TILBURG UNIVERSITY

Lean for Logistic Service Providers

The application of lean on the transport process of Logistic Service Providers

Bachelor Thesis

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Abstract

The lean philosophy regards transport and inventory as waste in a process. However, transportation and warehousing are some of the main activities in the business model of a LSP. The application of lean on LSP operations therefore result in a paradox. This thesis addresses some of the main topics of the lean philosophy and the LSPs business model. Eventually the application of certain lean characteristics on LSP processes are discussed in further detail. The literature review was undertaken to gain insights in what is currently known within the field of lean logistic service providers.

Preface

This bachelor thesis is written in partial fulfillment of my pre-master Logistics and Operations Management, at Tilburg University. The thesis consists from a literature review, investigating the application of the lean philosophy on the processes of logistic service providers. Especially the application of the lean characteristics standardization and flexibility on the transport process of a LSP is elaborated in further detail. The eventual establishment of this thesis was also completed by a pleasant collaboration with my group/review members, all of them were willing to discuss and comment on my work during the writing process. Finally, I would like to thank Dr. Job de Haan, for his enthusiasm, directions and fruitful advices during the writing of this bachelor thesis.

Eindhoven, June 2010

Erik Zeegers

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Abbreviations

CODP	Customer Order Decoupling Point
EDI	Electronic Data Interchange
ETA	Estimated Time of Arrival
GPS	Global Positioning System
JCM	Job Characteristic Model
LIFO	Last In First Out
LSP	Logistic Service Provider
TMS	Transport Management System
TPM	Total Process Management
TPS	Toyota Production System
SMED	Single Minute Exchange of Die
WMS	Warehouse Management System

1. Introduction

This chapter encloses the initial research proposal that will be used as a guideline for the bachelor thesis within the topic of Lean Management. First, an introduction to the research environment will be described. Next, the problem statement and its relevance / context are addressed. Based on this, the central research question and sub research questions are developed. In the subsequent sections, the research design, and methodologies that will be used during this research project are discussed. The introduction of the conceptual framework and the structure of the thesis are the final parts of this chapter.

1.1. Problem indication

Ever since the theories of Dr. Shigeo Shingo epic lifework were captured in 1981 in clear "English" concepts, lean management became the new corporate philosophy. The revised version of "A study of the Toyota Production system From an Industrial Engineering Viewpoint" gained widespread attention in the academic as well in the business field (Womack, Jones and Roos 1990; Steward and O'Brien, 2005; Treville and Antonaksis, 2006, Scherrer- Rathje, Boyle and Deflorin 2009). When discussing lean it is necessary to establish the differences between the operational and the philosophical perspective. The operational perspective discusses means to achieve waste reduction within the full cycle of the production process by implementing a set of shop floor tools and techniques. These include: setup time reduction, kaizen, six sigma quality, visual displays, kanban, just in time supply systems, and preventive maintenance. The philosophical perspective deals with: the interrelationships and synergistic effects of these practices in order to improve overall levels of productivity and product quality, waste reduction outside of traditional manufacturing, interaction across functional departments, and improved work force autonomy (Scherrer-Ratjhe, Boyle, Delforin 2009). The application of the lean concepts is not as overwhelmingly a success story as its theory might promise, and many hurdles in the implementation process have be to be analyzed and addressed. Therefore it is vital to investigate the interrelationships and synergies to grasp the complexities that lean brings about. A critical analysis of the existing literature regarding lean can produce valuable outcomes for scholars as well as business managers.

Special emphasis during this literature review will be for the application of lean practices within logistic service providers (LSPs). On the lowest level (2PL), a LSP is a warehousing and/or shipping partner of a large corporation, performing tasks on an operational level. When the number of tasks performed by the LSP for its client increases, the LSP becomes a 3PL (3rd party logistics) LSP, being more integrated and operating on a tactical level. When a LSP offers a high level of problem solving ability and customer integration, this is commonly referred to as a Supply Chain solution provider (4PL), acting on a strategic level. The tasks a LSP performs can be divided into three processes: the inbound, outbound, and transportation process. The inbound process deals with all movements of goods from the moment they are delivered until they are stored in the warehouse, as well as all administrative processes needed to perform this task. The outbound process deals with the reverse process, all movements of goods from storage in the warehouse until the moment they are shipped, as well as all administrative processes needed to perform this task. As for the transportation process, it deals with all movements of goods outside the scope of the warehouse, all transportation of goods between the moment of shipment and the moment of delivery (elsewhere). Although extensive research (of philosophical and practical nature) has been conducted regarding lean, the implications of lean within this specific business area remains under investigated. A thorough study of the literature addressing lean and the literature addressing LSPs can provide a good basis for further research that has a more practical nature and includes real life case studies of the application of lean within LSPs.

1.2. Relevance

Being faced with intense competition due to an increasing globalized economic playfield, the lean management view puts forth -now more than ever- its importance and its necessity for the survival of companies nowadays. However, nowadays there are some unresolved issues within the lean field that managers and academics struggle with, and deserve attention. LSPs especially face challenges due to their role within the production and supply chain process when implementing lean management practices. The efficient distribution of goods from factories to the marketplace is now recognised as a major determinant of company profitability. Today's marketplace is characterized by a large variety of products with increasing shorter life cycles. This resulted into largely varying product assortments from LSPs customers. Businesses and consumers demand for Just in time deliveries of the right products, in the right quantity, in the right quality and at the right time. This has led to an offering of freight to LSPs with high variety, high frequency deliveries and small batch sizes. In order to retain a flexible attitude towards customers and continue to stay operational efficient internally, it is required to standardize products, volume and processes to the highest extend without becoming inflexible. However, the transport operations of LSPs are under demanding constraints because they face increasing operational costs, e.g. congestion, pollution, legislative pricing (e.g. German LKW MAUT) and the ongoing raise of fuel costs. Combined with the fact that transportation is considered as a commodity service, makes it hard for LSPs to obtain and conserve a distinctive role in the market place. Standardization and flexibility as characteristics of the lean philosophy are possible strategies to support keeping a LSPs transport function valuable for customers and operational payable for the LSP itself.

1.3. Problem statement

The problem indication identified the paradox regarding the application of lean on LSP's. Previous research resulted in clear insights of the lean philosophy and all its related aspects to a large variety of business processes. However the translation of lean on Logistic Service Providers remains underexposed. Therefore the problem statement for this thesis can be defined as follows:

How can standardization versus flexibility as characteristics of the lean philosophy, be applied to the transport processes of Logistic Service Providers (LSPs)?

1.4. Research Questions

- What is the content of the lean philosophy and what are the major dilemmas it addresses?
- What are Logistic Service Providers (LSPs) and which processes can be differentiated in LSPs business operations?

1.5. Research Design

An exploratory research design will be used in order to answer the problem statement '*How can standardization versus flexibility as characteristics of the lean philosophy, be applied to the transport processes of Logistic Service Providers'*, since very few studies have been conducted in the application of lean philosophy within LSPs (Sekaran, 2003). For this thesis an extensive literature review will be done in order to deal with lean strategy in a logistics environment.

In order to start the literature review, the concepts, factors and variables have to be identified first. This way the demands of the research objective can be fulfilled properly. The characteristics of Lean, the processes of LSPs, and the impact Lean strategy has on LSPs will be discussed subsequently. Since the focus is on the field of Lean and LSPs, academic journals concentrating on lean, LSPs, and lean practices within LSPs will be used. After achieving a general understanding of lean practices and LSPs, it is important to obtain an accurate view about the consequences lean practices have for LSPs.

1.6. Data collection

In this thesis a secondary data collection method will be used. More specifically, data coming from textbooks and scientific literature in the field of lean logistics will be used. The search mechanism used to identify these publications will be a four step approach:

Step 1: Data Collection

Electronic data will be acquired by means of search words like: ‘lean’, ‘lean philosophy’, ‘lean characteristics’, ‘Logistic Service Providers’. The search machines Science Direct, Web of Science, Google Scholar, and Online Contents scientific journals (UvT) will be used in order to find articles that contribute to finding a solution to the problem statement, since these databases contain scientifically relevant information. These applications will also be used in order to find textbooks.

Step 2: Data Selection

The most important authors will be selected by means of the most cited and named authors in the particular field of interest. The names of the authors will then be used in the library and Google Scholar search machines to find the most appropriate textbooks and articles.

Step 3: Elaborate data selection

The relevance of the articles and books will be determined by reading the abstract and concluding parts of the sources. However, when the same information is presented in two sources, the source that is most cited will be taken as data source for the thesis.

Step 4: Data discrimination

After finding relevant articles and books, we will use the reference lists of these sources to find additional sources that may be useful. These sources will then be downloaded and reviewed.

A schematic overview:

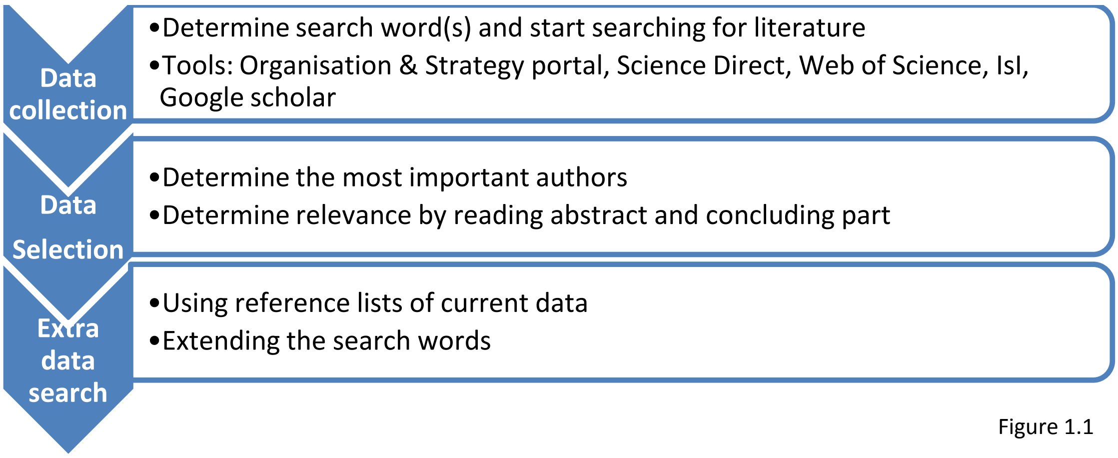

Figure 1.1

1.7. Conceptual research framework

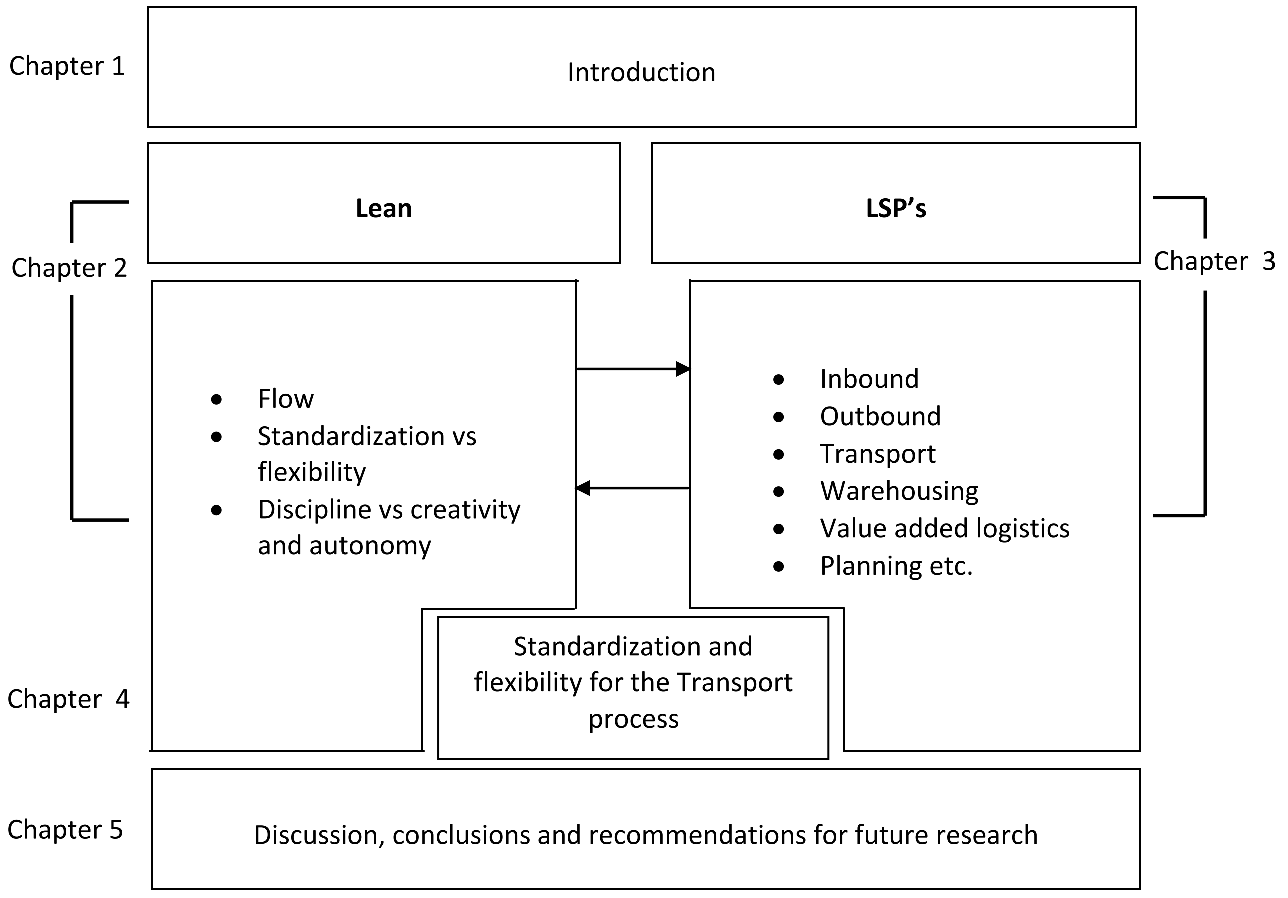

Figure 1.2

2. The lean philosophy and its characteristics

This chapter consists of an extensive elaboration of the lean philosophy. The first part describes how the arise of lean developed over time and identifies the different forms of waste the lean philosophy distinguishes. The consecutive parts describe the main components that make up the Lean philosophy. The components flow –standardization versus flexibility – discipline versus creativity are subsequently treated in this chapter.

2.1. The lean philosophy

In short lean is a systematic approach to enhance value to the customer by identifying and eliminating waste through continuously improving the flow of the product to the customer (Manrodt et al., 2008). The lean concept as we know it nowadays is the result of the evolution of the Toyota Production System (TPS), developed and gradually evolved from 1948 onwards. Toyota analyzed the Western production systems and the results were striking for Taiichi Ohno. He identified two major flaws within these Western ways of producing, the first flaw he argued was that producing components in large batches resulted in large inventories, which took up costly capital and warehouse space and resulted in a high number of defects. The second flaw he pinpointed was the inability to accommodate consumer preferences for product diversity. (Holweg, 2007). With these flaws in mind he started to develop a concept, which has become known as the Toyota Production System. Not until the end of the first oil crisis in the early 1970s Toyota began to draw attention as people noticed that it suffered less during the downturn and recovered much faster than its competitors did (Lander et al., 2007). The term 'lean production' was first used by Krafcik in 1988, but it did not become globally known in the academic world until the book 'The machine that changed the world' (Womack et al., 1990) was released. In this book lean production is seen as the next paradigm of manufacturing beyond mass production, of which the TPS was considered the best-known example and thus became the model on which the book's description was based (Lander et al., 2007). Within the TPS system it became clear that the only activities which count within a production system are the activities that add value for the customer, and thus eliminate all other activities which were labeled as waste (Ohno, 1988).

The identified forms of wastes (Ohno, 1988 and later Womack et al., 2003):

- Waste of overproduction
- Waste of time on hand (waiting)
- Waste of transportation
- Waste of processing itself (over-processing)
- Waste of stock on hand (inventory)
- Waste of movement
- Waste of making defective products

The results when using a lean system are striking:

	USA 1994	USA 1996	Japan 1990
Service rate	98 per cent in 7 days	98 per cent in 1 day	98 per cent in 2 hours
System stock index	100	33	19
Throughput time (weeks)	48	8	4

Source: J. Womack et al, 1996 Table 2.1

As can be seen, some of the indicated wastes by Taiichi Ohno, in this case waiting time and inventory, are reduced by more than a half. Looking at the results it may be worth arguing about the benefits of lean within a company. Some claim that lean production will be the standard manufacturing mode of the 21st century (Rinehart et al., 1997). To further understand the theory of Lean it is necessary to address its' main constructs which are:

- Flow
- standardization vs. flexibility ;
- discipline vs. creativity and autonomy

The above characteristics will be addressed next in this chapter in the above listed order.

2.2. Flow

The concept of flow is one of the core elements of the lean philosophy and is related to the ideal of the flow of value without interruptions, eliminating waste and reducing the lead time of generating new products or services (Womack, 1996). Flow is concerned with processes, including material and information. Although the material flow is the most obvious category in an organization, the identification of all the processes is still very difficult. In order to understand flow, it is necessary to define the concept of value stream—the linkage of events or activities which ultimately delivers value to a customer (Melton, 2005).

2.2.1. Value stream mapping

Value stream mapping is a simple but effective approach to understand the flow of material and information, which indicates the product or service's value added activity as it progresses through a process, operation or supply chain (Slack, Chambers & Johnston, 2004). It uses a simple visual graph to map a product or service process from beginning to end. It not only records the direct value added activities or services but also the indirect information systems which support the direct activities. A value stream perspective involves working on (and improving) the 'big picture' rather than just optimizing individual processes (Slack, 2004).

2.2.2. Material flow

Smooth, uninterrupted material flow in the organization is important for Just In Time (JIT) practices within the lean philosophy. The lack of the material flow could cause a huge amount of inventories, or disconnected information. Long working processes in organizations bring the opportunity for inventories to build-up and lack of information, which increase the chance of non value added activities. JIT puts the lean philosophy into practice, tries to reduce the lack of information and non value added activities. JIT has two approaches to control material flow: pull and push scheduling.

The pull view of JIT is an approach to material control based on the view that the process of material flow should be operated only when a customer signals the need. Materials are pulled through the value stream, which responds to the demand of the end-customers. When the material flow is operating in a JIT way, products should be delivered to customers without waiting time (Harrison, van Hoek 2008).

Harrison and van Hoek (2008) describe the push approach as a system of controlling materials whereby the makers and providers make or send material in response to a pre-set schedule, regardless of whether the next process needs them at that time. In this way the people who work in the office make a plan to decide when to send a certain amount of products to which customer. A certain amount of inventories is necessary to ensure quick service to the customer. Push scheduling is always associated with inventories which do not always help organization to be more responsive. Unfortunately, the push approach is commonly used nowadays.

2.2.3. Information flow

The ‘flow’ principle of lean suggests that the value creation steps (the value stream) should be made to obtain flow. In the case of information, the aim is to ensure that information flows efficiently, and let only the most valuable (appropriate, accurate and up-to-date) information flow. To achieve this, information should be available as soon as it is generated or acquired. All information processing and support processes should occur in the shortest possible time. Thus, all procedures and processes should be invoked and performed in the simplest way possible. It is also important to minimize the duplication of information and the amount of out-of-date or unnecessary information within the organization and between customers and suppliers. Therefore, result to reduce the duplication of effort within the organization, across departments and customers and suppliers (Hicks, 2007). The fluent information flow is an efficient way to reduce inventory, which subsequently leads to the reduction of waste in material flow.

2.3 Standardization versus Flexibility

2.3.1 Standardization

A ‘lean’ organization means ‘an organization which uses its entire action principles of leanness and flexibility’ (Kosonen, 1994). The basic idea is to do all the organization’s activities as lean as possible. Standardization has been seen as a fundamental building block for the lean philosophy; it supports and maintains organizations’ lean workplace and structure. Successful implementation of standardization will determine whether the organization is able to transform to a sustainable lean structure. It improves flow, simplifying the management of the physical inventory, reduces mistakes and motion. Standardization should also be used as an indicator to check daily performance and identify infraction. Furthermore, it helps to develop organization internal reliability.

2.3.2 Standard procedure

In the lean philosophy, standard procedure is regarded as a useful tool to reduce waste. The seven forms of waste, described that the process itself may be a source of waste, due to poor product design or poor maintenances. Thus, the standard procedure could prevent the waste generated in the process. In 5S systems, standardization is described as maintain cleanliness and order – perpetual neatness (Slack, 2004). Standard procedure could help to eliminate all types of waste, such as waste related to uncertainty, waiting, searching and so on. By eliminating what is unnecessary and making everything clear and predictable, clutter is reduced, hence, the work process is made easier and faster. In order to reach this step, the process needs to be designed; standard procedure should be easy and simple. The whole complex process can be broken down into a group of ease procedures, and standardize them to make sure the procedures are kept simple and waste free. Behind this concept, the operation needs to focus on simplicity, repetition and experience breed competence (Slack, 2004). The internal organization needs to focus in each process on limited, manageable sets of products, technologies and volumes. And between all the standard procedures there should be a coherent structure, rather than inconsistency and conflicts.

2.3.3 Standard time

Standard time in a process means trying to satisfy the customer’s demand in time. Which in order is to reduce waste such as waste of inventory, unnecessary waiting time, and so on. Amongst the lean philosophy, the JIT production system is a key method to achieve significant reductions in production lead times by having all processes produce the necessary parts at the necessary time with the minimum stock, which is necessary to hold the processes together (Reichhart, Holweg, 2007). In lean processes, any stoppage will affect the whole process. The waste in a process can be measured by the throughput time. The longer items are being processed, are held in inventory, moved, checked or subject to anything else that does not add value, the longer they take to progress through the process. Hence, paying attention at what exactly happens to the items within a process is a good method to identify the waste. Setup time reduction could also help to reduce waste in the process, and it supports the standard time. Setup time reduction is a process of reducing the time taken to change a process from one activity to the next (Slack, 2004). Standard time helps the organization to reduce the waste by creating a smooth, continues flow and holding less inventories.

2.3.4 Flexibility

The lean philosophy focuses on enriching value from the customer perspective (Harrison and van Hoek, 2008). The aim of lean production is to increase efficiency, by means of decreasing total lead time and increasing flexibility in processes. Hence, a high level of standardization is not the only key for elimination of rework and waste, but it also opens the way for capacity and flexibility (Balle, 2005). Flexibility is the degree to which an operation's process can change what it does, how it is doing, or when it is doing (Slack, 2004). According to Womack (1990), the basis of a lean enterprise is dynamic, multi-skilled groups. These groups do the main part of work and they carry the responsibility of these tasks. This makes the entire organization more flexible. Furthermore, flexibility shows in employees' involvement. By instituting observations as practical learning, employees can provide more feedback about how regular daily operations can be executed more efficiently and result into lean practice, in order to reduce the number non-value adding activities.

2.3.5 Batch size one

Jobs are classified into different groups or families and the same types of jobs can be processed together in a batch. The lean thinking philosophy has raised the question whether an optimal batch size could or should be calculated at all. The ultimate target is to achieve one-piece flow. For an optimal flow rapid change over is required. Practices that reduce changeover times are often known as single minute exchange of dies (SMED, Harrison & van Hoek, 2008). Thus, the batches should always be as small as possible. A small batch size has the ability to create high flexibility and an integration process that helps achieve individual designed products and services for every individual customer. The justification for the smaller batch size is based on: first, the new flexible manufacturing and information technologies enable the organization to deliver a higher variety at lower cost. Secondly, customers desire more variety of products or services. Thirdly, organizations focus on individual customers, due to short product life cycles and intense competitive environments (Silveira, Borenstein, Fogliatto, 2001). Batch size one is a very helpful tool to support the organization to mix flexible individualization with high variety and standardized processes. Using batch size 1 is an enabler for ultimately achieving the lean philosophy – enriching value from the customer perspective.

2.4. Discipline versus creativity and autonomy

This part will introduce the employees' role and especially its relevance within the lean theory. The analysis will contrast the prevailing theories on lean with the empirical findings of some studies regarding the implementation of lean. Contrasting these two approaches with respect to theory building will highlight the critical aspects that remain unresolved within the lean philosophy and need further investigation. Starting point for the first part of the analysis will be the TPM theory to balance discipline versus creativity. The analysis will continue with the Treville and Antonakis report written in 2006. Then the empirical evidence will be presented based on several studies conducted by different scholars. Within the empirical papers there is a distinction between failures and success of lean implementation to highlight critical areas in implementing lean practices.

2.4.1. Theory of the lean concept "Discipline versus creativity"

Womack Roos and Jones address the human aspect in their book "The machine that changed the world" with minor attention and vague concepts. They raise the question whether LP can be humanly fulfilling. They display the "Creative tension" concept that is used within TPM as the subsequent answer. The creative tension concept indicates that workers are induced to address their creativity to deal with the resource constraints under which they function. Although they are equipped with tools and skills to perform their job, workers are under constant pressure to improve performance as resources are at sub-minimum level which spurs their creativity (De Haan, Overboom, and Naus, 2008; Treville and Antonakis, 2006). The above highlights why scholars are still disputing whether lean production systems are intrinsically motivating or not, it is so far only a meager representation under which conditions a worker experiences his/her job as fulfilling.

2.4.2. The introduction of the JCM model into the Lean theory

The JCM developed by Hackman and Oldham in 1975 would imply that a job designed according to lean principles cannot be intrinsically motivating, since it greatly reduces autonomy due to the fact that lean designed jobs are based on standardized processes . Treville and Antonakis incorporated the degree of leanness as a moderating variable (contextual factors) in the JCM model. The configuration of job characteristics, are grouped together as organizational level factors and the critical psychological states as individual level factors. The synergistic effects of work practices are labeled as work outcomes which are related to the individual level factors and influence the organizational performance. Autonomy is furthermore split up in two forms: Responsive autonomy and Choice Autonomy. Treville and Antonakis claim that dividing autonomy into two parts underlines why the JCM model predicted that workers could not experience autonomy within lean applications and why this model does explain for the autonomy that workers can have under lean conditions. What Treville and Antonakis suggests, highlight how many companies incorporate lean; as a set of rightly configured tools and not as a complete philosophy. Treville and Antonakis overly emphasize on the standardization of jobs and procedures, reducing lean to a mass production system; that which they claim to refuse in their first part of the paper. Why so many failures can be witnessed with the implementation of lean practices is due to the general neglect of the human aspect, that most companies lack to incorporate when applying lean practices. (Bhasin and Burcher 2006).

2.4.3. Empirical evidence from different research papers

Three different papers that highlight the failures and successes of lean implementations are dealt with in this part. The paper of Sim and Rogers (2009) and Scherrer-Rathje, Boyle and Deflorin (2009) focus on the difficulties that were encountered introducing lean. The paper by de Haan, Overboom and Naus (2008) highlights positive effects of lean implementations in two different manufacturing companies.

Difficulties encountered when implementing lean

The application of lean procedures, which is often viewed as a threat to job loss (Sim and Rogers 2009), stresses the need for reassurance and clear communication towards a company's workers. Hobson noted in 1914 that "the most destructive aspect of economic insecurity in a market economy is related to fear of job loss" (Lutz, 2008), a notion that in hindsight only vaguely captured its destructive power. Back to our present day, there are many failures regarding lean that centre around communication from the management levels (Bhasin and Burcher 2006). Rattje, Boyle and Deflorin found out that for lean practices to be implemented successfully the following ingredients are necessary:

1. Lean will not succeed without visible management commitment;
2. Develop formal mechanisms to encourage and enable autonomy;
3. Openly disclose mid-to-long-term lean goals;
4. Ensure mechanisms are in place for the long-term sustainability of lean;
5. Communicate lean wins from the outset;
6. Continual evaluation during the lean effort is critical.

All of these findings underline the importance of good communication from the management levels to the employees for a lean implementation to succeed. Another case study of a US-based manufacturer conducted by Sim and Rogers revealed that "management failed under the area of coaching, communication and support". Another thing the research revealed again stresses the need for good communication, as elderly workers experience lean as a way to "using fewer workers to produce more products as a negative and long term threat to job security… if training is only about new techniques and metrics, workers who fear for their jobs tend to lack motivation for these forms of programs" (Sim and Rogers, 2009). The implementation of lean practices requires a change in ideas and working practices for employees as well as management and the success of lean is dependent on the relationship between these two groups (Deppe, 1994).

Positive outcomes of lean implementations

During an extensive research at two different Dutch manufacturing companies, de Haan, Overboom and Naus (2008) analyzed the characteristics of the JCM model, were lean practices were applied. The introduction of the lean practices at these manufacturing companies, led to increased worker satisfaction. The alteration of the JCM with regard to autonomy made by Treville and Antonakis was also tested in this setting, and proved to be valid. The main aim of the paper was to investigate the relationship between discipline and creativity, the results showed that discipline provided the necessary boundaries for employees to be creative and used their creativity to further improve work processes (de Haan, Overboom and Naus, 2008).

In the table below the concepts are displayed and the findings are summarized and theory and empiric evidence are contrasted with each other.

Job Characteristics	Theory	Empirical evidence
- Skill variety	Increase in skill variety where workers participate in problem solving, receive training, rotate jobs.	Job rotation is positively perceived.
- Task Identity	Lean is positively related as the employee is better to see his/her contribution to the whole.	Task and responsibilities that are more clear are well received by employees.
- Feedback	Lean is positively correlated to feedback from both process and coworkers.	An informal and formal increase of feedback increases the job experience. Management often fails in this area. Continual evaluation and the wins of lean need to be better communicated.
- Responsible Autonomy	LP is good for RA where workers participate in developing procedures, and responsibility and decision making authority are transferred from higher levels.	More autonomy increased intra-team cooperation and increased interdependencies. Teams have some supervisory tasks and are consulted before decisions are made. Not creating team autonomy induces lengthy decision making, employee frustration and refusal of necessary lean implementations.
- Choice Autonomy	LP negatively relates to choice	Fixed sequence reduced Choice Autonomy.
- Work Facilitation	LP is positively related to work facilitation	Creating a better lay out provides clarity for employees.

Table 2.2. The JCM model in theory and practice, based on Treville and Antonakis (2009), Sim and Rogers (2009), Haan, Naus and Overboom (2008)

3. Logistic Service Providers and their processes

This chapter will start with a general introduction to the business model of LSPs. Hereafter the LSPs position in the supply chain is further determined. This general introduction is followed by an elaboration of the different processes a LSP executes. Both the LSPs position in the supply chain, as the LSP processes will mainly be focussed on the inbound- and transportation process. While these two processes are the main subject of further discussion in chapter 4, these processes are most relevant to address in further detail.

3.1 Logistic Service Providers

A LSP is an external party managing, controlling and delivering logistics activities on behalf of a client. The activities a LSP performs can range from basic operational logistic services, like transportation, to sophisticated strategic logistic services, such as Supply Chain management. The relationship between LSPs and their customers has grown over time from a contract-focused view (Virum, 1993) to partnerships (Bagchi, Virum, 1998) and is now seen as mutually beneficial to both the LSP and its client. A LSP serves as a middle man between the client or its supplier(s) and the buyer of the goods. For the remainder of this paper, the following definition will be referred to whenever a LSP is mentioned:

*"A LSP is a provider of logistics services that performs all or part of a client company's logistic function (*J.J. Coyle et al 2003).*"*

3.2 The position of the LSP in the Supply Chain

LSPs are involved in several positions in the supply chain. This is further underlined in figure 3.1 below, which represents a modified example of a generic supply chain by Delfmann, Albers and Gehring (2002).

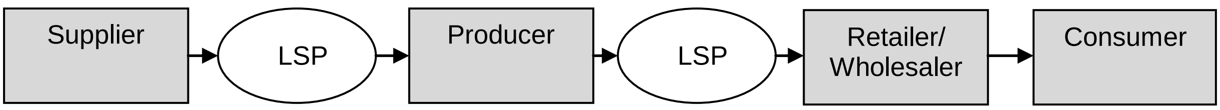

Figure 3.1

Derived from the this graphical overview can be stated that the LSP bridges the gap between a number of successive links within the supply chain. Or as Tseng, Yue and Taylor (2005) state, ''by means of a well-handled transport system, goods could be sent to the right place at the right time in order to satisfy customers' demands. It brings efficacy, and also it builds a bridge between producers and consumers’’ (p.1662). However it is important to underline which party the LSP is serving. In most situations this will be the party that is positioned most upward in the chain, the delivering party. The LSP takes care of a large variety of logistics activities, e.g. are the actual transportation of the goods and the warehousing activities, in which the in- and outbound processes are included as well. However the nature of the work performed in these activities is particularly determined by the direction of the goods flow. This implicates that a clear distinction is required between incoming goods from the customer (the delivering party) and the outgoing goods flow from the LSP to the receiver. For incoming goods it applies that the goods flow is mainly pushed into the LSPs warehouse. On the other hand, for the outgoing goods flow applies the opposite. The outgoing goods flow is mainly based on the principle of pull. For example a manufacturer produces optimal batch sizes and pushes the inventory of finished products from the factory to the LSP. The LSP is subsequently obliged to take care of the supply of customer specific (pulled) orders to the manufacturers customers (e.g. retailers/wholesalers). This implicates that the CODP (Customer Order Decoupling Point) is actually placed at the position of the LSP in the supply chain. Graphically this situation would look as follows.

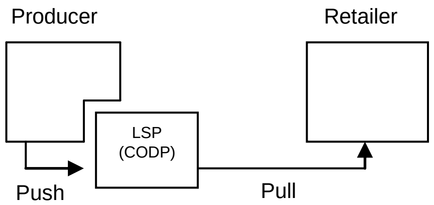

Figure 3.2

3.3 Logistic Service Provider processes

The processes a LSP entails can roughly be divided into the following three processes.

- Inbound. The inbound process covers the movements of freight from arrival at the LSP warehouse until it is stored as pickable stock, as well as the administrative efforts needed to guide and complete these movements. Rouwenhorst et. al. (2000) describes the inbound process in detail, from unloading the quantities to the inbound transportation to the storage area.
- Outbound. The outbound process covers the movements of stock from pickable storage until the moment it leaves the LSP warehouse as freight, as well as the administrative efforts needed to guide and complete these movements. Due to limited space there will be no further elaboration on this process.

- Transportation. The transportation process covers all movements of freight outside the LSP warehouse as well as the administrative efforts needed to guide and complete these movements.

3.3.1 Inbound process

The inbound process can be subdivided into three main processes; receiving, checking, and internal transportation of goods. Rouwenhorst et. al. (2000) described these processes in detail.

The *receiving process* consists of the receiving of goods on the receiving docks and steps like scheduling inbound shipments based on EDI information. Also, the administrative handling of the shipments documentation, for instance by a customs department, is part of the receiving process. The aim of this sub-process is to schedule shipments evenly to avoid a pile-up of goods at the inbound docks.

After the goods are received, the goods are moved to the *checking process*. In this process the quantities are verified in order to check if there is a match between the shipments documentation and the actual shipment. Next to that, random quality checks are performed. Information about arrival time and contents, item verification and quality checks is documented in a WMS (Warehouse Management System). This process also includes checking the status of the goods, slow-moving or fast-moving, and making a location decision between either the reserve area or the forward area. This sub-process aims at an early detection of rework or repackaging needs, as well as determining whether the right goods have arrived in the right quantities without defects.

In the last stage, *internal transportation*, the quantities are prepared to be stored. To store the goods, the quantities are adapted to the internal storage modules if the external storage modules differ from the internal storage modules. The process finishes with the inbound transportation of the quantities to a location in the storage area, where they can be picked up easily and transported to the next stage. Rouwenhorst et. al. (2000) divide the storage area into two parts, the reserve area, where slow moving products are stored in the most economical way, and the forward area, where fast moving products are stored for easy retrieval. This sub-process is aimed at getting the storage of goods right the first time, avoiding relocation.

3.3.2 Transportation process

The key element in a logistics chain is the transportation system. One-third of the logistics costs are occupied by transportation, additionally the transportation systems has a huge influence on the performance of logistics systems (Tseng et al., 2005). The transportation process covers all movements of freight outside the LSP warehouse as well as the administrative efforts needed to guide and complete these movements. Powell (2002) stated that: ‘’a manufacturing supply chain can be viewed as a sequence of steps consisting of the modification of a resource at a point (manufacturing) followed by the transfer of the product over space (transportation). Transportation arises because of the spatial distribution of resources, skill sets and customers. The challenge we face is completing this component of the supply chain efficiently, reliably and, in the case of common carriers, profitably’’ (p.1).

Three main activities shape the actual transport process, these are: loading, shipping (actual movement of freight) and unloading. The transportation process takes off by checking the orders and subsequently loading them into the trucks, or any other carrier (Rouwenhorst et al., 2000). For loading the trucks unit load handling equipment can be used to move the freight from storage area into the trailers / containers (Bowersox et al., 2007). If the loading activity is finished, the actual shipment of goods takes place to its destinations. When arrived at these destinations the goods are unloaded from the transport carrier and issued to the receiver. Also for unloading the freight, load handling equipment can be used to move the freight from the trailer into the receiver’s preferred receiving area.

As stated earlier shipping is the physical process of transporting goods, shipments can take place by sea, air, and land. Transportation of goods over these three different modalities can be performed by different transport carriers, of which all in their turn have some advantages and disadvantages. For example maritime logistics (sea) is important for transporting international freight. It provides a cheap and high carrying capacity conveyance, some disadvantages are that it needs longer transport time and schedules can be affected by weather factors. On the other hand, air freight transport provides deliveries with speed, lower risk of damage and a good frequency for regular destinations, however a major disadvantage is the high delivery fee. Finally land logistics extends the delivery services for air and maritime transport from airports and seaports. A positive characteristic of land transportation is the high accessibility level in land areas. Railway transport, road freight transport and pipeline transport are the main transport modes of land logistics. Compared to railway transport, which is characterized by a lack of elasticity in urgent demands, road freight transport has advantages such as high accessibility, mobility and availability (Tseng et al., 2005). Given the trend of global markets, the future tendencies of transport development are integration of the different transport modes, this helps providing a service base of door-to-door deliveries that can be delivered Just-In-Time.

4. Standardization and flexibility for transport operations

This chapter answers the central problem statement of this thesis, by relating the lean characteristics standardization and flexibility with the transportation process of LSPs. First the most relevant issues addressed in prior chapters will be treated. Hereafter both theories are combined to give a sound answer to the central problem statement and will eventually result in the introduction of an integrated framework for the application of standardization and flexibility on a LSPs transport operations.

4.1 The transport process

As stated earlier in chapter 3, three main activities can be addressed that shape the actual transport process, these are: loading, shipping (actual movement of freight) and unloading. Because of the intermediary function of the LSP in the supply chain, most LSPs are obliged to process two different good flows. At first, the goods flow from parties more upward in the supply chain to the LSP, this flow is characterized by a convergent stream of raw materials that are pushed into the process. In this case most transport operations are performed by sea, railway and in a limited degree, air carriers and road freight transport. On the other hand, the goods flow from the LSP to parties more downward in the supply chain, is characterized by a more divergent stream of end products that are pulled by demand of the end customer. Most of these transport operations are performed by the deployment of road freight transport. The application of standardization and flexibility seems most relevant for this transport modality, while road transport is mainly used for freight with high varieties, small batch sizes and highly frequent deliveries. In order to limit the scope of this chapter, further elaboration will therefore be focused on road freight transport.

4.2 Standardization

Standardization is a fundamental building block of the lean philosophy, successful implementation enables the organization to transform towards a sustainable lean structure. Overall standardization helps reduce waste and maintains clearness and order (Slack, 2004). Eventually these factors result in the improvement of flow. A distinction within the subject of standardization is made between standard procedures and standard time.

4.2.1 Standard Procedure

Standard procedures can help eliminate several types of waste, for instance waste related to waiting and searching. Eliminating all that is unnecessary and making the process predictable makes the overall work process easier and faster. The application of standard procedures on loading, shipping and unloading is further elaborated below.

Loading

Application of standard procedures on loading makes this activity more clear and predictable. For instance the use of commoditized containers makes sure that the workforce knows how to handle the freight and where to load it into the truck. Preliminary dock assignment of arriving trucks, enables the workforce to queue decomposed deliveries in LIFO order at the dock. This standardized procedure forces the workforce to load deliveries in the right order.

Shipping

For shipping most relevant standard procedures encompass the standardization of informational procedures. For example navigation software, forces the transport of deliveries over optimal routes. Other examples of standard shipping procedures are, the legislative deployment of speed limiters and tachographs. Limiting speed and monitoring total driving time forces the driver to transport the delivery within certain standardized boundaries.

Unloading

Standard procedures for unloading are closely related to those of loading. The use of commoditized containers enables the workforce to handle freight in a standardized way. By informing the client on the Estimated Time of Arrival (ETA), the arriving truck can preliminary be assigned to a dock and the workforce at the location of issue can prepare for unloading.

4.2.1 Standard Time

Standard time actually means satisfaction of customer demand within time. A possible way to reduce waste in the process is by reducing set up times, this eventually supports achieving standard times in the core process as well. To summarize the concept of standard time the following can be stated: standard time helps the organization reduce waste, by creation of a smooth and continuous flow and by holding less inventories. A few applications of standard time, within the concept of the transport process will be illustrated below.

Loading

The usage of standardized containers and load handling equipment enables the set up of a accurate workforce planning for loading activities. Hence, to standard procedures, standard time measures can be applied. Preliminary programming standardized tact time in the vehicles black box makes sure employees are aware of the limited time frames.

Shipping

Most relevant subjects for standard time in shipping are the carrier and the driver. In order to keep the equipment reliable, scheduled maintenance is required at standard intervals. For safety- and health reasons the driver is obliged to take his/her rest with standard intervals as well.

Unloading

The standard time issues related to unloading are almost common to loading. The use of standardized containers enables relative accurate planning of unloading activities in time. Application of a black box is a manner to monitor standardized tact times for unloading.

4.3 Flexibility

The eventual aim of lean production is to increase efficiency, ways to achieve the desired efficiency level are, decreasing the total lead time and increasing the overall flexibility of the process. As Ball (2005) stated earlier in this thesis, high levels of standardization are not the only key for elimination of rework en waste, it also opens the way for capacity and flexibility. Slack (2004), describes flexibility almost as follows, it is the degree to which an operational process can change what is does, how it is doing and when it is doing the performance of a certain action.

4.3.1 Batch Size One

The rational thought behind the concept of batch size one, is that small batches create higher flexibility. The obtained flexibility levels subsequently enable the organization to individually design products and services for every individual customer. Deployment of information technologies enables the satisfaction of demand for higher variety at lower costs (Silveira, 2001). Ultimately application of batch size is 1, enriches value from the customers perspective, which is central within the lean philosophy.

Loading

Practical application of batch size one for loading requires for information technologies. Deployment of EDI systems enable the LSP to optimally synchronize customer demand with internal operations. Proper insights into customer demand at preliminary stages enables the LSP to thoroughly prepare consolidation and cross docking of decomposed deliveries on forehand.

Shipping

The application of batch size one/ flexibility for shipping requires for information technologies also. Deployment of TMS (Transport Management Systems) enables the LSP to ship different deliveries in optimal routing with the same carrier and adjust routings real time if necessary. Another important enabler for realizing batch size one is the use of flexible carriers. For instance the deployment of trailers with an adjustable lay-out, these trailers enable the LSP to ship a largely varying number of deliveries within the same transport movement.

Unloading

Deploying on-board load handling equipment is a way to obtain flexibility in the unloading activity. A large variety of innovative systems are introduced to the market over the last decade, enabling LSPs to deliver customer orders in large varying quantities and at inconvenient locations (e.g. city logistics).

4.4 Integrated framework of standardization and flexibility for transport operations

An integrated framework for flexibility and standardization on transport operations is reflected below. The framework combines the eventual process of transportation, loading, shipping and unloading, with the key elements of standardization and flexibility explained earlier. The framework helps create an overview of most relevant applications of standardization and flexibility (the lean philosophy) on the transport process in a real life setting.

Transportation Process		**Loading**	**Shipping**	**Unloading**
Standardization	Standard Procedure	-LIFO Queue -Planning of workforce (load handling equipment and multi skilled work groups) -Use of commoditized containers -Standard price for each m3 loaded -Preliminary Dock assignment	-Optimal route planning -Use of tachograph -Speed limiters -Standard price per m3/km -Use of navigation in truck -Tracking and tracing shipment information	-Inform client of ETA -Planning of workforce (load handling equipment and multi skilled work groups) on issue location -Use of commoditized containers -Standard price for each m3 unloaded -Preliminary Dock assignment
	Standard Time	-Shedule workforce on departure location for loading -Standard price for waiting time -Standardized tact time in vehicle's black box	-Standard rest interval for driver -Standard service interval for truck -Cost price based on Estimated driving time -Display estimated driving time on planning schedule	-Shedule workforce on issue location for unloading -Standard price for waiting time -Standardized tact time in vehicle's black box
Flexibility	Batch size = 1	-Cross docking -Use of multi skilled work force -Use of commoditized containers -(de)consolidation -Separate billing for each additional m3 freight loaded -Use of EDI for optimal synchronization	-Use of flexible trailers (e.g. flexdecks, side loaders, adjustable trailer lay-out) -Double shift workforce -Separate billing for each additional km driven -Premium pricing for rush transports, rebates for off peak transports -Use of Transport Management Systems (TMS) for optimal routings and rescheduling	-Use of on board load handling equipment (e.g. on board cranes, lift truck) -Specialized vehicles (e.g. Bandit, transferrable containers) -Use of commoditized containers -Separate billing for each additional m3 freight unloaded -Inform customer on ETA - Deployment of tracking and tracing systems

Figure 4.1

5. Discussion and recommendations

This final chapter addresses the discussion that is based on the findings of preliminary chapters in this thesis. The discussion is followed by some recommendations and suggestions for future research and logistics and operations management practice.

5.1 Discussion

In the preliminary chapter the application of standardization and flexibility on the transport process of a LSP was elaborated in closer detail. For practical reasons the scope was narrowed to road freight transport only. However generalization of the findings to other transport modalities is possible to a large extend. For example the deployment of intelligent information systems enabling synchronization within the supply chain is desirable and applicable to any transport process. Eventually perfection is the ultimate goal of every application of lean to a process. However for transportation this goal will never be satisfied totally. Because of restrictions in load capacities, problems with optimal consolidation of orders, congestion and a countless number of other external and intervening variables. However application of a large number of suggestions displayed in the integrated framework can help the LSPs transport process achieve an ever increasing level of leanness, using standardization and flexibility as key drivers.

5.2 Recommendations

Existing literature provides hardly any empirical research on the application of lean for LSPs in particular. However this thesis has shown that the characteristics of the lean philosophy are interesting and relevant for LSPs. It is therefore suggested to evaluate or execute an extended amount of case studies, measuring the level of leanness at LSPs in practice. This can eventually result in some interesting insights into the feasibility and status quo of the lean philosophy within the field of Logistic Service Providers.

Although this thesis did not encompass any field research in the business area of LSPs, the results of this literature review seem relevant for practice. As stated in the first chapter of this thesis, transport operations of LSPs are under demanding constraints. They face increasing operational costs, e.g. congestion, pollution and legislative pricing. In order to obtain a distinctive role in the market place, it is suggested to implement some of the characteristics of the lean philosophy in the LSPs operational strategy. New investment issues should therefore be aimed at state of the art information technologies, innovative and flexible transport systems and integration of different transport modes. Overall these operational changes and new investments can help create a profitable business model, offering a distinctive service base that meets current customer demands.

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