CHALMERS
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Operation Strategy for Contractors

What is beyond lean?

Master's thesis in Design and Construction Project Management

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ABSTRACT

All construction companies have an operation strategy that leads them to achieve their overall strategy or business strategy. However, an operation strategy is not always explicitly depicted within construction companies which results in poor implementation at the operational level. Operation strategies for construction companies constitutes important processes and functions that affect the progress of the construction company in both short and long term.

Lean construction has been known for more than two decades as an operation strategy that could help the contractors to save time and cost as much as possible. However, the application of lean construction into the operation strategy of the contractors is considered low compared to the application of the traditional operation strategy.

In this study, a literature review has been done in order to understand the current theoretical advancement regarding both the contractor operation strategy and lean construction. Four case studies of different contracting companies in Sweden have been studied also in order to investigate the current application of lean construction in the market and how to adjust lean construction implementation according every contractor's needs.

There are three ways discussed of implementing lean construction in this research, implementing lean fully, partially or trying to investigate a way to achieve lean construction goals without the need of implementing lean tools.

The researchers have found that the application of lean construction in Swedish market is mainly partial and the understanding of lean construction in the market is not as an operation strategy, instead, it is just a group of tools that help the contractors to achieve more with less time and waste.

Key words: operation strategy, lean construction, construction, contractor, building, just-in-time, production

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1 Introduction

Construction contractors should always look for a more productive and efficient operation strategy that leads them to produce more with less resources, thereby minimizing waste in resources in order to create better value for construction contractor.

According to Slack and Lewis (2010), Operations strategy is the total pattern of decisions for an organization that reflect and form the long-term capabilities of any operation within operation strategy as well as their contribution to organization's overall strategy. Therefore, operation strategy is an indispensable part of any organization as it implies how an organization deploys its resources to produce products and/or services to satisfy its intended customers and achieve its intended business objectives.

In construction sector, an operation strategy reflects how a construction contractor plans to produce constructions such as residential and commercial buildings that will extend current built environment and serve more people and needs. Construction companies have most often project-based organization which includes managers and workers who are in charge of execution of company's operation strategy that aims to deliver a quality output project. The operation method for this organization is crucial for the level of quality of the project and reflects the extent to which company's operations' resources interrelate and cooperate to attain business goals.

Lean construction arises in the last two decades as a construction operation strategy and have got a lot of attention by theorists to examine its ability to minimize time and waste on construction sites.

1.1 Background

Overall or business strategy for any construction company should have an efficient operation strategy that supports it and leads it to achieve its long-term objectives. And as mentioned before, Operations strategy is the set of decisions that shape long-term capabilities for operations which determines operations' contribution to achieve organizational objectives Slack and Lewis (2010).Therefore, formulating an efficient operation or production strategy will result in more benefits for both contractor and customer Lidelöw and Simu (2015).

Construction contractors with project-based organizations have most often faced the problem of establishing an efficient and productive operation strategy that can adopted and implemented as a standard operation method for all construction projects they undertake. Operation strategy is always affected and guided by number of aspects that affect its performance and validity in different contexts. According to literature in this area, it shows that poor planning, low awareness about company's resources actual capabilities, not intending a certain market segmentation and low or non-existing communication with bottom-line workers are most common affecting factors for the success of any operation strategy in any construction sector.

Since the emergence of Lean construction in construction sector by Koskela (1992) as a new production philosophy that leads to savings from waste minimization in resources and efforts which in turn will lead to higher value creation for construction contractor. Basically, Lean construction is an adaption of lean manufacturing principles to the end-to-end design and construction process which consists of operational research and practical development Gao and Low (2014).

Today, in the Swedish construction industry, Lean construction is an argumentative topic as an operation strategy for contractors. Full or partial implementation of Lean construction is the

main dispute among those who believe in it. On the other hand, there are other perspectives that regard the adoption of lean principles in construction wasn't always successful and inefficient in the construction industry. Consequently, Lean construction is only used in a few projects that tend to be simple or standardized.

1.2 Purpose

The purpose of this thesis is to get a closer insight of the operation strategy for Swedish construction contractors. Depending on the empirical findings from interviews conducted with Swedish construction contractors, the main principles and perspectives of what and how an operation strategy should be, will be concluded according to the context in Sweden. In addition, main differences between relevant theories mentioned on the theoretical part and empirical findings will be highlighted in order to show the variance in Swedish construction market.

Furthermore, this thesis figures out the extent of applying Lean construction as an operation strategy for construction contractors in Sweden. Different levels and methods of applying Lean construction among construction contractors in Sweden will be highlighted. Therefore, research questions relevant to Operation strategy and Lean construction application will be answered based on empirical findings in terms of construction contractors in Sweden.

1.3 Research Questions

The research is aiming to answer three different questions from this research:

1. What is an operation strategy for construction contractors in Sweden? And how does it support business strategy?
2. What perspectives should be included in operation strategy for construction contractors in Sweden? How should they be included?
3. How are the target contractors applying lean construction in their operation strategy?
4. How can lean construction goals be achieved without the need of implementing lean tools?

2 Research Methodology

2.1 Introduction

The method that will be used in this research is the qualitative research method. The goal is to try to gain an understanding of reasons, opinions and motivations related to the contractors' operation strategies and to compare it with the literature. It is also a try to investigate the currently used strategies and the companies' incentives to choose an operation strategy.

The researchers have made a literature review about the operation strategy for contractors. The literature review was depended mainly on Operations Strategy (Slack and Lewis, 2010). The review also has investigated on more literature.

The researchers also made a literature review about lean construction and a search of a lot of studies have been done in order to gain an understanding of the strategy theoretically. The study was mainly depended on the researches done by Glenn Ballard and the researches issued by The International Group for Lean Construction.

The focus of the research is mainly on the international literature context with the application of this literature into the Swedish contracting market and especially in the Västra Götaland county. Gathering information about contracting companies through a research within the published material and through interviews held with selected companies' staff will be the technique used in this research. The research contains 4 case studies and in each one of them the researchers have held an interview to get a better understanding for the construction market. The interviews will also focus on what lean construction means for those companies and how they are applying it within their work. The interviews are conducted with different strategic managers and site managers in different contracting companies which will give an overview and a deep insight of the current situation in the real-life work environment.

There are 4 case studies have been investigated as follows:

1. Case Study 1 is about a major Swedish contracting company that has presence also in Nordic countries and has an experience in different nature of projects. The researchers held an interview with an engineer who is working for the company. Interviewee 1 has a good academic background about lean construction, and she is now working to implement lean construction into the company she is working for.
2. Case Study 2 is about a small contracting company that are specialized in the residential projects mainly. The company's geographic location is in Gothenburg city with a little existence in Stockholm also. The researchers have held an interview with a project manager who is working for this company.
3. Case Study 3 is about a small contracting and real estate development company which is mainly specialized in executing commercial buildings and warehouses. The company is located north of Gothenburg city. The researchers have conducted an interview with two of the company's staff, a strategic manager and an architectural engineer.
4. Case Study 4 is about a major Swedish contracting company that has a big presence in the Nordic countries too. The company has an experience in different nature and sizes of projects. The researchers have held an interview with a project manager who is working for the company.

2.2 Selection of Case Studies

The case studies in the empirical part were selected based on their relevance to the main topic studied in this research and its compliance with criteria that has been drawn to cover as much understanding about the topic as possible.

The criteria for choosing the companies are as follows:

1. All the selected companies are members of the Lean Forum Bygg. It is a Swedish national industry organization that works to make more companies want to implement Lean thinking as a strategy by arranging workshops, seminars and training courses.
2. All of the chosen companies are in charge of executing integrated construction projects in Sweden generally and in the Västra Götaland region specifically, which indicates the importance of finding more efficient construction processes and operation strategy for those companies.
3. All the companies have a very good reputation in the Swedish construction market and are well-known companies which make them good examples in the market.

3 Literature Review

3.1 Operations Strategy

In this part, it will be answered the first research question that is what an operation strategy is according to relevant literature. In addition, it will be highlighted some different aspects of operation strategy in general and in construction context.

3.1.1 What is Operation Strategy?

Operations are simply defined as the function of integrating resources in order to transform inputs, that are tangible and intangible resources, to outputs that are products and/or services by which an organization seeks to satisfy its customers by creating value for them Slack and Lewis (2010).

An operation often consists of a number of activities or functions that are integrated to accomplish the main function of an operation, which is producing products or delivering services. In construction contractors' context, operations have many input processes that provide them with resources they need to produce products and services, such as logistics, raw materials, storage, financial and administrative operations. Moreover, operations also have many output operations if they are not delivering the outcome directly for the consumer, as they will be delivered to other customers who will in their role deliver products and services to their own customers, such as property development companies and housing companies.

Consequently, each operation has one or more input and output operations that support the operation itself to produce and deliver its services or products. Those input and input operations are called supply network as they represent the work cycle for an operation from the very first point until end user.

Operations management through the management of its resources, activities and networks at all levels will result in better execution of operation strategy which in turn will lead to more efficient use of resources and thus more efficient operations, higher quality of outcomes, less failures, better resilience as well as basement for further innovation in operations. Put simply, an operation within operations strategy consists of a number of activities that in turn have a number of allocated resources required to implement every activity and function according to Slack and Lewis (2010).

Functions or operations performance can be assessed through five main aspects or criteria that reflect the quality and efficiency of operations and activities as to how efficient they can contribute to the achievement of long-term organizational objectives and customer satisfaction. Those criteria are quality, speed, dependability, flexibility and cost Slack and Lewis (2010). To be clearer, percentage of work that conforms to agreed and determined specifications, lead-time for operation implementation and emergence of unforeseen delays due to poor planning, on-time delivery of outputs, ability to change in the execution phase as well as no need for extra monetary resources than those allocated during operation strategy planning phase.

Operation strategy according to Slack and Lewis (2010) is the total pattern of decisions which shape the long-term capabilities of any type of operations and their contribution to overall strategy, through the reconciliation of market requirements with operations resources .

That means, Operation strategy is the plan that explains how an organization does to be capable to achieve its long-term overall objectives and its purpose. It also relates to the allocation and utilization of resources within set of production processes to be able to achieve those awaited

objectives. When formulating an operation strategy, managers should translate the needs and demands of the surrounded market and environment into a comprehensive operation strategy that takes into consideration expected and beyond expected customers' needs and values Slack and Lewis (2010).Therefore, it is a conciliation between operations resources capabilities that construction contractors have and market requirements or clients demands.

According to Lidelöw and Simu (2015) Operation strategy is a long-term planning for the functions of operations included in production. In terms of construction industry, Lean construction is a popular example for operations strategy in this domain Koskela (1992). Operation strategy for construction contractors should balance between temporary engagement in construction projects and long-term survival Lidelöw and Simu (2015).

Moreover, strategy is the determination of long-term organizational objectives of an organization and the adopted course of action and allocation of resources fundamental for attaining these objectives Junnonen (1998). And according to Jonsson (2014) Production or operation strategy refers to the plan of an organization for exploiting certain resources to produce products that support business strategy.

In this thesis, Slack and Lewis's definition for operation strategy will be the main one, and it will be used as a base definition for analysis in further sections.

3.1.2 Operation Strategy and Business Strategy

Strategy in a simple definition, is a planned series of actions that lead to achieve something wanted or targeted. In organizations and enterprises, there should be a business strategy that forms the core of the business and its overall objectives. Put simply, a business strategy encompasses an organization's overall objectives as well as its purpose and essence as a business Slack and Lewis (2011). A business strategy includes and drives many sub-strategies such as marketing strategy, financial strategy and operations strategy that defines how an organization allocates its tangible and intangible resources for planned functions to produce its products or services in a strategic way in order to help the rest of strategies and the whole organization to achieve its goals Lidelöw and Simu (2015).

Consequently, operation strategy should be driven by organization's over all business strategy that directs the whole organization towards its overall objectives Slack and Lewis (2011). In terms of construction contractors , according to Lidelöw and Simu (2015), operations strategies should prioritize and focus on organization, planning, quality and human resources . Construction contractors, like organizations and firms, have to have a business strategy supported by operations strategy that leads their work towards it objectives Junnonen (1998).

Figure 1: Operations strategy & Business strategy relationship Lidelöw and Simu (2015)

As figure 1 simply implies the linkages between a Business strategy and Operation strategy according to Lidelöw and Simu (2015). Mangers at **Tactical level** base decisions concerning operations management on the idea of achieving business strategy objectives. However, the gap between Operational management at **Operational level** and operations management at **Tactical level** should be narrowed in order to get a cohesive and clear operation strategy for construction contractor.

Therefore, decisions at **Tactical level** should be based on both **Operational level** feedback and business strategy plans and objectives. That can also be achieved by narrowing the gap between business and operation strategy so that an operations strategy will integrate and support business strategy at permanent level and not only in temporary projects.

3.1.3 Operation Strategy Perspectives

A complete operation strategy for any type of business should include and align four aspects in order to make it more comprehensive. According to Slack and Lewis (2010), those four perspectives are Top down, Operations resources, Market requirements and Bottom up . Those aforementioned perspectives are simply displayed on the following figure,

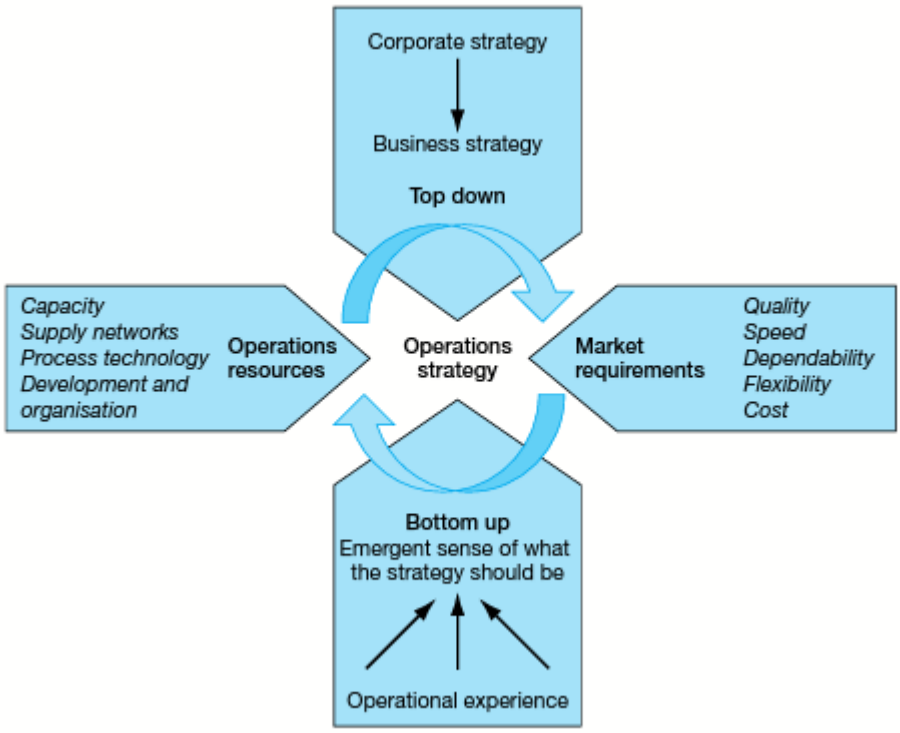

Figure 2: Operations strategy four perspectives Slack and Lewis (2011)

Each of those four perspectives has central impact on the strategic performance of operations and how they can be improved in order to achieve the best possible results and organizational goals.

In terms of **Top-down perspective**, decisions and objectives determined by the top of the organization should be reflected in the operations or functional strategy for each unit within the organization. That means, operations and activities within operations strategy should be designed to accomplish the objectives and purposes set by the top of organization. Therefore, top-level managers have a big contribution to formulate operations strategy for the organization, since it will be formulated according to the objectives determined by them and how they believe they will be able to compete and have superior value in the market over rivals Slack and Lewis (2010).

Bottom-up experience or operational experience refers to expertise of individuals responsible for implementing day-to-day functions. The operational experience and broader insight they have into daily production practices, give them significant importance in process of operation strategy formulation. Individual functions within a business has the real-life experience that is based on day-to-day experience and not only literature theories. Therefore, when formulating an operation strategy for the whole organization or business, it is recommended to incorporate both top-down and bottom-up perspectives. This incorporation will result in less risks and less negative impacts that affect the progress of work and achievement of organizational objectives. Emergent strategy is a good concept to depict the constant adapting and updating of the operation strategy to existing conditions and market demands. Thereby, operational experience form individuals and functions managers is crucial to the progress and competitivity for any business in whatever sector or industry Slack and Lewis (2011).

Market requirements perspective is the most important perspective to be taken into consideration when formulating an operation strategy. Organizations and enterprises are found to work for their customers service. Therefore, an organizations operations strategy should

reflect how the organization is intending to serve its customers and satisfy them by offering them superior products that in turn will give the organization superior competitive advantage over competitors and thus better market positioning. Thereby the strength of operation strategy can also be assessed by organizations customers. Customers assessment will be based on their satisfaction upon services and products provided by this organization Slack and Lewis (2011).

In connect with market requirements, there is another important and interconnected factor that is crucial in determining whether an organization is capable to compete with others or not, this factor is **Operations' resources**. Every organization should be fully familiar with the actual capabilities of its own resources and the acquired resources through their suppliers. Moreover, organizations should know the actual capabilities of the operations resources included in their operations strategy.

For example, in case of construction industry, more people demanding houses or apartments in urban areas. The contractors or building companies have diverse operations resources, so only a part of them will be able to implement projects in urban areas. On the other hand, some of them don't have the capability of resources to construct such projects. Resources and operations resources are the factors that decide who will be able and how. Consequently, it is recommended by Slack and Lewis (2010) to balance between operations resources and market requirements by targeting only the market segmentation to which an organization is capable to supply products or services for.

Good operations resources deployment will definitely result in more efficient production and less defects and mistakes, and that can be implemented through examining interaction between allocated operations' resources or resources of processes that constitute a complete operation with an operation strategy.

3.1.4 Operation Strategy Content

As mentioned before, one of the main tasks or functions of an operation strategy is the reconciliation between operations' allocated resources and market requirements or demands. Ability to deploy resources in a way that serves and leads to satisfy market requirements can be accomplished through well taken operation strategy decisions. Those strategic decisions, in terms of resource deployment, have certain strategic objectives. The interaction between the objectives of that operation strategy and decisions about deployed resources is regarded as the content of an operation strategy Slack and Lewis (2011).

According to Slack and Lewis (2011), there are four main decision areas in relation to operations or sub-processes within an operation strategy, those areas are crucial and decisive in operation strategy capability and validity to achieve expected and targeted final outputs. Those four areas are Operation capacity, supply network for operations, operations technology and operation organization and development. Capacity refers to distribution of organization's capabilities among operations and how they can be deployed and distributed to produce efficient results and to satisfy clients and market requirements. Supply network including procurement and logistics for an activity or operation is simply about the interconnection and role of every activity within the network of activities, that comprises the very first phase of acquiring input until to the very last delivery of output of an operation, it also concerns operations mapping through operations network. Supply network helps organization to make decisions about how many suppliers it should have to be able to work efficiently. Process technology is about the choice of technology included in production system for operations. Development and organization concerns sustainability and enhancement of operations to provide best results.

Slack and Lewis (2011) in their book, explains a simple tool that can be used by organization with different domains to help them in decision areas and operations objectives. This tool is called operation strategy matrix, organizations can use it to take decision according to their prioritized operations objectives. This tool makes it easier for organizations to understand their objectives and understand how those objectives can be achieved through strategic decision regarding the deployment of organizations resources. Construction contractors have different priorities, in relation to market requirements, other than those in manufacturing organizations Lidelöw and Simu (2015). According to Lidelöw and Simu (2015), construction contractors should focus on organisation, quality, human resources, and planning as decision areas for their operation strategies.

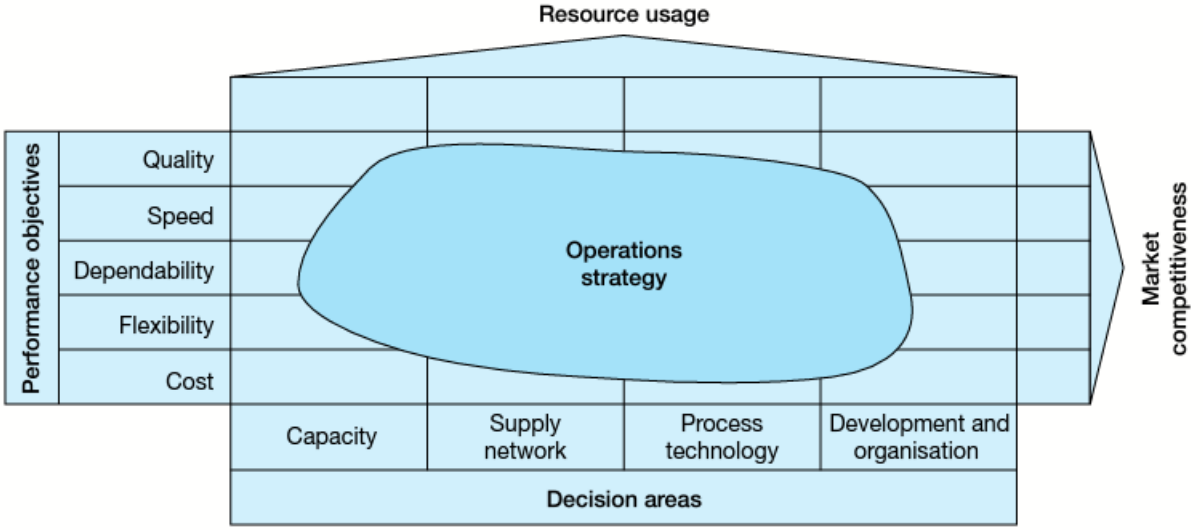

Figure 3: Operations strategy matrix Slack and Lewis (2011)

According to Junnonen (1998), the content of a strategy in general consists of objectives or organizational goals, allocation of organizational resources and normative character of strategy that reflects how an organization guides individual to achieve organizational goals. Based on that, an operation strategy should have operational objectives that satisfy market requirements and that can be achieved through efficient allocation of resources in favor of operations and organization.

3.1.5 Operation Strategy Process

It is about the approaches or methods used by organizations to formulate their operations strategy. In other words, the procedures or framework that an organization follow to formulate its operation strategy and it covers details about each stage of making decisions to create operations strategy content. It explains how an organization plans to satisfy market requirements by deploying its available resources. Operation strategy process consists of four phases that are formulation, implementation, monitoring and control respectively Slack and Lewis (2011). In case of construction contractors, operations strategies are rarely formulated in documents, but in fact, operation strategies are founded based on the prioritization of decisions in the four decision areas Lidelöw and Simu (2015). Formulation and implementation are main activities of strategy process Junnonen (1998).

Operation strategy formulation is the duty of strategic leaders in an enterprise or organization. Those leaders are more aware of surrounding competitive environment and how to evolve production and operations continuously Slack and Lewis (2010).

3.2 Lean Construction

3.2.1 History of Lean

Lean construction was considered one of the most effective operation strategies by a lot of researchers. It has gained a lot of attention by them in the last three decades looking into the application of its concepts into the construction sector. The concepts of lean brought from industry to construction by Koskela (1992) who tried to apply lean concepts in a sector full of peculiarities such as: immobile product, large scale projects and different way of handling logistics.

Started in the industry sector, a lot of arguments have arisen about the ability of an industry technique to be applied in the construction. This is because the differences between the construction and the industry sectors. These arguments criticize lean in construction as its goal is to make construction more like manufacturing (more standardized procedure) while Ballard et. al., (1998) argued that the goal of lean is to "describe the management of dynamic projects". Ballard et. al., (1998) also argued that lean's goal is not to standardize the product but the procedure.

Ballard et. al., (1998) also described the three main goals of implementing lean in the construction sector. Those three goals are seen by many researchers what distinguish lean from traditional project management (TPM). The first goal is to deliver a unique project according to the client needs and requirements. The second is to achieve that by delivering the project instantly and the last is delivering it with nothing in stores.

Looking into the history of lean in the researchers' views, the first authors which discussed lean in the construction sector between 1992 and 2000 focused on how the construction industry should adopt production principles and techniques. They also argued that there is a better way to manage construction projects. The most proposed model to manage the projects in this era was Koskela three principles model T-F-V (Table 1):

Subject of theory		Relevant theories
Project		Transformation Flow Value generation
Management	Planning	Management-as-planning Management-as-organizing
	Execution	Classical communication theory Language/action perspective
	Control	Thermostat model Scientific experimentation model

Figure 4: Koskela three principles model Biton et. al., (2013)

Koskela & Howell have declared that TPM is obsolete in 2004. They showed that TPM is lacking to the value-driven procedure which will make most projects fail to achieve the cost and time goals Biton et. al., (2013).

The theoretical development of lean according to Biton et. al., (2013) have been altered into a theory of the project (TFV) and a theory of management planning, executing and control. The role of this model is that it is able to direct the construction industry into delivering the projects with most value generated and to resolve conflicts in better and innovative way.

The journey of lean construction thinking hasn't reached its own destination according to Biton et. al., (2013). There a lot that has to be studied especially in: complexity, safety and collaboration and how all these factors may affect the final product.

It has been discussed that lean is improving the performance of the construction industry Egan (1998) by delivering the project with least wasted resources. Lean is also trying to develop projects by relationships, shared knowledge and common goals.

3.2.2 Principles of Lean

Herrala et. al., (2012) have discussed that the five principles of lean are as follows: (1) Specify value: specifying the value creation from a customer's perspective, according to Womack and Jones, (1996) the value is the critical starting point of lean thinking. (2) Identify the value stream: process chain identification. The process chain could be identified as a group of sequenced actions done by an entity to create a value for the customer. (3) Flow: the process of making the value is flowing. The objective is to make the process go from a value making step to another until the end. (4) Pull: concentration on customer's needs. (5) Perfection: trying to achieve the perfection point by concentrating on the customer needs.

However, Howell et. al., (1998) have discussed the principles of lean as follows: Stopping the Line, Pulling Product Forward, One-Piece Flow, Synchronize and Align, and Transparency. These techniques have been set in order to support the goal of implementing lean into construction.

Production according to lean varied from other operation strategies and presented a very different model. According to Howell et. al., (1998) production in lean is managed in a way that makes the actions produce unique value for the customer. Time and cost of the project are considered overall which make the time and cost for the whole project are more important than the time and cost for a single activity. Coordination also is taken into consideration in general by a central schedule and the details of the work is the role of the organization.

The main feature that distinguish lean thinking from other project management operation strategies according to Howell et. al., (1998) is that lean focuses on how the value is generated rather than how the single activity is managed. Lean thinking is looking into the project as a one big operation. However, some researchers argued that it is not easy to optimize a construction project because of the big scale and the sophisticated interaction between the parts. According to Howell et. al., (1998) if understood, lean can be applied into the construction "if not directly then in principle".

3.2.3 Lean Tools

Ballard et. al., (2002) there are a lot of tools and techniques have been developed in order to implement Lean Project Delivery System (LPDS). Production management according to lean consists of Work Structuring and Production Control.

Lean work structuring according to Ballard et. al., (2002) is a technique used for process design along with the product design and it has a capability to go in depth from the entire project into the details. Lean work structuring is distinguished from work breakdown structure functionally.

Last Planner® system is the production control technique of lean. It allowed the manager/s to follow the production procedure periodically (often weekly). Last planner® according to

Ballard et. al., (2002) consists of three components: lookahead planning, commitment planning and learning.

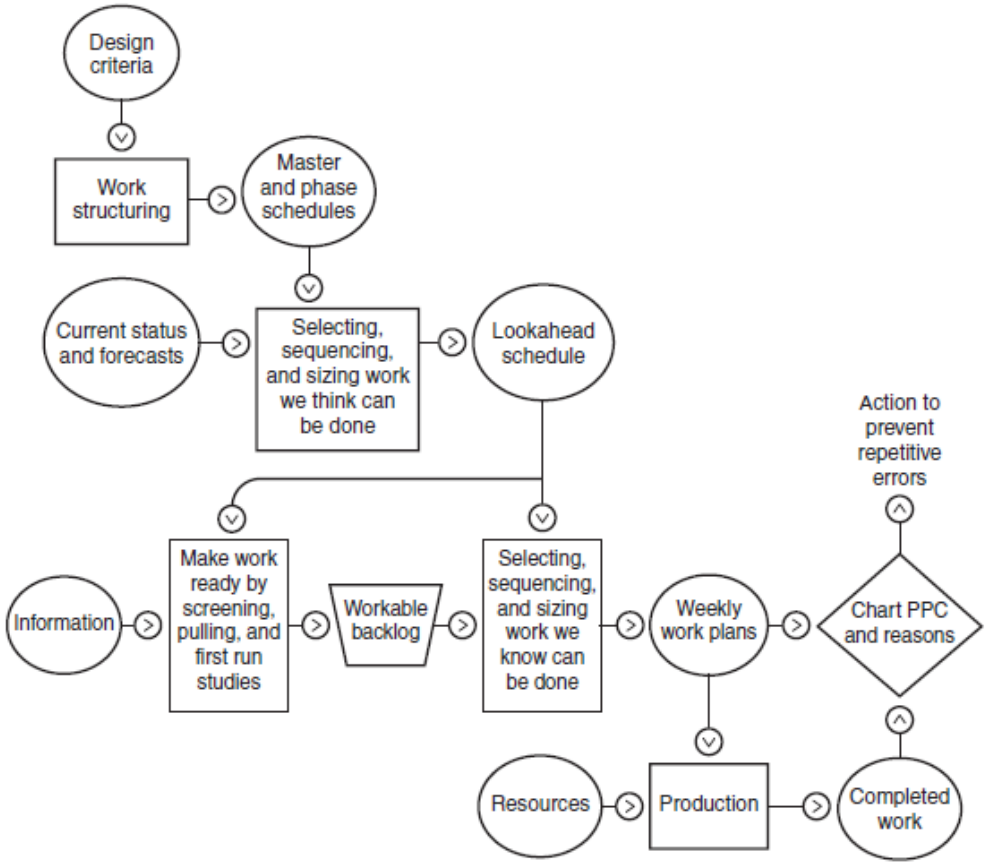

Figure 5: Last Planner® system of production control Ballard et. al., (2002)

The lookahead planning main function is to maintain the workflow and the rate. While the main function of the commitment planning is to make quality assignments of different stages of the project which will guarantee the quality of the procedure. Lastly, learning is a very important component of Last Planner® that will guarantee more enhanced decisions based on weekly analysis of the work executed in order to avoid pitfalls and enhance the overall procedure.

Howell et. al., (2017) have argued that lean projects are safer and more respectful for people. This safety is mainly psychologically, and it makes the atmosphere of the project more acceptable for everybody contributing into it. Lean thinking is encouraging the team to learn more by submitting their feedbacks or talking about the errors and the pitfalls. It is also encouraging them to ask more questions about the procedure.

It is also discussed by Howell et. al., (2017) that lean projects are safer than other projects in terms of the site safety. The suggested ways to improve the safety of a project suggested by Howell et. al., (2017) is better planning and higher agility.

Herrala et. al., (2012) have discussed that the way to understand lean affects your managing of a specific project entirely. They also discussed that there are three different understandings of lean as follows: eliminating waste, improving efficiency and implementing tools.

Herrala et. al., (2012) have argued that lean is often seen as a set of tools that could be implemented into any project with any operation strategy. Although, implementing lean tools

is seen in a good way to improve the production but the core of the lean as it is a set of thinking, planning and a complete operation strategy is not what most managers see it. Moreover, some of the interviewees by Herrala et. al., (2012) have seen lean as nothing new. They felt as their organizations are already working according to lean thinking.

Torp et. al., (2018) have discussed that the implementation of lean thinking into the construction sector should be from the top organizational management down to every division until it reaches the construction projects. This way of implementation will guarantee that lean achieving its goals and make more value. This way of implementing lean will make the organization continuously improving and will affect the future expansions of the organization in a positive way.

The paper written by Simonsen et. al., (2014) shows that lean construction is an enduring concept that can fit in different context and can also develop. However, Simonsen et. al., (2014) have suggested some solutions to overcome the challenges that are facing lean construction. Some of the suggestions include: to have and keep a balance between the supply and the demand in the market and to ensure the continuous developing of lean construction concept.

4 Empirical Findings

The empirical findings are based on the results of the four interviews that were conducted with professionals who work within construction industry and have different perspectives about 'lean construction' implementation as an operation strategy, and how it can be developed to suit more different contexts. The results will be highlighted according to the questions were posed to the interviewees and will be presented as case studies for each construction company.

4.1 Case Study 1

Case Study 1 is about a major Swedish contracting company that has presence also in Nordic countries and has an experience in different nature of projects. According to company's website, the researchers could find a good description about the company and its main activities. This company is a civil engineering and infrastructure construction contractor in the Nordic region. The company implements various types of construction projects, such as developing and building residential and commercial properties, constructing public buildings, roads, industrial facilities, civil engineering structures and other types of infrastructure projects. The company can also supply its customers with raw materials as input materials for construction, such as including aggregates and asphalt since the company is also active in paving processes and road services.

Main clients of this company are government, municipalities, housing companies and financial investors. That results in many strengths that boost this company position in the Swedish construction market. The main strength aspects for this company are the strong market presence, order backlog and constant focus on Research and Development. Therefore, this company has many causes for concern that raises the need for continuous improvements on operating performance, which in turn leads to gain financial profits as well as to safety most of issues related to both internal and external customers.

Based on a study concerned with this company as main case study, operating performance at this company was seen to be poor by company's internal customers for some years ago. Even though the company is seen as a good investment for shareholders. Based on that, the company had a concern that this poor operating performance will result later in the company loses investors and clients confidence, which in turn leads the company to loss its position in the market as a major construction contractor for huge projects in Sweden. Huge revenues for this company do not mean big net profit, and according to this study that can be referred to poor operations that should be updated to be more efficient and productive rather than just consumptive of company's input of resources.

According to the company's website, the company has developed its own working concept in order to implement lean in the design phase. The concept is based on the fact that during one, or several days of the week, everyone involved in the planning in the same room gather, which creates the prerequisite for reducing waiting time for answers, discussing problems and working proactively with problem solving. Consequently, waste reduction for effort and time of workers that also results in better outputs that are compliant with intended plans and objectives. The company has been looking for a more efficient operation strategy that will lead to waste minimization and more value for both internal and external customers. The company has established, with help of its experienced managers within Lean Construction, a new variant that is called Porjektstudio or Big Room concept which is a Lean tool. The concept Projektstudio is about gathering designers and consultants during the early and late design. It

consists of a structured work method that involves working with a number of visual tools such as BIM and pull planning.

Based on a research conducted about this company, the company have had the belief that it works within mature markets that are characterized by high competition. Therefore, being able to make more profitable work is basic. One of the company's main aspirations is to be the first choice for Swedish customers as to construction projects.

As a result of that, the company is trying to attain that aspiration by boosting current customers relations and also establishing new ones by delivering the right product, with the right quality, on time and for a competing price. In order to achieve that, the ability to identify cost reduction are critical, and emphasizes the importance of being able to realize synergies across the business areas and follow up on projects to understand where improvements can be made. As a result of that, the need for Lean construction has emerged for this company which has already started by finding the Big Room concept that is about applying Lean in the design phase of project.

Based on an article published on the company website, the company has the belief of the great impact that everyone is working towards common goals. The company sees big benefits in gathering all the skills that can come up with the best results through discussions at the early stage of any construction project, which means design phase. By working collaboratively within the project, all participating parts seek the best of the project, rather than their own interests. And this the main goal of the Big Room concept.

According to the published material about the company, the company is a part of Lean Building Forum which is a Swedish industry organization that consists a group of companies who are trying to implement more of lean construction into their operation strategy. The company is trying also to focus on applying lean into the design phase as it is one of the earliest stages of any project which make the updates and changes in such phase many.

The company also is claiming that the construction market has begun to tip over to turnkey projects and collaborative projects, which has made the using of their working concept that is based on the shared knowledge more optimal and better for such projects.

Moreover, the company is claiming that a key to obtaining the full effect of the working concept is that the client also participates actively and is committed to making decisions. The concept is a way of working that will enable issues to be solved faster, create higher involvement and that more decisions are made, which makes the client's participation crucial in order to get full effect. The company has a program to quickly train staff in using this concept.

The company have been nominated for couple of lean related prizes among the contractors and have a very good reputation about implementing lean.

However, nor the company's website or any other public material that the researchers have investigated have published anything else about lean implementation in this company except in the design phase.

The researchers held an interview with an engineer who is working for the company. Interviewee 1 has a good academic background about lean construction, and she is now working to implement lean construction into the company she is working for.

For Interviewee 1, an operation strategy is a big topic that depends on whether it is a corporate or individual perspective. It is a framework that directs the activities of the whole corporate. This framework is based on what the corporate or organization are intending to own and to achieve. Thereby, it is a result of what consequences an organization are really looking to

accomplish. Those consequences can be financial, societal, environmental and more. An operation strategy implies what an organization really wants and how it intends to achieve that.

In Interviewee 1 point of view, an organization or corporate within construction industry should be looking for objectives beyond financial returns. For example, sustainable objectives such as sustainable buildings with low profit for construction companies, societal objectives such as residential houses for low- or limited-income people in urban areas. Consequently, an operation strategy should be formulated to fill a gap in the industry that is not yet fulfilled in the market. Focusing on performance objectives, for example quality and dependability, is the ideal approach that leads organizations to build trust with customers and thus make profit.

Moreover, the set of actions that compromise an organization operation strategy will enable it to lead intended market segmentation where it competes, those actions should result in trust and reliability between organization and customer which will make easier for organization to achieve its overall objectives. Put simply, the more value is created for customers the better results an organization will achieve. Traditional operation strategies that only focus on monetary objectives are no longer valid for construction companies if they want to compete with rivals in the market.

The company's various research projects are carried out in collaboration with universities in Sweden in order to work constantly with organization and development of processes and thereby operation strategy. These researches focus on sustainability, energy efficiency, industrialized and virtual construction, civil engineering, building technology. In addition, these researches aim to improve various construction methods and collaborative processes and reducing consumption of energy and other tangible as well as intangible outputs.

For Interviewee 1, As regards the relation between business and operation strategy, Interviewee 1 explained that a business strategy focusing only on economic goals are doing that in order to survive in the market and to be able to operate and get financial resources. However, in Interviewee 1 point of view, the overall business strategy objectives should be determined based on why the organization is in the market and what it looks forward to being in the future. By answering those question, a business strategy determines how to achieve the consequences of the question by mapping operations and allocating resources for those operations. Thereby, operation strategy will be driven and intended to accomplish the objectives determined by the overall business strategy. In the company where Interviewee 1 works, business strategy drives operation strategy and have only economical profit as business strategy objective. On the other hand, in their point of view, that is a short-term way of directing an organization.

As a result of that, she believes that a business strategy objective can be a combination between financial returns with other encouraging objectives for the customers. By filling out the gap in the market that customers need and miss an organization will be able to make profits and have ideal goals for the targeted customers by producing the best possible products or services.

For Interviewee 1, When it comes to the perspectives that should be included in operation strategy, she explained how a construction company should deal and include those perspectives. In regards with **market requirements** perspective, a construction company should fill a gap in society that will encourage customers to buy company's products, for instance, building environmental buildings, so market unfulfilled requirements should be the actual objectives for operation strategy in order to be effective and productive for the company. Those requirements represent what it is not yet offered for society that will help both society and construction company to grow and develop.

With respect to the Operational experience **(bottom-up)** by workers at construction site, she believes that directors at the top of hierarchy need to understand what the actual problems are for the workers at the bottom of hierarchy. This understanding leads to benefit from them and their day-to-day emerging experience. Top directors need also to know the obstacles that workers face in their operations that prevent them to succeed in managing their tasks and provide the top directors with constructive information that can be used for further development in favor of both construction company and community. There also needs to be trustworthy communication techniques that enables bottom-line workers to tell truthful feedback and information about the problems they face at construction site.

For **operations resources**, She also emphasizes that truthful communication environment will also help top directors to understand the capabilities of operations resources and how the resources can be utilized, harnessed and developed. Real changes come from real understanding of bottom-line; therefore, site managers and Middle managers have a great role to help their superiors to understand the problems and real difficulties that really happen in bottom-line before deciding any changes rather than basing decisions on explicit symptoms. All that will help top directors to successfully fill the gap in the market and assure that they have a real competitive advantage over other competitors in the market in terms of results of operation strategy.

Focusing on Research and Design is seen to be one of the main strengths of this company that helps them to find a more efficient operation strategy that will help the company to satisfy its customers and shareholders at the same time. The company invests in new technology to develop energy-efficient products and solutions. It carries out research in collaboration with customers, suppliers and universities. By doing that, the company takes into consideration **Operation resources** and **Market requirements** perspectives in order to continuously find better solutions and offers.

When it comes to **Top-down** perspective, it is critical for the success of business; therefore, directors of construction companies should have a complete understanding about the other perspectives included and to be innovative in order to be able to lead and take the right decisions, otherwise the whole company will be at risk in short-term.

For Interviewee 1, operation strategy process in terms of Lean thinking have four -level sequential process. This four-level process is **PDCA cycle**, which means plan, do, check and act respectively. Operation strategy process starts with planning of operations and allocation of resources, then doing or execution of operation strategy, thereafter, checking that the intended results are achieved or not, and finally acting on the results of checking and making improvements.

The adjustments in the everyday operations have to support the company's strategic goals, so there is a deep analysis and measurement of the current processes conducted prior to the first implementation of them in order to start producing intended outputs of each operation.

The main goal and looking forward element is to attain the best possible operation strategy that helps the company to both achieve its strategic goals and also satisfy end-users by creating better value for them that competitors in the market cannot offer. This implies that the company seeks more efficient production processes that lead to better output and higher competitive advantage in the market.

Interviewee 1 has stated according to her experience as an engineer in a major Swedish contracting company that the most important thing distinguishing lean construction from any other operation strategy that it gives a deep understanding of the client needs and requirements more than any other operation strategy. The other important point is that lean is focusing more

and more about creating more value out of process and the final product all together which makes it special more than other strategies. Lean construction also focuses on producing what it is already requested by the customer which meant there is no probability for over or lack in producing.

According to her also, it is distinguishable that lean has a frequent feedback that help to enhance what it is right in the process and to revise what is wrong. She also stated that lean relies on three principles: value, transformation and workflow and lean is always trying to balance between those three. If one of those principals is not achieved, it will be considered that lean construction is not fully implemented.

Interviewee 1 has stated the main goal of implementing lean construction as to satisfy the customer with the most value that can be made. This value also according to her has to be made along with the presence of the three -previous mentioned- principals which are: value, transformation and workflow.

Interviewee 1 has stated that the development of lean construction enhanced it a lot especially while implementing lean in major and big contracting companies. This implementation helped to test the ability of the strategy in a professional context which lead to a success in the operation strategy for those companies. However, this success in implementing lean construction was not on the international level but in some parts of the world e.g. California, Florida, Australia and Scandinavia and some countries in South America.

Interviewee 1 also stated that the theories of lean construction regarding the production now is well-developed and the real development of lean now is about the implementation by the contracting companies. However, the theoretical development will not stop because there is always an opportunity to add more to the idea and it is already growing in the theoretical context.

Interviewee 1 thinks that the partial implementation of lean construction is effective and using of some lean construction tools will help to enhance the overall work. She also thinks that the implementation of lean construction is a journey which will not happen on short time and that means the partial implementation of lean is not a choice but a must. However, it is better for her to see a lean construction company implementing it from top to bottom and vice versa but this is not going to happen by the night, and it needs a lot of time to be achieved. According to her, lean construction is seen today as group of tools and not as a whole operation strategy.

However, she describes the implementation of lean in the company she is working for as weak and the company management doesn't want to implement more lean because they think that it will not add market value for them.

According to Interviewee 1, one of the difficulties for implementing lean in construction that it is contradicting with the principle of making quick profit which most of the contracting companies are aiming for. There for, lean construction needs a long-time view to understand it and implement it in order to get the most value out of it. To her, lean construction is considered as investment in the future.

The other difficulty -according to her- is when the top management of a firm doesn't understand the importance of implementing lean in construction.

4.2 Case Study 2

Case Study 2 is about a small contracting and real-estate company that are specialized in the residential projects mainly. The company's geographic location is in Gothenburg city with a little existence in Stockholm also.

The company is specialized in residential building and their business concept is based on turnkey projects from idea to finished projects. According to their website, the company is trying to include their customers in all stages of the project and including them in the decision-making process also. The company is also claiming that it is working toward the best value for the customers always and this is a goal for them.

Since autumn 2015 the company have been established in Stockholm and since spring 2018 also in Malmö. Company's main goal is to preserve the traditional builder role in a modern vintage, where professional skill, responsibility, quality and businessman ship are important words and well-utilized.

The construction business at this company conducts construction on a total contract where they, together with customers, jointly strive to design and build as rationally, environmentally friendly and cost-effective as possible. The majority of company's projects are carried out on behalf of external customers.

Based on the information published on company's website, the company has a big belief that in combination with great responsiveness to the customer's needs, competent employees, modern applied business model and strong financial position, the company has grown to become one of the major players in the Gothenburg region and on its way to grow in the other cities where it has low presence and not strong market position.

According to the CEO of the company, the top management there has the belief that together with customers, partners and employees, they realize ideas for completed projects. The company implement that with knowledge, commitment and businessman ship in combination with the company's financial strength.

The company has three branches of business that are project development, construction and real estate. All of these business branches are based on idea and belief of a holistic approach where the customer is always at the center. That implies the extent to which the company emphasize the importance of actors involvement with customer in order to be able to deliver to the most possible output that will be for the most the same of demanded output by customer.

Early involvement and collaboration with customer can be seen as lean way with respect to the main aim of conducting it in this company. However, they see it as unique way that differ from a project to other based on the width of customer contribution to input at each phase of construction.

This involvement also comprises construction contractor, subcontractors and customer depending on the issue, phase of construction and the influential actors related to every issue that needs to be discussed. For instance, At the real estate company, they manage their own properties that contain housing and commercial premises. The company work with its tenants to create good and safe living environments and well-adapted premises for each business.

Moreover, at this company, as different from the rest on cases studied on this research, they don't apply lean construction as an operation strategy for construction processes. However, they have developed their own operation strategy that is almost have the same principles of lean construction, such as waste reduction as well as better value creation for customer.

As a result of that, the company are drawing their operation strategy using Last Planner® and that this lean tool is saving cost and time for them.

The researchers have held an interview with a project manager who is working for this company in order to investigate more about implementing lean construction in this company.

For Interviewee 2, operation strategy is a quite big system that includes a set of small systems for each part of the production plan. In relation to the company where Interviewee 2 works, they have developed their own system for planning operations. There are a set of checklists for each phase of construction, or operation that consists of set of relevant activities, until the delivery of project. Those checklists are for production, quality, work environment as well as collaboration and communication at construction site.

He also informed that production phase is a highly critical and important part that requires quite good planning. Therefore, he believes that site managers need to make a considerable effort and to allocate enough time in order to formulate a good operation strategy that will guide all the activities at construction site.

According to him, operation strategy should be adapted according to the conditions and requirements of project. Operation strategy should also make it explicit of who do what and how, so it is also an organizing tool for the roles and resources allocation at construction project.

For Interviewee 2, As regards business strategy drives operation strategy, he believes that the main objective of formulating an operation strategy should be meeting clients' expectations and fulfilling clients' needs. Those should be the main drivers for operation strategy that will enable the company to make profit. Therefore, before they start formulating an operation strategy for a construction project, they meet the customer several times in order to understand client's requirements and make it explicit and clear about how they can attain that by creating adapted operation strategy.

In addition, he believes that workers should feel safe and satisfied in their work, so it is the framework by which both internal and external customers will be satisfied when implementing it. He also emphasizes that having satisfied workers will lead to positive results in the execution of the project.

For Interviewee 2, in their operation strategy, they have a good balance and engagement of the four perspectives that should be included in operation strategy according to Slack and Lewis (2011). **Top-down perspective** is included by giving the main guidelines that site managers and project managers should follow in their execution.

And regarding **market requirements**, they have several meetings with client before formulating the operation strategy that will be followed during production. The company has main measurements and milestones that they agree about with clients before starting the project, for instance time plan, quality, as well as environment.

When it comes to **bottom-line perspective** involvement in formulating operation strategy, he believes that they need to develop continuously and to develop their operations as well. They believe that can be done by good participation and contribution of workers at construction site who work with day-to -day operations rather than planning.

That will lead them to find new ways to develop and learn from their mistakes in order to enhance their overall performance and reach a better utilization of company's tangible and

intangible resources. In relation to that, they organize regular meetings with sub-contractors in order to benefit from their feedback about the project and to discuss possible developments.

For Interviewee 2, he agrees completely with the advantage of Last Planner® as a good logic to collaboratively formulate operation strategy. As to company's own operation strategy, it is a result of constant development by both site managers and projects managers, it started with guidelines from the top of the company before being available for site managers and project managers to modify it according to their planning and possible improvements. One of the main goals of their operation strategy is zero mistakes as tenants move in, that implies the importance of being rigorous when formulating an operation strategy. Thus, formulation, implement, monitoring and control is the process to formulate an operation strategy there and it is done collaboratively between main contractor and sub-contractors.

Interviewee 2 is a project manager in a small housing contracting company in western Sweden. When asked about how he understands lean he stated that it is just in-time delivery. However, this understanding supports the Interviewee 1 view as lean is seen today as group of tools not an operation strategy. Interviewee 2 stated that he is not much experienced with lean construction, but this is what he knows about lean only.

Interviewee 2 has mentioned that while executing the project the company tries to involve every sub-contractor in the decision-making process in order to understand their expectations, limitations and their way of work. However, this implementation is done only on the upper level staff of every sub-contractor and the engagement of the lower level staff is mostly not happening and he explained that every upper staff has the responsibility to deliver the message from the staff under him.

Interviewee 2 stated that the most important thing about lean is to deliver an efficient product in an efficient process to save money and time during the executing of a project as much as possible and when asked about the value for the customer he stated that the customers' needs are already defined before the start of the project and there is no meaning of making more value for the customer because the customer is not involved much in the process of executing the project.

Interviewee 2 stated that the partial implementation of lean construction could be a good solution for the different conditions of projects and that applying some tools of lean in some projects will not be applicable in other projects. He also stated that he is working already with some lean tools in some projects that he is managing including Last Planner®.

Interviewee 2 prefer not to have inventory on his construction sites because the inventory costs money and this will contradict the principal of executing the project with the lowest cost, but it is not always applicable because the project manager have to store some materials sometimes which means that this is a partial implementation of lean in construction.

While Interviewee 2 sees lean as just in-time delivery he thinks that one of the most common difficulties is when the delays happen and affect the whole project timeline. He thinks that any emergency case could happen while delivery of any material or even while executing the project will consume the time of the project and will delay the whole project. However, interviewee 2 here suggest that the project schedule is fixed and can't be adjusted but one of the most important features of lean is that the project scheduling is on short-time basis and can be adjusted frequently.

The other difficulty mentioned by interviewee 2 is that every project has its own conditions which will affect the application of lean. The different conditions will lead to different application method of lean construction.

4.3 Case Study 3

Case Study 3 is about a small contracting and real estate development company which is mainly specialized in executing commercial buildings and warehouses. The company is located north of Gothenburg city.

This company is one of the few companies that are trying to achieve fully lean construction implementation in their operation strategy. They claim that lean is their only way of executing their projects and that lean is saving them a lot of time and money.

In the beginning, the company does not have enough budget to build new buildings in order to be hired out. Therefore, it was necessary for the company to benefit as much as possible from the monetary resources they own.

Lean construction work started there at 2009, where all employees there attended lectures about lean construction application. Top management have the belief that lean construction should be implemented in their operation strategy and they worked in order to train all staff to understand what lean construction really is about. Therefore, the company doesn't hire anybody today unless he has a very good knowledge about lean and this is mentioned clearly in their website.

In 2012, the company was awarded to the Lean Builder of the year prize in Sweden. That means and indicates the big effort of both top-management and workers to apply Lean construction fully and correctly in a way that leads them to be the best in Lean construction application over the whole of Sweden. The prize was also a big incentive for the whole company to keep working with Lean construction as an operation strategy at all parts of a project, it means from the design to the delivery of the project, as well as to move forward in more areas with different Lean tools.

A strong Lean culture has enabled this company as a smaller player to take on large assignments. They have gone from project focus to process focus with continuous improvements along the way and commitment throughout the business, from projector to performer. With simple means and methods, and by living as you learn, the company have made the whole staff feel involved and proud in their work which in turn raises their internal incentive to be more creative and helpful in implementing their work and day-to-day work tasks.

The management's insight and personal commitment have permeated the company and at the same time influenced and involved subcontractors. Through increased standardization, better experience feedback and more production-adapted design, the company can point to a stable profit margin and a sharp reduction in errors. This company is a very good example that has proven that Lean works in the construction industry leads to gaining more satisfied customers, more satisfied employees and higher profits.

According to the top management on this company, they believe that employees' participation and commitment, contractor and sub-contractors' early involvement and customers' involvement in the early design phase are key factors in order to be able to obtain the most possible advantage of their participation that leads to many types of waste reduction. One of them is time waste reduction that can be utilized to implement other functions that benefit all actors involved.

For them, the lean work is moving forward, and they are working both more structured and wider today. At the same time, they are careful to maintain the core of early and wide

participation and continuous improvement for both processes and operations resources that contribute to waste reduction and value creation for both company and end-user.

The company's main business idea is how to benefit from customer's money in order to create better value for both the company and the customer. The company started a work system where they and their co-operators get more knowledge about lean construction. The goal was not only to learn about lean but also to convey it for the others. All companies' employees and the co-operators' employees should be engaged in this idea and have the same beliefs about lean construction and its benefits.

The company is working on standardizing its operations and learning from previous problems and its solutions in order to save time and avoid searching for the same thing many times which is time-consuming.

The company and its upper management believe that applying lean construction in their projects will benefit all actors. The company will be more profitable, the employees will get more secured work and the customers will get better properties with less costs. The company won lean prize in Sweden one time in the last decade.

The researchers have conducted an interview with two of the company's staff, a strategic manager and an architectural engineer who explain how they are implementing lean fully in their company.

For Interviewees 3, an operation strategy is a framework or organization of activities that will lead to fulfil customer specified needs and at the same time help the company to make profit as a property development company. Put simply, it is how to employ and allocate company's resources to create value for customer and make money for the company. According to Interviewees 3 about their company, planning of construction activities is divided into milestones where each phase of production or construction is planned separately depending firstly on the time of project delivery and move in for customer.

For Interviewees 3, The business strategy of this company is to build customized commercial buildings, based on the type of industry the customer will drive at the building or property, to be rented out for long periods for commercial companies in Sweden. However, this fulfilment of customer needs will also result in financial benefits for the property development company in form of monthly rents. Based on that, company's business strategy drives its operation strategy in a beneficial way for all actors engaged in the transaction, it means both company and customer. Company slogan is to keep it simple and keep it easy, which implies that company will not let customer pay for something they do not need, and this is according to them can be achieved through following Lean construction, waste minimization and flexibility.

For Interviewees 3, adopting lean construction as an operation strategy should be adapted to the perspectives of market, bottom-up, top-bottom and operation resources. For example, they construct what the customer really needs according to customers business, however, it will be produced in lean principles. They believe that long term relationships with customers and good reputation are crucial for this company to ensure having the competitive advantage over other rivals in the market that offer same products and services, as well as boost company's market positioning. Flexibility is also a key factor that help them to create more value for tenants as company offer the service to rent out adapted commercial properties according to customer needs and also facility management included services that will make the customer prefer them.

As regards **bottom-up perspective**, the company arrange regular meetings in a weekly basis where mangers convey their subordinates' perspectives and problems. For instance, workers at construction site have an improvement board where they put their suggestions for problem

solving and possible improvements in activities and equipment used at construction site that can result in more efficient work and better outcome. Thereafter, managers of different parts of work are in charge of bringing up those perspectives to their superiors during arranged meetings in order to work further with and examine the efficiency and feasibility of each suggestion for improvement before approving it and enforce new standards by the top of organization.

At the end of every project, the company arranges a big meeting where all its workers and even subcontractors with their workers are called to this meeting to discuss possible improvements for further projects and to create the motivation of team work between workers and managers to be compatible and to collaborate as one team even with subcontractors. That also helps them to figure out **operations resources** and how to improve it for better utilization of resources.

For **top-bottom perspective**, they believe that even their subcontractors should have the belief in and understanding of Lean construction and its principles. Subcontractors should also be interested in applying Lean in their activities. That will make it smoother to collaborate with subcontractors when having the same thoughts and beliefs at the same working place which will enhance work environment.

Based on that, there is an active role for subcontractors as to the execution of operation strategy. Therefore, they can be invited at specific stage of the formulation of operation strategy or operation strategy process, which in turn will result in better understanding for tasks and main goals of implementing specific operation strategy.

As a method for improving operation strategy, this company uses 5s approach that help them to create and maintain work place by starting firstly with Sort which is eliminating all unnecessary activities and tools, secondly Set in in order which is organization of activities and tools in order to promote efficient workflow, thirdly Shine which is clean the work area and make it tidy, fourthly Standardize that means to set standards and enforce them at work place, and finally Sustain which is review and maintain the new way to operate. In addition, A3 tool is a problem-solving tool that is also used by this company to figure out how to solve problems in an efficient way by finding the main causes for unwanted effects and eliminate it.

For Interviewees 3, they follow the Lean construction way as operation strategy process that is **PDCA** which indicates plan, do, check and act. For them, they try to have a standardized operation strategy since they are only specialized in commercial buildings, however they keep updating their operation strategy constantly in order to get better outcome and more lean construction and waste minimization in favour of customer value creation.

Adopting lean construction as an operation strategy for this company means using material and equipment that may cost more but will give both company and customer more sustainable and quality results. Thus, waste minimization is not only for the production phase but also includes long-term consequences under the construction project occupancy period by tenants, so it is basically to produce smarter.

Interviewees 3 have stated he and the company he is working in have worked on their own version of lean. He stated that he and his companions have made some configurations within the context of lean in order to fit into their field of business. He also stated that the company have started to adapt lean construction since 2010 but the company have been founded since about 4 decades with a lot of ideas that was later defined as lean. He stated think that even the company started implementing lean construction since 2010 but implementing lean in construction is a long way and it will take a lot of time and efforts in order to achieve the full implementation of it.

Interviewees 3 thinks that if a company decided to implement lean construction in their strategy the whole company should adapt it and not only some divisions. He clarified that if only some parts of an organization implement lean construction it will hinder the workflow and make it more complicated.

He also stated that when a company start to implement lean construction in their work it will be more like culture or lifestyle, the worker will think within lean context even in his daily life and not only in work.The Interviewees 3 also confirm that one important part of lean is that the company has to make every person's suggestions and problems heard and considered. He thinks that every employee is specialized in a small part of the work and he is the only expert in this part. Therefore, his voice has to be heard in order to enhance the quality of the overall project.

Interviewees 3 also mentioned that the company is trying to make every one's voice is heard by the management. He also described that a lot of tools and procedures are set in order to guarantee that every staff's comment and suggestion are heard by everybody including the top management. This also applies on the sub-contractors that the company is working with also. The company has long-term relations with sub-contractors that could be described as strategic partnership and that the main contractor is working with those sub-contractors as partners not competitors or only hired sub-contractors. Sharing the knowledge between the different parties and entities according to him also is done in the same way with the staff. Everyone's voice has to be heard and listened to which will make the overall process updates in a regular basis and on practical foundations as he described.

One of the benefits of implementing lean in construction according to Interviewees 3 is that it helps the company and the personnel to "do it right" without the need of re-do it again every time there is a new project. There is a lot of repetition in every new project in lean, but it will not make you plan everything from the beginning every time.

Interviewees 3 also mentioned that lean tools such as: PDCA (plan, do, check, act), 5S (sort, set in order, shine, standardize, sustain) and A3 are good examples of why somebody has to implement lean in construction because those tools and others will help the business and personnel always to produce more and to waste less.

Interviewees 3 thinks that the partial implementation of lean is not a solution. Implementing some tools of lean only and discarding the strategy itself will hinder the overall work and will make it more difficult and slower according to him. He thinks that either you draw your operation strategy according to lean or don't try to implement anything of it. Implementing lean in construction according to Interviewees 3 is like going up using stairs, it is a process that has to be taken step by step.

They also think that the standardization is the best theme of the projects that can be delivered using lean as an operation strategy. When asked about more complicated and distinctive projects such as hospitals, he agreed that lean construction could not be applied always but the nature of the projects that are executed by his company fit the lean construction context.

Interviewees 3 have stated that the most important difficulty while implementing lean that everybody in the organization should understand and apply lean in the work. Which makes it difficult for the organizations whose are going to implement lean. They have either to teach everybody how to work lean or to change your staff in order to assure that they are understanding what lean is and they can work with it with no problems.

Another difficulty mentioned by Interviewees 3 which is the time needed to implement lean into your strategy. Implementing lean in construction usually takes a lot of time and resources but you will get good results out of it in the end.

4.4 Case Study 4

Case Study 4 is about a major Swedish contracting company that has a big presence in the Nordic countries too. The company has an experience in different nature and sizes of projects.

The company have hired two senior strategic managers with a wide academic background about lean construction in order to help modifying their operation strategy and make it more compatible with lean goals and tools. The company also was candidate for a lean prize in Sweden couple of years ago for their efforts in implementing lean.

The company have developed their own work model that is lean-inspired. They claim that this model has helped them to have better team spirit and better time keeping on the construction site. However, according to the company website, this work model have been implemented only in 10 projects around the country which is a very low number compared to the number of the projects that the company is working on especially that it is one of the biggest contractors in Sweden and have a variety of nature of projects also.

The work model that has been developed by the company is based, among other things, on specific meeting series both before project start and during the project. In this way, the company aims to give a full understanding for different parties of a project which leads to discussing all the issues related to the project and the company will guarantee that nothing is hidden "under the carpet".

The model has created a much higher level of engagement among the employees and the company does not have any colliding activities on the construction site anymore because everyone can see and have access to the planning, each professional person gets better opportunities to plan their job and communicate directly with the person or persons they are dependent on in order to be able to perform their job.

The customers of those projects have been involved in the planning work also so that they can also influence and add to the process. This type of customers' engagement helped the company to know the real expectations of the customers and to make them understand the process better.

The company decided after that to not use this strategy that they have developed more, and the decision was to look for new ways of achieving the goals without the necessary of implementing lean. The goals for sure were to minimizing cost and waste and trying to involve the customer more in the process.

The researchers have held an interview with a project manager who is working for the company and he described his way of understanding lean and how is his company trying to implement lean on another hand.

For Interviewee 4, he believes that operation strategy is to get an organized and controlled flow of planned operations and their sub-activities. This flow will benefit the production as to achieve intended outputs and results, however it should take into consideration workers safety, environmental concerns around construction site and security. Put simply, he emphasizes that achieving targeted results, in terms of production milestones and financial benefits, should not be the main concern of operation strategy, but also not to endanger workers health and work environment at construction site. Happy and safe workers are crucial for the success of any operation strategy; therefore, he assures the importance of focusing on workers satisfaction and safety aspects at construction site.

For him, an operation strategy is to perform and produce to achieve objectives beyond predetermined and expected objectives, and at the same time having the best work site for your

employees. For instance, any operation strategy must not include any savings as to workers safety. Based on that, for Interviewee 4, operation strategy first priority should be workers safety and the financial benefits comes after that.

For Interviewee 4, he emphasizes that company's business strategy should not be the main driver for workflow and progress. It is obvious that business strategy at any company will be about making profit and also having the biggest market share in that industry or sector. Therefore, he explained that internal customers satisfaction is crucial to drive operation strategy and the focus should not only be on financial benefits, but also on how to make workers saved and satisfied so that they will be loyal for their work as well as their environment. Put simply, internal customers satisfaction leads to external customers satisfaction. Thus, it is kind of an equation that construction company should balance in order to attain its business main objective that is financial benefit.

For the company where he works, business strategy goals, that should be achieved through the operation strategy that he formulates with help of other site managers, are given to them so that he and his colleagues are familiar about it. For that company, business strategy priorities are environmental, security, organizational and financial goals respectively. Those goals can be adjusted by project manager if they see any possibilities for better performance and better results.

For Interviewee 4, operation strategy is adjusted according to supply and demand. That means, **market requirements and operations resources** are adapted in relation to needed production and the actual capability of company's resources. Put simply, the company tries to have the biggest market share in construction and property market in Gothenburg, however, that will be accomplished according to available resources for the company and its capabilities. This how they include those two main perspectives in their operation strategy. Moreover, the company always tries to allocate the right work team with appropriate experience in order to be able to meet the certain demands for each construction project. Before every milestone in the production, a meeting is organized where site workers and site managers have a dialogue about how to execute the work and the best ways and resources to accomplish that part of work.

The gap between **Top-down and bottom-up perspectives** should be reduced and based on facts in order to include both them. That means, when formulating operation strategy for a certain project, the top of company cannot expect work more than actual abilities for human resources of company, which raises the need for good communication means between bottom workers and top of company in order to benefit from any possibilities for better performance depending on the experience of workers at construction site. Allocating less work for bottom-line workers will give them better opportunity to figure out improvement possibilities in terms of resources utilization and production. As regards operation strategy priorities, Interviewee 4 believes that being the best employer, having the best worksite and following company's key values (down to earth, developing, personal, reliable) are the main aspects that will lead a construction company to have competitive advantage in the construction market.

For Interviewee 4, the company uses premade checklists and standard procedures in order not to miss anything that should be included in company's operation strategy. The checklists are different depending on different types of projects. However, the company tends to follow **PDCA process** to formulate operation strategy. Having planned operation strategy for a certain project, they implement it as it is, thereafter, they meet again in order to figure out what could be done and make improvements based on that to act later according to the updated operation strategy. That means, it is kind of Lean construction as to waste minimization during production.

The adjustments in the everyday operations have to support the company's strategic goals, so they are preceded by deep analysis and measurement of the current processes.

Interviewee 4 has stated that a lot of the ideas of lean construction found before Koskela set the theoretical basis for lean in 90s. A lot of the ideas are already there before, and the name 'lean construction' is a fashion today. He also thinks that the professional experience could give the personnel a higher understanding of the problem comparing to what the theorists and the academics could find or investigate. Therefore, he believes that the goal of implementation of lean is already achieved in the company. The purpose behind implementing lean is the same as any other operation strategy in his opinion. For example, no contractor will choose to execute a project with higher expenses if he can execute it with the same value generated for the customer with less expenses. He also stated that the atmosphere in most of the contracting companies today is based on sharing the information and suggestions between the staff and trying to solve the problems in a democratic way, all of this is happening without the implementation and therefore he doesn't see much benefit from implementing lean in construction.

Interviewee 4 see that the implementation of lean in construction is all about the continuous updates while executing a project. This important feature of lean construction is the key of the success of lean and that the more a project manager tried to make value out of the errors happened the more he/she well-implementing lean in his operation strategy.

Interviewee 4 see the goals of implementing lean in construction as to give a better understanding of the industry and to focus on the goals of every contractor which are several but mostly on the economic view.

He also sees that two important goals of implementing lean are to make value out of the mistakes and to minimize waste of money, time and materials at all stages of a project.

However, the health, environment and safety are also three more important goals that can be considered more within the context of lean construction.

Interviewee 4 thinks that lean construction still has a big future. He also thinks that this future can't be effective without the continuous theoretical developments. These developments should be focused mainly on how to implement lean construction in the different contexts and the different construction sites conditions. There should be a solution for that because lean construction is a bit tight in this side as he stated.

Interviewee 4 has stated that one of the most important difficulties of implementing lean in construction is that the nature of the business itself because lean has been started in car manufacturing company where most of the things are standardized and the location and the staff are always the same while in construction the conditions are always different because in every project there is a new construction site with new staff and what makes it more complicated is that when there is sub-contractors with new staff every time. The design of the building and the sophisticated nature of the construction will make the implementation of lean more difficult also. Every time you start a construction process is similar to the first time you learned how to walk, as he stated.

The industry of the manufacturing cars is completely different than the construction industry which will make implementing lean in construction as a hinder to the construction process as he thinks.

5 Discussion

In the discussion chapter, the researchers will try to investigate the research questions depending on both the literature review that was done before and the empirical findings out of the interviewees that have been held with professional staff working in construction industry.

The research questions are the focus in this chapter and the researchers will try to answer those questions in order to get the desired results out of this research.

5.1 Operation Strategy for Contractors

In order to answer first and second research questions, that are, what is an operation strategy for construction contractors in Sweden? And how does it support business strategy? As well as, what perspectives should be included in operation strategy for construction contractors in Sweden? How should they be included? relevant theories and empirical contributions to answer the question will be highlighted and investigated.

5.1.1 Operation Strategy Definition

As mentioned in the theoretical part, according to Slack and Lewis (2010), operation strategy is the total pattern of decisions which shape the long-term capabilities of any type of operations and their contribution to overall strategy, through the reconciliation of market requirements with operations resources . For construction contractors, operation or production strategy includes a long-term planning for the functions of operations and allocating of adequate resources that will help them to balance between temporary engagement in construction projects and long-term survival .

Table 1: Main results from case studies, in terms of Operation Strategy concept.

Nr. Of case study	Definition and understanding of Operation Strategy concept
Case study 1	It is a framework that directs the activities of the whole corporate to achieve corporates' intended consequences.
Case study 2	It is a big system that includes a set of small systems for each part of the production plan, that should be adapted according to the conditions and requirements of project.
Case study 3	It is a framework or organization of activities that will lead to fulfil customer specified needs and at the same time help the company to make profit
Case study 4	It is to get an organized and controlled flow of planned operations and their sub-activities that will benefit the production as to achieve intended outputs and results, however it should take into consideration workers safety, environmental concerns around construction site and security.

According to the results shown in table1, that is based on the results from interviews, operation strategy for construction contractors in Sweden can be defined as a framework that governs the flow of activities that directs the whole company to attain its strategic goal. This organized and controlled framework makes it explicit about what the company aims to deliver and how it intends to deliver it, so it is an organization of company's resources and organization of roles for company's human resources at construction project.

By comparing this definition with Slack and Lewis (2010)'s definition, it is explicit that both of definitions agree about the principle and aim of operation strategy. The framework is the basics and principles that decisions related to production operations and its resources will be based on. In addition, by having organized and controlled framework, reconciliation of market requirements or customer satisfaction can be attained as it explains the distribution of resources that will lead to more efficient operations.

Efficient operation strategy should direct resources towards market requirements that is not fulfilled yet. Thus, operation strategy should be designed to fulfil customer needs and at the same time help the company to make profit and gain bigger market share in order to sustain and progress. Based on that, it is how to employ and allocate company's resources to create value for both customer and company.

Operation strategy is designed based on the objectives and purpose of organization, that is what the construction company intends to achieve and own. Therefore, operation strategy should be adapted according to the contexts and requirements of each project in order to achieve targeted results from undertaking each construction project.

ased on that, it can be concluded that operation strategy cannot be standardized and fixed but flexible. As interviewees informed, check lists are a useful tool for designing and following operation strategy, it facilitates procedures for operational managers when formulating an operation strategy by following the main guidelines and objectives of the construction company to be considered when adapting operation strategy to a construction project.

According to most of the interviewees, operation strategy should consider goals beyond financial goals for the construction company. Societal and environmental goals should also be taken into consideration when formulating an operation strategy for the construction company since operation strategy implies and reflects the main interests for the construction company in any country. Therefore, focusing on objectives beyond profitability of any construction project can be clear and touched by client or end-user since it creates better value for them.

Moreover, from the interviewees point of view, operation strategy should also take into consideration workers safety and security. That means not to endanger workers health and work environment at construction site. Happy and safe workers are crucial for the success of any operation strategy; therefore, performance objectives for operation strategy for construction contractors, should be both internal and external customers satisfaction even if there are more expenditures for internal customer satisfaction.

With respect to operation strategy process, there is a consensus among interviewees that PDCA is the most adopted process when formulating an operation strategy for their construction projects, as it is mentioned in cases 1,3,4. This process is relevant to Lean construction even though some of the interviewees do not believe completely in Lean construction or even use it as an operation strategy. Plan, do, check and act respectively, starting with planning of functions and allocating resources for it, doing or implementing functions, checking attainment of intended result and finally acting on the results and making enhancements on the operation

or production strategy. All that is a result of constant collaboration and development between mangers and construction workers.

As regards operation strategy supports business strategy, referring to the theoretical part, Construction contractors, like organizations and firms, should have a business strategy and operation strategy that will direct their work towards it objectives Junnonen (1998).Operation strategy is driven by business strategy and established in a strategic way in order to lead the whole organization to achieve its overall business goals and purpose Lidelöw and Simu (2015).

Building on the results from the case studies, it is obvious that there is a consensus among interviewees that a construction contractor business strategy with business objectives, should not only be focusing on economic aims and bigger market share, but it should be directed and intended to lead to sustainable benefits for both contractor and customer together. Common benefits are more efficient to create value for both construction contractor and customer and not only one part. That generates an internal incentive for internal workers in the company and external customers who ill be more willing to deal with such company having such efficient operation strategy.

It is explicit that operation strategies are driven by business or corporate strategy. Therefore, an efficient operation strategy should lead to objectives beyond financial returns as an innovative way to both create value for the customers in market as well as to gain good returns by organization. The consequences of business strategy for any construction contractor are achieved by their operation strategies.

Consequently, business strategy should seek to fill the gap in the market and establishing an operation strategy to achieve that. Fulfilling client's needs and meeting expectations should have the same degree of importance as organizational goal in any construction operation strategy. For instance, offering apartments for low-income people is a great idea to design an operation strategy for at a construction company.

It can be a smart combination between construction contractor's and client interests. In that case, construction contractor will have more encouraging motivations for customers to choose them as constructor or property development company, in addition, that will make it simpler for the contractor to gain profit and attain their future objectives and what they are looking for to be in long-term. That is considered as a long-term way of directing and driving a construction company that in turn will lead to long-term results.

Based on that, it can be concluded that business strategy for construction contractors should have other priorities other than financial aims. For instance, workers safety and satisfaction, fulfilling customer actual needs, and environmental issues should be prioritized more than gaining profit for construction contractor when formulating operation strategy that will drives all resources to serve and accomplish those goals and deliver projects.

5.1.2 Operation Strategy Perspectives

When it comes to the second research question, what perspectives should be included in operation strategy for construction contractors in Sweden? And how should they be included? Interviewees contributions will also be investigated to answer the question.

According to Slack and Lewis (2010), a comprehensive and complete operation strategy should include four main perspectives of actors and resources that contribute and have effect on the performance and efficiency of operation strategy. These perspectives are top-down or company's directors' perspective, bottom-up perspective for labour at working site, market requirements that represents what clients need and expect, and the fourth one operations' resource that are about resources and technologies allocated for each operation.

Table 2: Main results from case studies, in terms of Operation Strategy perspectives

Nr. Of case study	**Top-bottom**	**Bottom-up**	**Market perspective**	**Operations resources**
Case study 1	Directors of company should have a complete understanding about the other perspectives included.	Directors at the top of hierarchy need to understand what the actual problems are for the workers at the bottom of hierarchy.	Fill a gap in society that will encourage customers to buy company's products	Focusing on Research and Design is seen to be one of the main strengths of this company that helps them to find a more efficient operation strategy.
Case study 2	Giving the main guidelines that site managers and project managers should follow in their execution.	Good participation and contribution of workers at construction site who work with day-to -day operations rather than planning.	Several meetings with client before formulating the operation strategy that will be followed during production.	Regular meetings with subcontractors and their workers.
Case study 3	Top management believe that even their subcontractors should have the belief in and understanding of Lean construction and its principles.	The company arrange regular meetings in a weekly basis.	Relationships with customers are crucial for this company to ensure having the competitive advantage in the market.	Big meeting where discuss possible improvements for further projects.
Case study 4	Should base decisions on real needs of bottom workers.	Should have good communication channels with top management.	Operation strategy is adjusted according to market demands.	The company always tries to allocate the right work team with appropriate experience to gain more experiences.

As it shown on table 2 that is based on findings from interviews, it is explicit that all companies agree about the inclusion of all four perspectives that Slack and Lewis (2010) mentioned in their theory, and the necessity not to omit the role and effect for any perspective. Therefore, all perspectives are indispensable for construction contractors, which raises the importance of balancing the contribution of each perspective in formulating production or function strategy for construction projects.

Top-bottom perspective is the reflection of thoughts and directions by the top of the company, which is most often characterized by targeting and focusing on financial returns for the company. Efficient production strategy means for the top of organization saving money and resources. Or in another way, produce as much products or construction by using as less resources and human resources. Construction company should adapt its business strategy to the market, that means not only seeking financial returns as a result of construction projects. Top of the organization perspective should be aware and familiar about the problems and obstacles for workers at construction site that hindering them from performing better. By being completely aware about the rest of the three perspectives, business strategy will have better prioritization for objectives from construction projects. Those objectives emerge from business strategy that aim to have satisfied internal and external customers and not only financial returns. This perspective is important to be reflected in operation strategy since it provides it with adequate resources, directions and leadership towards the accomplishment of construction project.

Bottom-up perspective reflects the ideas and improvements gained from operational experience from workers executing day-to-day functions in terms of production at construction site. Contractors believe that real changes come from the bottom-line of organization, that means workers at construction sites with different roles. Bottom-up perspective consists of participation by of both main contractor workers and sub-contractor workers. Based on that, construction contractor should be able to manage the feedback from both their workers and their sub-contractors' workers. Good understanding of this perspective should be based on constant feedback before, during and after the completion of every construction project. Improvements and developments of operation strategy is highly based on the reflection of this perspective.

Therefore, it results in saving in both resources and human resources for construction company and thus less costs for customers. Moreover, it is the top directors' responsibility to understand the actual circumstances for workers at construction site in order to be able to benefit from them and their day-to-day emerging experience. Therefore, most of the interviewees emphasized on the importance of creating a truthful communication environment within project-based organization that is aimed to help Top-directors to get real feedback from bottom-line workers through project managers in daily contact with workers at construction site. This feedback will be utilized for further developments on function strategy. Moreover, construction contractors and sub-contractors' early involvement can more likely reduce uncertainties during production.

Market perspective is the most crucial one, since construction contractors' function is to build infrastructure that customers really need such as residential and commercial buildings. Operation strategy for construction contractor should deliver outputs that will serve customers and satisfy them and their expectations. As one of the interviewees mentioned, operation strategy should aim to fill out the gap in the market by providing and delivering projects that align with customer needs.

Therefore, there is an emphasis about designing operation strategy depending on customer demand which leads construction contractor to have competitive advantage and thus more

profitable projects in all terms. Adapting operation strategy to customer need will make it more encouraging for customer to deal with construction contractor. For instance, building houses for low-income people, building warehouses with sizes and features adapted to the function and profession of customer, and building eco-friendly buildings. Offering such services will help both customer and contractor to develop and grow. As a result of that, it can be concluded that construction contractors in Sweden have a consensus about adapting operation strategy to the requirements and conditions of community and market.

Operations resources perspective concerns the capability of each operation that result from allocating certain resources for it and selecting certain suppliers and technologies for this operation. Construction contractor should be fully aware about the actual capabilities of every operation within production strategy in order to utilize it in the most efficient way. Improvements on this perspective can be a result from the feedback from construction workers since they are in daily interaction with operation resources. It is easier for workers to figure out failures in resources and also possibilities to deploy operation resources in more efficient way that will create more value for company and customers. Therefore, the emphasis about truthful communication environment plays a crucial role for Top-directors to figure out details that are not visible without being examined in production by bottom-line workers.

Good operations resources deployment will definitely result in more efficient production and less defects and mistakes, and that can be implemented through examining interaction between allocated operations' resources or resources of processes that constitute a complete operation with an operation strategy. Based on that, this perspective with Bottom-up perspective is important for waste minimization in production strategy for the construction contractor.

As regards how the four perspectives should be included, for market requirements perspective, there is a consensus among construction companies about regular meetings before and during construction in order to be able to get the idea of customer expectations and needs from the project. In case of big construction projects such as residential apartments, companies should figure out the need of market that is not yet filled out through questionnaires , feedback from people in a certain area or investigating what market segmentation that is not yet satisfied and provided with adapted constructions such as young people or even aged-people homes that are provided with special facilities.

Bottom-up perspective inclusion can be achieved thorough trustworthy communication environment and truthful communication techniques that enables bottom-line workers within project-based organization to tell truthful feedback and information about the problems they face at construction site, where middle managers have crucial role in conveying real demands and suggestions of bottom-line workers at construction site to their superiors to be considered when updating production strategy and making decisions.

Operations resources, collaboration between top and bottom of the hierarchy is the most efficient way to understand operations resources and be able to consider this perspective when formulating an operation strategy for a certain project. Constant learning about operations resources is efficient for allocating the most efficient and capable resources for every operation within network of operations.

5.2 Lean in Construction

Under this sub-title the researchers are trying to investigate the third and fourth research questions which are:

How are the target contractors applying lean construction in their operation strategy?

And, how can lean construction goals be achieved without the need of implementing lean tools?

Regarding the third research question, lean construction has been in the market world widely for around three decades with low relative presence among the contractors. This presence is always combined with claims about minimizing cost and time while implementing lean Ballard et. al. (2002). On the other hand, there are also claims that implementing lean in construction is hindering the overall process and slowing down the project since it is a manufacturing strategy and the manufacturing sector is different than the construction sector.

This differentiation in the views is reflected on the application of lean construction into the market, as mentioned in the empirical findings in Case Study 1, the interviewee thinks that lean construction is a good solution for a lot of problems in the sector since it can help the contractors to accomplish more with less cost and time. This view also was the same with the interviewee in Case Study 3 also. They both believe in lean construction as a wholly operation strategy that can improve the work and the sector overall.

However, the interviewee in Case Study 4 thinks that lean construction is nothing but a title for a lot of tools and procedures that he and the company are already working with daily. He thinks that there is a giant gap between the theories and the application of lean and this gap is always present with no real intention to fill it from the researchers and the theorists.

Moreover, the interviewee in Case Study 2 shares some ideas with the interviewee in Case Study 4. He also thinks that most of the contractors 'including the company that he is working for' are applying a lot of ideas and tools of lean without naming it as "lean". This is also supporting what the interviewee in Case Study 1 said about how lean construction is seen today as a bunch of tools not as an operation strategy.

Therefore, most of the interviewees 'apart from interviewees in Case Study 3' thinks that applying some parts and tools of lean construction into their work is going to help them improve the overall work without the need to redraw the whole operation strategy of the company. This partial implementation of lean construction could be the answer of this contrariety between the supporters of lean and the opponents.

According to the interviewee in Case Study 2, the partial implementation of lean construction includes Last Planner® as an advantage tool that helps to draw the operation strategy of the company. Using Last Planner® could help the company to understand what is more critical and what is less and to balance between the different tasks in order to achieve more productive process.

There are also other sides of this partial implementation as mentioned by the interviewee in Case Study 2 also as trying to minimize the inventory in the construction sites as much as possible in order to save more costs by trying to implement Just-In-Time (JIT) in the construction sites in order to make the process faster and less expensive.

The company in Case Study 3 is implementing lean fully with the use of a lot of its tools. Last Planner®, PDCA, A3, 5S and many more. They can describe their power and their presence in the market is because using lean tools.

Another type of implementation of lean construction is the partial implementation like what the researchers have investigated in Case Study 2. The company is using Last Planner® only in their operation strategy. They have found it very useful for them and that it can add more flexibility and better understanding to their work. Even though, they don't understand lean construction fully, but they believe that Last Planner® is a good tool for their work.

The company in Case Study 1 doesn't implement lean fully also but they are trying to do so by starting the implementation in the design phase only. The implementation of lean construction into the design phase is not by using one of the well-known lean tools rather than the company strategic staff have worked on developing their own working concept that are achieving lean goals as to minimize cost and waste by applying it.

This work concept could be considered as part of lean, but this partial implementation is different than applying some tools of lean only. This implementation of lean considers the company special conditions and needs because the staff in the company that are facing the problems everyday are the same guys that developed the concept which make it special for their case.

We can see part of that also in Case Study 4, the company also tried to implement lean by the same way that was on Case Study 1. They have developed their own work strategy according to lean. However, the company then decided not to proceed with this strategy and tries to look beyond lean in order to achieve lean goals without the need to implement lean. Their goals of executing the project without lease cost and waste were their key to won most of the contracting bids around Sweden as the interviewee 4 stated.

The application of lean construction is not always easy and good for the project. There are always some difficulties while implementing lean into the construction sector.

One of the most important difficulties mentioned by interviewees in Case Study 1 and 3 that lean is a strategy that needs a lot of time to implement and also needs a lot of understanding by every personnel in the company. It needs also to understand the goals that the company is going to gain out of implementing lean beforehand. All of these are making the implementation of lean in construction is a long process and this is contradicting with the quick profit goal that every contractor is aiming for which makes the presence of lean construction in the market relatively low.

The other important difficulty mentioned by interviewees in both Case Study 2 and 4 is that the nature of the construction business is different than the manufacturing business in a lot of ways. One of them that the conditions while manufacturing are mostly stable, and process is repetitive which is not applicable in construction. A car manufacturing company is making millions of units of the same prototype with no big changes while a contracting company has different conditions and different project to execute every time.

Lean is also more about standardization which is more suitable for manufacturing not construction since it is critical to build distinguishable buildings.

Lean construction is also described according to interviewee in Case Study 5 as an improvement process that always seek to deliver the best projects and to get the better result for everyone.

Most of the interviewees as they are involved in the everyday operations didn't see the philosophy in lean. They just describe it as bunch of tools that could lead to deliver a good project. This is mainly because of the gap that is always there between the researchers and the professionals. These professionals should understand the customer value as the main drive of the business to achieve the best for everyone. The customer value is not always about the money but could be about the safety, economy and even the environment.

Regarding the last question, lean construction could be developed according to the literature and empirical findings in a lot of ways in order to gain more presence in the market. One of them is to try to implement more tools of lean separately as it doesn't require a lot of change.

The implementation of some lean tools into the contracting companies could be a transition period that can help the companies understand what lean is really about and how they could modify the strategy to fit into their work.

Lean construction can't be successful without the individual acceptance and understanding which makes it difficult since all the employers are requested to train their employees frequently in order to gain the most out of it. This is a difficulty as the researchers discussed before, but the more lean construction is presented as culture the more it gets more acceptance.

Lean construction could give perfect results in special nature of projects that have repetitive operations as discussed in Case Study 4. The contractors should find some standardized operations within the projects in order to apply lean construction on it. For example, the pre-fab buildings are a good example in this context.

6 Conclusion

The research questions presented in this research have been answered based on empirical findings from interviews conducted with four well-known construction contractors in Sweden who helped the researchers to accomplish the scope of this project.

Operation strategy for construction contractors is a crucial aspect, since it will determine the success or failure in delivering a construction project according to its economic and temporal plans that are initiated before commencing construction works.

Since most of the theoretical part regarding operation strategy concept is based on Slack and Lewis (2010), the empirical results for this part will be compared to this book theories. As mentioned in the theoretical part, according to Slack and Lewis (2010), operation strategy is the total pattern of decisions which shape the long-term capabilities of any type of operations and their contribution to overall strategy, through the reconciliation of market requirements with operations resources .

It can be concluded regarding the first research question which is **What an operations strategy is and How it does support business strategy**, that operation strategy simply means a framework that governs the flow of activities that directs the whole company to attain its strategic goal, this framework includes set of principles on which operational decisions in a construction company will be based. By comparing with Slack and Lewis (2010)'s definition, it is explicit that construction contractors interviewed have almost the same understanding of the theoretical definition, as operation strategy consists of set of operational decision that are based on certain principles for each company. Those operational decisions will lead the company to fulfil market requirements with its available resources, consequently, operational decisions are crucial for the position of the company in the market as it affects its ability to allocate its resources for production activities in the best possible way.

However, the objective of formulating an operation strategy should not only be financial benefits but also to fulfil market requirements that are not yet fulfilled. In addition, a safe operation strategy should take into consideration workers safety at construction site. As a result of that, since business strategy is the key driver for operation strategy, business strategy should seek both internal and external customers satisfaction when formulating an operation strategy for a construction project. That will result in better value creation for both company and external customers.

Based on that, it can be concluded that operation strategy concept for construction contractors in Sweden means present operations management, as it means for them planning, organization and supervising actions in order to make possible improvements that will lead them to attain their overall organizational objectives. Those objectives vary upon companies' top-down perspective, and it can be for example to attain operation strategy that creates safer and more convenient work environment for workers as it is mentioned in case study 4.

Moreover, for the second research question that is **Which perspectives should be included in an operation strategy and How they should be included**, it can be concluded that a comprehensive and complete operation strategy should merge the four key perspectives, that are Top-bottom, Bottom-down, Market requirements and Operations resources, and make them as one unit. Sub-contractors should be included in the operation strategy process instead of restricting their role by day-to-day operations. That will boost their comprehension of the strategy and its implications on their work and performance. Moreover, it is worth to mention that seeking financial benefits and waste minimization does not necessarily mean using cheap

equipment or materials in the production which can be less efficient or harmful for both construction workers and customers. For the method of perspectives inclusion, regular meetings and trustworthy communication channels within organization as the most recommended ways for both bottom-line and operations resources perspectives. For market requirements perspective, in case of one big customer, regular meetings before and during construction is an efficient way to understand the actual needs for customer from their project. And in case of many customers for public project, questionnaires and investigations are functional in order to figure out what it is really needed in that market segmentation to be fulfilled by a construction project.

Regarding the answer of the third question **How are the target contractors applying lean construction in their operation strategy,** the researchers have found that the application of lean construction for the target companies 'and could be generally also' is divided into three groups:

1. The full implementation of lean: this is when the company in total staff have understood lean fully in both ways (up-bottom and bottom-up), implement it in their strategy and using its tools such as: Last Planner®, PDCA, 5S and many more. The example of this was in Case Study 3.
2. The partial implementation of lean: the partial implementation has two types, the first is when the company is only implementing one of lean tools such as: Last Planner® and the example of that was in Case Study 2. The second type is when the company is trying to develop its own work concept that is compatible with lean goals like what the researchers have investigated in Case Study 1.
3. Trying to achieve lean goals without the need of implementing lean construction: the goals of implementing lean should be the goals of every contractor, minimizing waste and cost and trying to achieve more value for the customer and this is what the researchers have investigated in Case Study 4.

The researchers have found also that lean construction has low presence as an operation strategy among the contractors because it is seen today as a group of tools not as a whole operation strategy. This is because there is a gap between the theory and the reality, and this gap has to be filled by more deep studies that can characterize the reality more and try to find answers for the construction problems.

Moreover, some of lean tools 'especially Last Planner®' have gained success in the market among the contractors and that it is because the application of the tools individually and according to the contractors' needs are easier and much faster than redrawing the whole operation strategy of a company.

Lean construction could be applied fully and easily in some types of projects but not all and the nature of the construction market is always hindering the full application of it.

Regarding the findings about the fourth research question **How can lean construction goals be achieved without the need of implementing lean tools,** the researchers have found that lean construction goals should be the main goals of any contractor. Minimizing waste and cost and trying to achieve more with the less is the best solution for any contractors. More implementation of customer into the project could help the contractors to understand the process in more precise way and therefore the implementation of lean is not necessary for achieving its goals in all cases. Looking beyond lean construction could include stepping forward and override it in order to look for new strategies to take place and achieve the same 'and maybe more' goals.

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