customer value, although some evaluations of customer satisfaction has started in workshop B. This first step, to specify value, is really crucial, since without knowing what creates customer value, waste elimination becomes inherently difficult.

2. Identify the service value-stream

Due to that the Belgium workshops have come further with re-thinking value from the perspective of the customer, they also have come further with assessing what is value-adding and what is waste in the service value-stream. They have therefore been able to recognise and eliminate more waste. By having improvement teams integrating all the different departments in the work with GRS, it may prove easier for the Belgian workshops to look at all the different activities in the service process.

3. Make the service flow

To understand demand can provide very powerful in making a service flow. Belgian workshops have exploited the fact that being proactive rather than reacting towards customer demand will allow them to better manage demand. This has been done by for example arranging customer meetings and evaluations, using RFTOT evaluations and calling customers when they see that they need to service their industrial products.

Another important feature of making the service flow is to create a standard situation from which the deviations can be analysed from. As Rother and Shook argue, it is hard to discover deviations unless a regularity, a flow, within the work has been created (Rother and Shook, 2003). The absence of a flow might explain why workshop A had problems to find improvement points when first trying to work with GRS. The Belgian workshops have proven that creating standard situations can be done in a great extent without interfering with flexibility towards the customers.

For example, in workshop C good planning has lead to that they can have a standby technician that can be used when peaks in demand occur.

One way that creates incentives for the workshops to achieve a standard situation and a process flow is a shift from hourly based pricing to pricing models such as package or subscription pricing. By transferring the risk of failures both in the industrial products and in the service and repairs, the system becomes less forgiving for errors and standard times are likely to be honoured in a greater extent than today.

Package pricing is not as common in the Swedish workshops as in Belgium, as the Swedish workshops still most of the time charged their customers per hours. Charging customers by the hour can be one of the reasons why the Swedish workshops had harder to keep standard times, since the incentive to maintain these are lower when the extra costs can be transferred to the customers.

From a lean and GRS perspective, the most desirable pricing model is the subscription based because it enables the workshops to put pressure on customers to service their industrial products at a regular and frequent basis. Due to this, unnecessary and unpredictable repairs can more easily be avoided, making planning of demand simpler for the workshops, which facilitates creating flows in processes. This model is not so commonly used today, but upper management wants to increase its use.

4. Supply at the pull of the customer

Service providers always encounter the paradox flexibility vs. efficiency. More mature workshops, as the ones in Belgium, have learned how to better balance these, in comparison to more immature workshops, as the ones in Sweden, which still regards them as trade-offs. Mature workshops are still very flexible towards their customers, but due to better pre-planning and follow-ups they are better at quickly responding to demand and adjust their processes.

5. In pursuit of perfection

What characterises the Belgian workshops that have worked with GRS for some time is their constant strive for improvements. By finding problems and solutions and never be content with the current situation, this takes expression in a constant production of A3:s. Something that was

notable for all workshops working with GRS is that they have attempted to make a more transparent environment by making it consistent and providing workers with visual information that is easy to understand and impossible to miss. That way, employees are always aware of the current state which also makes it easier to find new improvements.

5.2.3 Commitment and support as critical success factors for implementing lean

When working with GRS, something that distinguished the workshops in Belgium compared to the ones in Sweden, is management commitment. It is a prerequisite that the manager understands the concept and acts as a driving force in order create a sustainable motivation for it among the employees (Achanga et al, 2005). This of course affects the work with the GRS concept. For example, low motivation for working with improvements had been experienced in workshop A when working with an earlier GRS project, and the concept eventually ceased. This can, in the light of the work in Belgian workshops, be explained by the absence of management commitment and the absence of a change agent.

5.3 Summing-up our findings – what constitutes a more mature GRS workshop?

By applying the lean principles and the five-step process of lean and by comparing these with our observations in the workshops, we have come up with some major summarising differences. The major differences we have identified between the workshops that have come further with adopting the GRS concept than the others, can be grouped into six different categories. In each category there are several determinants constituting how mature a workshop is, how far they have come in working with the GRS concept.

Customer value:

Workshops that have come further with implementing GRS have re-defined customer value. They have decreased the gap between customer expectations and the work of the technicians. They are working proactively, actively and reactively through the whole service process in order to be able to deliver a high quality service to their customers. Properly defining customer value is

the fundamental first step according to the five-step process of lean, as it defines the processes needed to fulfil these customer values. The second step, identifying the service value-stream should also be done in order to structure the findings from defining customer value. It is very important to define customer value in order to create value-adding activities. Therefore, customer value also affects all the lean principles, directly or indirectly.

Managing demand & Operations efficiency:

More mature GRS workshops have understood how to combine customer value with operations efficiency, and are therefore avoiding unnecessary trade-offs. They are learning more and more about how to deal with unpredictable demand, by pre-planning as much as possible and having extra capacity. They do not find it difficult to work within standard times, and they have all tools and equipments arranged in a good order identified by a visual labelling system. This creates more regularity, flow, within the system. Thus, managing demand and achieving operations efficiency relates to the third step in the five-step process of lean, to make the service flow. However, it is also important for fulfilling steps four and five. The lean principles primarily concerned are the principles of just-in-time and pull. Managing demand thus enables better usage of the resources employed and therefore elimination of waste is affected to a great extent.

The pricing of services and repairs is also an important feature of managing demand and enabling operations efficiency. The workshops charge their customers mostly by having one component for the number of hours the work has taken and one component of the spare parts used. However, by switching over to fixed package prices for certain services, or a subscription based pricing, the incentives to become lean for the workshops increase. Deviations in the processes and in the outputs of the repairs and services will be more costly for the workshops if selling packages and subscriptions. The risk of deviations in processes and in the outputs of the repairs and the services are partly (packages) and fully (subscriptions) transferred to the workshop from the customers. Thus, the pricing is an important feature of making both operations efficiency and continuous improvements possible. Using a subscription based pricing model also makes the relationship with the customer closer, which makes it easier to anticipate and manage demand in the workshops. As can be seen, the pricing relates to the lean principles of continuous improvements, elimination of waste, just-in-time, zero defects and pull. It also serves the purpose of enabling steps three to five to be fulfilled in the five-step process of lean.

More mature GRS workshops have also re-built their warehouse to self-pick warehouses, where the technicians can go and pick up the spare parts needed by themselves, by using a barcode system. By improving the efficiency in the warehouse, less people are needed there. A mature GRS workshop can also rely on its spare part suppliers that provide them with the right parts at the time needed. Inventory management is primarily related to the lean principle of elimination of waste.

Meetings:

More mature GRS workshops, in contrast to the ones that have just started, hold regular improvement meetings on a frequent basis. The meetings are also integrated in the daily work, indicating that they are held in the workplace and the boards also are placed in central parts of the workplace. This point of evaluation relates to the lean principle of vertical information and it can be seen as a prerequisite for continuous improvement.

Improvements:

In more mature GRS workshops the employees work in improvement teams constituting of people from different departments. This creates motivation and enthusiasm when the employees are responsible to solve problems together and cooperate to come up with the best solution. When working with improvements the employees use the A3 problem-solving tool in order not to miss any part of the improvement process and to follow a standard way of working. Workshops that have come further with GRS are more unforgiving against problems and continuously follow up and search for the root-causes to why they occur. Working with improvements is in more mature workshops also seen as something that is integrated in the daily tasks. In contrast, in immature workshops working with improvements is seen as something beyond the ordinary tasks. Improvements relate to continuous improvement, decentralised responsibilities, multifunctional teams and elimination of waste.

Commitment and involvement:

One important determinant when assessing maturity grade of GRS is the commitment and involvement of people. We observed differences in the manager's mindset to GRS and the commitment and involvement of employees. In more mature GRS workshops, the manager is

enthusiastic working with the concept, he has understood it, and is therefore able to motivate the employees that also feel enthusiasm working with the concept. It is important that someone is driving the project in order to convince others of the good outcomes of the concept. To create commitment and involvement, it is also vital that the manager gives the employees extended responsibilities and makes them more responsible for their own work. The involvement of people can especially be observed during the meetings by looking at how active and involved the employees are. Commitment and involvement relates to the lean principles of decentralised responsibilities and it catalyses continuous improvement. Commitment and involvement also relates to the critical success factors for implementing lean identified by Achanga (2005) and Flinchbaugh(2008).

Visualisation:

Another major difference we observed between workshops that just have started with GRS and workshops that have become more mature, is the grade of visualised information. In more mature workshops important information is displayed and visualised in the workplace, both on boards and as visual signals such as lines and lights. The information is integrated in the daily work and always updated. Results are shown to the employees, not just in numbers, but in for example pictures and diagrams. This is done in order to motivate and make the employees feel proud of their improvements. In immature workshops that have not or just started to work with GRS, these results were kept on the manager's room, the conference room or were not followed-up at all. Visualisation is part of the lean principle vertical information systems and it is also a facilitator for many other principles such as zero defects, elimination of waste and continuous improvements. Furthermore, visualisation is an important aspect of step three in the five-step process of lean as it makes it easier to create a flow by providing standards for layouts and real time updates of information.

6. Developing a model

In the summing-up part of the analysis we pointed out and grouped the most important differences between workshops that have come farther with implementing GRS compared to those who have not, into six categories. We used a method-based evaluation according to the lean principles, the five-step process of lean, and our own observations, in order to discover these differences. In this chapter we combine the most important determinants that we found, into a new model, a measurement model based on our investigations of the workshops. These measurements aim to fulfil the core values of GRS and be consistent with what signifies lean service operations.

6.1 The construct of the model

6.1.1 The structure of the model

The GRS maturity model is structured around the six components identified in section 5.3 in the analysis, Summing up our findings, as these components have been recognised as main determinants for GRS maturity. The components have in turn been broken down into a number of evaluation points that the workshops either fulfil or not. In order to mark the relative importance of the different components of the model and to be able to make comparisons between different workshops, a scoring system has been included. Each evaluation point that is fulfilled by the workshop yields a certain score. The possible score dedicated to each evaluation point indicates the relative importance of that specific activity in order to be leaner and to fulfil the values of the GRS concept. By adding the score from the different evaluation points that a workshop has achieved, a total score is derived and that total score will tell whether the workshop has come far or not in its implementation of GRS; it tells how mature the work with the GRS concept in a workshop is.

The model is primarily a detailed method based evaluation approach that is inspired by the findings of Goodson (2002) and Åhlström and Karlsson (1996). However, the sequence of the points is also of importance, as noted by Womack and Jones (1996) and Abdi et al (2006). In particular, our model also emphasises that defining and understanding customer value is the first and most important priority of the workshops. If the customer value component is not fulfilled

at the time of the evaluation, a big point deduction of the maturity score is made. The customer value component must therefore be fulfilled in order to score any high points in GRS maturity.

Apart from the customer value component, there is no specific order of component fulfilment required for the model. The reasons for this are mainly three. For one, it would be inappropriate as workshops might already undertake some of the activities evaluated, such as starting to have improvement meetings or visualising the workshops. The second reason is that actions towards lean not only tend to occur in sequential steps but in parallel with working with principles. Third, having more sequences that workshops have to comply to would indeed steer behaviour to a greater extent than our model does, which could potentially hamper individual initiatives and involvement in working with GRS.

In the model, the evaluation points are clear and easy to understand, but at the same time they give the particular workshop the freedom to come up with the exact method of achieving these evaluation points in order to cultivate motivation and enthusiasm for working with GRS. Despite the concerns of steering behaviour too much, it should be noted that some points in the model are more specific than others, such as those concerning the warehouses. That is because these points should be considered as current best practice, and of such importance for the workshop efficiency combined with being relatively easy to transform, that they need to be included.

6.1.2 Some limitations of the model

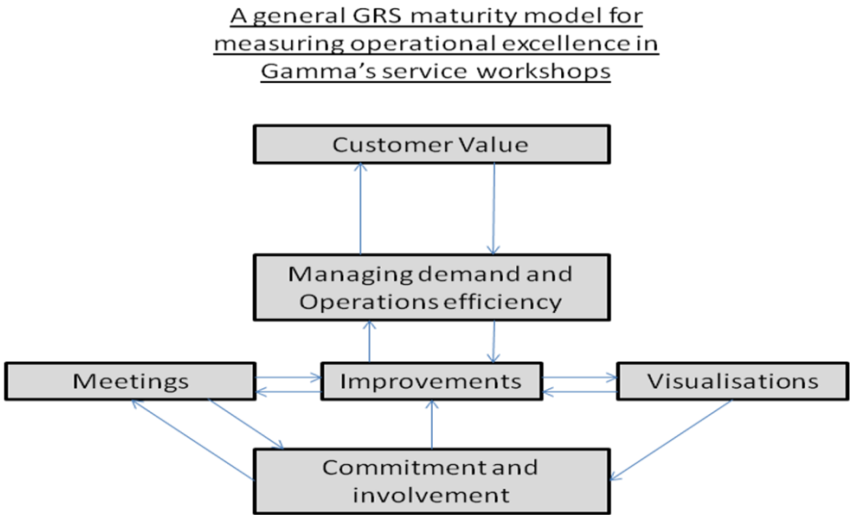
Although a good tool for evaluating GRS maturity, the point system may prove too subjective to be used as a control tool for measuring goal adherence and allocating rewards to these goals. The risk that only the things that gets measured get done (Kaplan and Norton, 2005), and the risk of people gaming the model (Neely et al, 2002 p. 34; Simons, 1995 p. 82-83) may also pose as potential problems, at least before thoroughly testing the model. In addition, in our strive to make the model easy to use, evaluation points that are easy to measure have prioritised. This may lead to too much emphasis on easily measured metrics (Neely, 2002 p. 34), although this is something that we have been very aware of when constructing the model. Perhaps at a later stage, when the model has been thoroughly tested, it can serve as a controlling device, but presently, the consequences of working with it have not been possible to observe. As for now, the main usage

of the evaluation model should be to highlight points that the particular workshops are good at and what they can improve, and for the GRS office to know which workshops that need special attention in their GRS implementation.

6.1.3 The components of the model

When evaluating the different components, we have tried to use as many as possible of the already existing measurement tools that the GRS office uses. These include RFTOT, lead time, efficiency, A3:s and CSI. We have however tried to develop them, making them more tangible by breaking them down in more concrete evaluation points. We have also tried to put them into a context that was before missing.

The components of the model have been described in Section 5.3 and are shown below. The relationships between the different components are also shown. These relationships are not measured specifically in the model, but they are drawn out here in the depiction of the model because an improvement in one component will likely make it easier to achieve success in other components. Therefore, although not specifically measured, it is important to identify these relationships. More specifically, this is important because the relationships clarify the fact that in order to achieve a high maturity of GRS, which is reflected by a high score in the model, it is very difficult to disregard any one of the components.



6.1.4 The scoring system

The scores for each point represent the relative importance of that point. Achieving customer value is the central and most important point, but for the practical everyday work in the workshop, it is perhaps not so informative. Therefore, the point sum dedicated to the customer value component is lower than for the component managing demand and operations efficiency, which is the main component for evaluating process performance in a workshop. This component is rewarded most points in this model, since it indicates that the workshop can transform its improvements into better performance. It is also rewarded most points because many different activities are important in order to excel in this component. The other components are rewarded approximately the same number of points, in order to reflect their more or less equal importance.

Numbers that indicate preferable changes in for example percentages of lead time or number improvements, are often used in the model in order to make it as tangible and unambiguous as possible so that measurements actually can be made. These numbers are realistic estimations of what is possible to achieve, based on our findings in the workshops. However, some of the numbers may need to be adjusted by the central GRS office when the model is tested in practice, if achieving some of the points is either impossible or all too easy. In addition, these numbers may need to be adjusted as time goes by. When it comes to what lead times to use for comparison, these are preferably determined on for example some of the service packages most commonly sold across workshops. That way workshops will be measured at the same type of activity, since average lead times, for instance, may largely depend on what types of industrial products that are used in the area of the workshop.

The point scores are added up to a total score of at the most 100. In order to see the maturity we have divided the maximum score of 100 into four different levels of maturity. Points ranging from 0-24 will give a maturity of level 1, 25-49 gives a level 2 maturity, 50-74 gives a maturity of level 3 and the ones achieving 75-100 will consequently reach a level 4 maturity of GRS. It should be noted that a level 1 maturity will be achieved if the workshop does not work with GRS or has just started, level 2 indicates that the workshop has done some important GRS adjustments, level 3 that the workshop is accustomed to work with GRS and in a good way has integrated many of its ideas, and level 4 that workshops are excellent at employing the GRS concept in practice and

are indeed very lean according to today's standards. To avoid building slack into the model (Simons, 1995 p.82), the evaluation points and the targets set are to be decided by GRS office and can not be adjusted by the individual workshop.

It is of course true that the exact scores derived in the model are somewhat arbitrary and that it is difficult from small differences in the total score to infer any greater insights of the relative maturity of GRS between workshops. However, by using broad intervals for different levels of maturity, this problem is reduced and we believe that by using this point scale it will be fairly easy and straight-forward to discern whether a workshop has come far with its GRS implementation or not so far.

When testing the construct of the model against the workshops studied, workshops C, D and E get point scores somewhere in the level 3 range, workshop A is in the level 1 range and workshop B is in the lower range of level 2.

6.2 The actual model

Customer value (20 p):

Does the workshop work both proactively, actively, and reactively with its customers in order to understand and increase customer value?

Proactive:

- Has the workshop investigated and, if needed, re-defined what customer value is for the customers? (8 p)

Active:

- Does the workshop analyse its activities through the RFTOT framework? (6 p)

Reactive:

- Does the workshop conduct customer satisfaction evaluations when a work is finished and are the results analysed? (4 p)

- Has the workshop drawn up its value-stream in order to see how to best fulfil customer value? (2 p)

If these steps are not fulfilled, deduct 10 points of the workshop's total score. This step is a prerequisite for the long term success of GRS and is vital for fulfilling many of the other steps. In addition, without this step, the underlying understanding of GRS is missing.

Managing demand & Operations efficiency (40p):

Managing demand:

- Are customers contacted proactively and asked whether they want to book service appointments? (2 p)
- Does the workshop have extra capacity to handle unpredictable demand, by for instance having standby technicians? (2 p)

How does the workshop charge its customers? Is more than 50% of work done charged through:

- Hour rate + spare parts? (0 p)
- Fixed package pricing? (2 p)
- Fixed subscription pricing? (4 p)

(If charges through hour rate + spare parts is less than 25% then +4 p)

Operations efficiency:

- Are standard times followed in at least 90 % of packages sold? (2 p)
- Is the workshop able to consistently work faster than standard times of packages sold? (if faster than 20% of total standard time in at least 50% of the works, given that the point above is fulfilled. +4 p)
- Are the number of reworks less than 1.5%? (4 p)

- Have lead times in the workshop been shorter since the implementation of GRS or, if GRS was implemented more than 1 year ago, since the beginning of the year? (2 p)
- Are deliveries to customers always on time, when needed? (5% acceptance of total number of works) (2 p)
- If deliveries are not on time, are these deviations followed up and acted upon? (2 p)
- Are the above points for operations efficiency fulfilled while also combining them with customer value as found in the Customer Value component of the model? (2 p)

Managing suppliers and the warehouse:

- Do deliveries arrive in time and in the right amount, every time? (a five minute deviance is allowed.) (2 p)
- Is the warehouse of a self-pick model, with a barcode system or equivalent for checking out parts? (2 p)
- Are there less than two employees working in the inventory? (2 p)
- Are standard deliveries more frequent than once a day? (1 p)
- Are express deliveries less frequent than 15% of total orders? (1 p)

Meetings (10p):

For meetings, different levels of maturity can be observed[1]:

1. No meetings at all (0 p)
2. Meetings are held but on an irregular basis (1 p)
3. Regular meetings, but held in the conference room (1+3 p)
4. Regular and frequent meetings held in the workplace (1+3+6 p)

[1] This evaluation point is adapted from Karlsson and Åhlström (1996)

Improvements (14p):

- Do improvement teams exist? (Yes? 2 p)
- Do the improvement teams consist of people from different areas of the workshop? (Yes? 2 p)
- How many A3:s that have been produced/implemented? (in average 2 improvement suggestions per week 1 p, more than 4 suggestions per week +1 p) (+1 p per level if more than 80% of the suggestions have been implemented within a month from being suggested) (maximum score 4 p)
- Have the improvements lead to a decrease in workshop lead time? (Yes? 1 p, with more than 10%? +2p)
- Have the improvements resulted in reduced movement, i.e. has the number of walking steps required for a technician to take for completing a job been reduced? (Yes? 1 p)
- Is both a reduction of lead time and the number of steps achieved? (+1 p). If the number of steps are reduced while the lead time is increased, no points are given for the reduced number of steps.
- If both more than two A3 improvements per week, reduced lead time and reduced number of steps (+1 p)

Degree of Commitment and involvement (12 p):

- Does the manager understand and is able to explain the GRS concept? (This point has to be checked externally, by for example an GRS coordinator. Understanding is not the same as being able to recapitulate the different parts of GRS. Emphasis should be on testing the understanding of the underlying reasons of the concept). (6 p)
- Is someone in the workshop responsible for being a change agent? (Is there a local GRS coordinator?). (2 p)

- Are the employees involved during the meetings? (How does the distribution of improvement suggestions look? An even distribution with at least 8 suggestion per employee on a yearly basis, is required). (2p)

- Do the employees take responsibility for the success of each other? (Do the employees clean their workplace after finishing a task, do they put back tools where they belong, and do they help a colleague in trouble? External evaluation, or by management, is required). (2p)

Degree of Visualisation (14p):

- What type of information is displayed and visualised for the employees? (Is the visual information sufficient for giving a good picture of the workshop and what can be improved. In other words, is information about improvements that have been undertaken and are in process being displayed?; is customer feedback displayed?; are results for operations efficiency shown?; are results from RFTOT shown? (1 p for each of these results). (Maximum score 4p)

- Does the workshop use boards for displaying information? (1p)

- Are there improvement boards in the workplace and are these used during improvement meetings? (2p)

- Does the workshop have before and after pictures of improvements made, or in any other way clearly signals the GRS improvements? (1p)

- Does the workshop use visual signals, such as lines and lights, in the workshop in a clear and comprehensible way? (2p)

- Is the visualised information always updated? (4p)

Maximum score: 100 p

Scores for different levels of GRS maturity:

Level 4: 75-100 p

Level 3: 50-74 p

Level 2: 25-49 p

Level 1: 0-24 p

6.3 Future improvements

Since continuous improvement is a fundamental aspect of lean and the GRS concept, the evaluation model cannot remain static over several years. The points identified in the model are those issues we have identified as important today, and what presently characterises GRS. That means it will be necessary to reassess the validity of the different evaluation points in the future. How far ahead in the future a reassessment is needed is largely dependent on the ability of workshops to fulfil the present evaluation points. In addition, the time aspect itself of how long a workshop has worked with GRS is important in considering the maturity of the GRS implementation. As time goes, maturity is expected to increase among workshops, which means that higher expectations and goals can be set.

Some evaluation points may increase in importance as time goes, while others may become less indicative of measuring GRS maturity. To reflect this, some points of the model might need to be inflated while others are deflated. In addition, some evaluation points may cease to capture the essence of how GRS maturity is achieved and should be removed altogether, while new points might need to be added.

7. Conclusions

Here we present how we have approached the research question and how well we have answered it.

In this thesis we have sought to find the answers on the two research questions:

How can an appropriate evaluation model for assessing the maturity grade of GRS look like?

and *What are the main challenges with developing this evaluation model?*

In order to answer these two seemingly straightforward questions, it has been necessary to examine three different aspects: how workshops generally function and what the distinctive features of workshops working with GRS are; given that GRS is a lean concept, the main focus areas of achieving leanness from a theoretical perspective; what type of evaluation should be used and what the main considerations when designing an evaluation model are. Based on the findings from these three aspects of investigation, we have designed the actual evaluation model, described how it works, and discussed some limitations of it.

On the basis of the thorough investigation undertaken, we feel confident that the model described provides an appropriate way of assessing the maturity grade of GRS. The main strength with the model is that it provides an uncomplicated and unambiguous way of comparing different workshops, along with giving a clear indication of what areas that the workshop should focus on in order to make the organisation leaner. A weakness of it is that it needs re-examination at some point in time, due to this concreteness, but given that the model should be applicable in practical situations, this is a trade-off we are willing to make.

The main challenges with developing an evaluation model have been addressed. The initial challenge has been to determine what evaluation method to be used – a financial, a scorecard based or a method based approach. All three have their own advantages, although the scorecard based and the method based evaluations are particularly interesting. The advantages of having the model as a control tool is tempting, but since the frame of the study does not permit us to do follow-up research and thoroughly test our findings, a method based evaluation model has been considered the most appropriate to develop. When constructing the model, other challenges have been to make sure that the model is consistent with theory, is clear enough not to be misinterpreted and that it measures what it is supposed to measure without causing model

gaming. We feel that the model is consistent with theory and that it measures what it should, as this is based on our own conclusions from the analysis done. We also believe that the model is clear and comprehensive enough so and does not create any major problems with gaming or misunderstandings, but to certify that the model should be tested in practice.

To sum up, the model created should provide a good foundation on which the maturity of GRS in Gamma's workshops can be measured. We have therefore succeeded with providing answers to our two research questions.

8. Future research

From our findings it ought to be possible to conduct a subsequent study of for example the correlations and/or causality between different components in the model we present in this thesis. This is preferably done once the GRS concept is used more broadly across Gamma's workshops. And it may prove very interesting and insightful for becoming better at working with GRS.

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Gamma Headquarters:

Responsible for KPI collection, March, 27 2009.

Service Manager Gamma Sweden, March, 31 2009.

GPS Office:

Coordinator 1, February, 24 2009.

Coordinator 2, February, 24 2009.

GPS Coordinators:

Production function 1, March, 13 2009.

Production function 2, March, 19 2009.

Production function 3, March, 25 2009.

GRS Office:

Manager at GRS Office, March, 31 2009.

Co-worker, April, 15 2009.

GRS Office Coordinator (WSE), (2), March, 30 2009 and May, 15 2009.

Workshops:

Workshop A

Workshop Manager, April 3, 2009.

Workshop B

Workshop Manager, April 23, 2009.

Workshop C

Local GRS Coordinator, May 15, 2009.

Warehouse staff, May 15 2009.

Workshop D

Local GRS Coordinator, May 15, 2009.

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