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Swedish University of Agricultural Sciences

Department of Economics

Green Lean

- The effects of Lean on Environmental Strategies in Swedish agricultural firms

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Malin Samuelsson



Abstract

Swedish agricultural firms are today facing high competitiveness from foreign producers and a decreasing profitability. Simultaneously, the agricultural sector are facing challenges regarding the impact generated from the production systems on the natural environment and especially emissions of greenhouse gases. Previous studies show that the implementation of Lean has led to both increased competitiveness and a reduced environmental impact due to a reduction of waste. In 2010 Lean Lantbruk was introduced within Swedish agriculture, where firms implement Lean during an 18 month period with the purpose of increasing the competitiveness of the firm through increased efficiency and profitability. The aim in this study is to examine whether Lean may contribute to a sustainable Swedish agriculture with long-term competitive agricultural firms. In order to achieve this aim, the following research question is asked: *How does Lean affect strategies concerning climate efficiency within Swedish agricultural firms?*

Green Strategies in SMEs (small and medium sized enterprises) is used as the main theory. Empirical data has been gathered through semi-structured in-depth interviews with the manager at 16 agricultural firms in Västra Götaland, Sweden. The sample consist of 8 firms that have implemented Lean and 8 reference firms. The result show that the farms that have implemented Lean have more well-developed routines in the production system compared to the reference farms, implicating that the companies that uses Lean also has been observed to use an Eco-efficiency strategy to a greater extent i.e. reducing environmental impact through increased efficiency. The reduced impact on the environment should however be viewed as a spill-over effect of Lean rather than a purpose within itself, which is in line with previous research. Finally, some suggestions of future research are made for regarding for example the perspective of employees.

Sammanfattning

Allt fler lantbruksföretag står inför en lönsamhetskris med hård konkurrens från utländska aktörer och en utveckling som går mot allt färre men större lantbruk. Samtidigt möter branschen utmaningar gällande dess miljö- och klimatpåverkan, i synnerhet med fokus på produktionens höga utsläpp av växthusgaser. Tidigare forskning visar att implementering av ledningssystemet Lean kan bidra till både ökad konkurrenskraft och reducerad negativ miljöpåverkan av företagets processer genom minskat resursslöseri. År 2010 introducerades Lean Lantbruk i det svenska lantbruket där företag under 18 månader implementerar Lean i verksamheten för att öka dess konkurrenskraft genom ökad effektivitet och lönsamhet. Syftet med denna studie är att från ett företagsledningperspektiv undersöka huruvida Lean Lantbruk bidrar till hållbar utveckling inom svenskt lantbruk för långsiktigt konkurrenskraftiga lantbruksföretag. För att uppnå detta syfte har följande forskningsfråga besvarats: *På vilket sätt påverkar Lean strategier gällande climateffektivisering i svenska lantbruksföretag?*

Som huvudsaklig teori används Green Strategies in SMEs (small and medium sized enterprises). Empiriskt material har samlats in genom semistrukturerade djupintervjuer med företagsledaren vid 16 lantbruksföretag i Västra Götaland, Sverige. Urvalsgruppen består av 8 företag som har implementerat Lean och 8 referensföretag som inte deltagit i Lean Lantbruk. Resultatet visar att de företag som implementerat Lean i större utsträckning använder rutiner i företagets arbetsprocesser jämfört med referensföretagen vilket landar i slutsatsen att företag som implementerat Lean i större utsträckning tillämpar miljöstrategin Eco-Efficiency, dvs. genom effektiviseringar minskar både kostnader och klimatpåverkan. Den minskade klimatpåverkan bör dock snarare ses som en sidoeffekt av Lean och inte ett mål i sig, vilket går i linje med tidigare forskning. Avslutningsvis ges förslag på vidare forskning där det vore av intresse att exempelvis undersöka de anställdas upplevelser av Lean inom lantbruksföretag.

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1 Introduction

The first chapter gives an introduction to the structural changes within Swedish agriculture, challenges and possibilities for sustainable agriculture, the theory of Lean and a brief description of the Swedish project Lean Lantbruk. This is followed by the aim of the study, as well as its delimitations.

The development in Swedish agriculture the last 30 years has led to major structural and economic changes within Swedish agricultural firms (www, SJV, 1). Competition from foreign producers' increases, profitability is perceived to be decreasing and rationalizations are leading towards fewer and larger units. This changing setting requires a new type of leadership in agricultural firms (Andersson & Andersson, 2014; Lantbruksbarometern, 2014). Parallel with the challenges in Swedish agriculture, there is an increasingly intense debate regarding the climate and environmental effects of the agricultural sector regarding emissions of greenhouse gases, over fertilization, use of pesticides etc. (Pers. com. Rockström, 2014; SJV, 2014). These negative impacts affect the global as well as local environment, the foundation for the activities in agricultural firms (SJV, 2014). The new conditions in the business environment as well as an increase in environmental concerns are central for Swedish agricultural firms to manage in order to secure long-term survival (SJV, 2014). Therefore, environmental strategies can also be viewed as a business incentive for the agricultural firms.

The term *sustainable development* was first defined by the World Commission on Environment and Development (WCED) in the Brundtland Commissions report (1987:43):

"Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs."

Since then the term *sustainability* has received over 80 different definitions and according to Röling and Wagemakers (1998:25) the general term needs to be problematized:

"In any discussion of sustainability, it is important to clarify what is being sustained, for how long, for whose benefit and at what cost, over what area and measured by what criteria. Answering these questions is difficult, as it means assessing and trading off values and beliefs."

In order to manage the complexity of sustainability for a specific firm it needs to be broken down into several parts, whereof one of these parts concerns environmental efficiency. Through modifying existing production systems into using inputs in a more efficient way, there will be a reduction of waste and lowered environmental impacts of the firm activities, as well as financial benefits (Röling & Wagemakers, 1998).

Production in the agricultural sector accounts for a significant proportion of greenhouse gas emissions due to carbon reserves released from the soil in crop production and energy intense livestock production (Smith et al., 2007; SJV 2, 2015). Previous research shows that increased energy efficiency in processes in agricultural firms have potential to reduce greenhouse gas emissions, without restricting yields or profitability (Smith et al., 2007, Burney et. al, 2010). Smith et al. (2007) presents a list of areas in agricultural firms where improvements may be made in order to reduce greenhouse gas emissions e.g. cropland management, livestock management, manure/bio solid management and bioenergy.

Management within agricultural firms is an important factor affecting resource efficiency and profitability (De Koeijer et al., 2003). In a farm setting, management is divided into three levels mainly based on the time perspective. *Strategic management* pertains to the long-term perspective and mainly affects management of assets such as capital, labor and land. *Tactical management* refers to a medium long-term perspective, such as production cycles and methods. Processes and decisions in daily work are defined as *operational level*. Each level affects efficiency on the farm in different ways (De Koeijer et al., 2003).

1.1 Problem Background

One established management system that aims at creating efficient businesses and reduce waste of resources is *Lean Productions*. The philosophy of Lean originates from Japan and Toyota Motor Productions that in the 1930's launched its general principals and practical tools in order to increase efficiency and remove everything in their activities that does not generate a value to the customer i.e. waste (www, Lean Lantbruk, 1; Shah & Ward, 2007). By optimizing the use of resources and producing what customer wants, when they want it, at a fair price has great similarities to environmental practices that aim at using resources in the most efficient way and through that reducing their environmental impact (Pampanelli, 2014).

Through the implementation of Lean, companies in different industries and countries have shown an increased competitiveness compared to companies that have not used Lean (Shah & Ward, 2007). In addition, previous studies have shown that companies that implement Lean often are greener than companies that do not use Lean; a field of research called *Green Lean* (King & Lenox, 2001; Pampanelli, 2014). Although the connection between Lean and green has been shown in previous literature, some researchers claim this should be seen only as a positive spill-over effect rather than a part of a strategy as a result of using Lean (Dakov & Novkov, 2007; Moreira et al., 2010). Ng et al. (2015) argues that it is possible to integrate climate aspects with the Lean tools. The traditional Lean tool *value stream mapping* can be modified to measure Carbon-Value Efficiency, which except lead time also identifies the carbon footprint of the firm's process. The result reveals that the carbon footprint was reduced by approximately 30 % after reducing lead time (Ng et. al., 2015). Meanwhile, other studies show that the implementation of Lean has had the effect of a catalyst for dealing with environmental impacts that go beyond just those caused by waste (Dues et al., 2013; Pampanelli, 2014). Companies working with Lean are more likely to work with long-term efforts such as pollution prevention, i.e. are integrating environmental efforts in the management (King & Lenox, 2001). By dealing with environmental impacts of the firm and integrating it in the long-term strategy, this can be turned into a competitive advantage by for example avoiding environmental threats or future laws and regulations concerning the natural environment (Klassen & McLaughlin, 1996; Porter & Van der Linder, 1996; Fraj et al., 2013).

In 2010 Lean was launched in Swedish agricultural firms through a project called *Lean Lantbruk* that overall aims at increasing competitiveness among firms within this industry. In order to achieve this several goals have been formulated, including increased profitability and increased climate efficiency (www, Lean Lantbruk, 2). Close to 100 agricultural firms¹ have joined the project since the start and have implemented Lean in their businesses (Pers. com. Andersson, 2015). During the 18 months the management undergoes a programme including

¹ In June 2015.

education and coaching that introduces the principles of Lean in the activities of the firm (www, Lean Lantbruk, 3). Even though the project Lean Lantbruk is relatively new, a few attempts have been made to evaluate the effects of Lean in Swedish agriculture (Melin et al., 2013; Andersson & Andersson, 2014). Andersson and Andersson (2014) examine the effect of Lean Lantbruk on leadership, from the perspective of both the business leader and employees. Melin et al. (2013) on the other hand have taken an environmental and financial perspective and studied the potential to improve resource utilization and climate efficiency on farm level by using the Lean principles through value stream mapping and calculations of the climate impact on a dairy farm.

1.2 Problem

Based on recent reports there is a need for firms within Swedish agriculture to increase competitiveness, increase profitability and lower greenhouse gas emissions. Previous studies show that leadership is a determining factor in how a firm is able to handle a changing setting and by introducing the principles and practical tools of Lean. The aim with Lean Lantbruk is to help the management within Swedish agricultural firms to create a business with the ability to meet these challenges (Andersson & Andersson, 2014; www, Lean Lantbruk, 3).

Along with an increasing focus on companies' impact on the climate through greenhouse gas emissions, there is a need to find new ways of management that contribute to sustainable businesses that creates competitive firms in Swedish agriculture. According to previous research in other industries the implementation of Lean does not only lead to a reduction of waste but also increases consciousness and management regarding the climate impact of the firm. Given this background, it is of interest to evaluate how Lean affects the way firms manages emissions of greenhouse gases, and in the long run the competitiveness of Swedish agricultural firms.

1.3 Aim

The aim of this study is to examine if management according to Lean can improve sustainable development in Swedish agriculture.

In order to achieve this aim, the following question will be answered:

- *How does Lean affect strategies concerning climate efficiency within Swedish agricultural firms?*

1.4 Delimitations

This study focuses on how Lean affects strategies regarding the climate impact of the firms, both in operational processes and long-term strategies. However, the study is limited to the usage of Lean in the agricultural sector and further to the specific project of Lean Lantbruk. This implies that the results in this study cannot be generalized to firms in other industries or to other agricultural firms that may apply Lean outside of the project Lean Lantbruk.

The firms in this study were chosen randomly within the sample group, although limited to firms entering Lean Lantbruk in year 2012 and the geographical area of Västra Götaland in Sweden. It is not possible to eliminate the possibility that firms that have entered Lean

Lantbruk have inherently different characteristics compared to companies that choose to not join the project. In that case the risk of the results being an effect of intrinsic differences between the firms with concern to openness to work in new ways and strive to be on the cutting edge, rather than an effect of Lean Lantbruk cannot be completely eliminated.

In addition, evaluating events that have occurred close in time always involve some degree of difficulty. The firms chosen entered Lean Lantbruk in 2012 and finished the programme in the middle of 2013. Since this study have a qualitative approach and aims at capturing the effects of Lean on management and strategies the time factor may be viewed as beneficial. The managers have the knowledge from Lean Lantbruk fresh in mind which increases the likelihood of capturing the effects of Lean on management and strategies. The time aspect for this type of research will affect the result regardless of when it is conducted and needs to be taken into account when interpreting the results as well as when replicating the study.

Since the purpose of this study is to capture the strategy formulation, the manager at each farm has been interviewed and no employees. According to the theory of Green Strategies in SMEs, the strategy is formulated in the first four steps of the model (see chapter 3.2.3). The two final steps, Implementation as well as Evaluation and Control, have been excluded since the purpose of this study is to identify existing strategies i.e. no measurements have been made concerning actual reduction of emissions. The determination of climate efficient strategies may be problematized. However for the purpose of this study climate efficient activities and strategies have been limited to the recommendations presented by Lean Lantbruk and Greppa Näringen (www, Greppa Näringen, 1; www, Lean Lantbruk, 4).

1.5 Outline

Chapter one gives an introduction to the background of the problem, the aim and the delimitations of the study. This is followed by a brief presentation of the findings in previous research in chapter two, which leads to chapter three where the chosen theoretical framework of this study is presented. Chapter four describes the methods used for this study, how the literature review has been conducted as well as the collection of the empirical data. The next section, chapter five, is the empirical study and it provides background information of Lean Lantbruk which is followed by an overview of the characteristics of the firms studied and thereafter the results found in the empirical study. In chapter six the theories and empirical data are compared and an analysis is concluded in chapter seven. Chapter eight provides a discussion of the findings of the study and finally suggestions for future research are made in chapter nine.

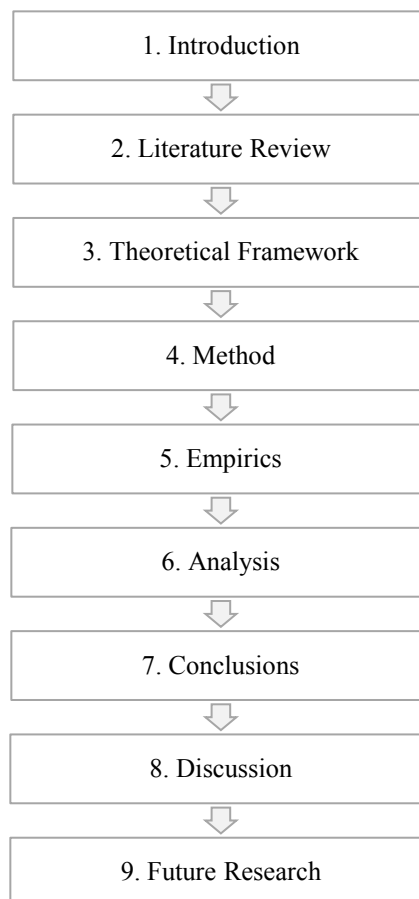


Figure 1.Outline of the study. Source: own modification.

2. Literature Review

Chapter two contains an overview of previous research conducted in the field. A brief presentation of research on farm management and strategies, previously observed effects of the implementing of Lean and finally the relationship between Lean and environmental effects with focus on greenhouse gas emissions.

2.1 Farm Management & Strategies

Management has in previous research been defined in various ways and may be viewed as a profession, specific activities or as a function. Nonetheless, it includes the responsibility to achieve objectives and control operations (Alvesson & Deetz, 2000). In a flat organization management is according to Alvesson & Deetz (2000:5) somewhat special:

“Managers also ‘work’, they do things, and workers ‘manage’ in the sense that they plan, decide, solve problems, coordinate. Take initiatives, exercise influences and so on.”

A central element in management is *strategies* which captures the motive/goal of the firm and the way it is accomplished (Harling & Quail, 1990). However, Mintzberg (2007) argue that the concept of a strategy is complex and fluid since there are two different types of strategies, planned strategies and process strategies. A planned strategy consists of a formally planned process which leads to a realized strategy or in some cases there is an intended strategy that is never realized. A process strategy on the other hand arises in the process and should rather be described as a pattern of decisions that in the long-term emerge into a strategy. In both types of strategies the manager has a central role (Mintzberg, 2007).

In a study by Harling & Quail (1990) the ability to apply a general theoretical management model on a farm business is explored, and the results show that such models are as applicable in farm businesses as in other industries (Harling & Quail, 1990). In addition, there is a correlation between applied strategic management and profitability and resource efficiency in agricultural firms (Harling, 1992; de Koeijer et al., 2003). With an increased efficiency farms have the possibility to reduce greenhouse gas emissions without negative effects on yield or profitability (Smith et al., 2007, Burney et al., 2010). According to Smith et al. (2007) there is potential for reduction in greenhouse gas emissions in several different areas within agricultural firms, for example in cropland management, grazing land management/pasture improvement, management of organic soils restoration of degraded lands, livestock management, manure/bio solid management and bioenergy. However, despite this potential there is a barrier for achieving this caused by lack of awareness of these opportunities among farmers (Smith et al., 2007).

2.2 Implementation of Lean

During the last decades Lean has received a lot of attention, and has become a well-established system among both researchers and practitioners through its solid record of increasing the competitive advantage of the firms who implement Lean in their practices. It has been continuously developing and been successfully introduced to a wide set of industries all over the world (Shah & Ward, 2007).

Although Lean has become a popular management system, the success of the implementation of Lean is affected by both due to the size of the firm and industry (Dora et al., 2013). Martinez and Lu (2013) show that there might be challenges in implementing Lean in firms without repetitive manufacturing activities. Although it is becoming increasingly applied within sectors such as health care, government operations and supply chain (Martinez & Lu, 2013). The transformation into becoming a Lean company requires an extensive cultural change in the firm with regards to strategy, structure and technology (Nordin et al., 2012). Within SMEs, the main critical factors for a successful implementation of Lean are defined as organizational culture, skills, financial capabilities and above all strong leadership and a committed management (Achanga et al., 2006). However, depending on the sector different factors might be important since each sector need to adjust the Lean principals to be relevant for the elements and challenges of that specific sector (Martinez & Lu, 2013).

2.3 Green Lean

Previous research shows that it is beneficial for firms to integrate green practices in their activities and strategies (Klassen & McLaughlin, 1996; Porter & van der Linde, 1996; Chan, 2005). By managing green practises, inefficient processes and waste can be defined and eliminated which reduces costs (Klassen & McLaughlin, 1996). Research regarding the relationship between implementation of Lean philosophy and lowered environmental impact started in the beginning of the 1990's (Moreira et al., 2010). Since then, support has been found for that increased efficiency and reduction of waste also has led to positive effects of the environmental impact of the firm activities, even though it hasn't necessarily been the main purpose with the implementation of Lean (Florida, 1996; Dakov & Novkov, 2007; Moreira et al., 2010; Pampanelli et al., 2014). Previous studies have mainly been approached the field subject by conducting case studies which provide deep insights to specific firms rather than general results (Moreira et al., 2010).

A study by Dakov and Novkov (2007) shows that industrial companies mainly use efficiency as a way to increase competitiveness and reduce environmental impact, and prefers to make these changes with small steps. Firms are generally not likely to take an increased amount of social and environmental responsibility in their practices unless there are substantial financial incentives or great pressure from stakeholders to do so. By using Lean firms aim at increasing efficiency and reduce waste, and at the same time receive positive environmental effects. This is however perceived to be a side effect, rather than the purpose of implementing Lean (Dakov & Novkov, 2007).

In addition to Lean leading to a reduction of waste and thereby lowered environmental impact, several other effects have been highlighted (Puvanasvaran, 2011; Dues et al., 2013; Pampanelli et al., 2014). Some researchers have found that Lean and different types of environmental management systems (and other green practices) have similar intrinsic characteristics and therefor they may be integrated and managed jointly (Puvanasvaran, 2011; Pampanelli et al., 2014). Puvanasvaran (2011) argue that by defining clear goals the environmental management system ISO can for example be integrated with Lean. Others show that the implementation of Lean has been a catalyst for implementing continued green practices, for example to a greater extent work with pollution prevention that reduces the future impact (King & Lenox, 2001; Dues et al., 2013). Finally, by doing more than meeting the current requirements from laws and regulations the firms are better prepared to meet future requirements. This creates a competitive advantage (Klassen & McLaughlin, 1996; Porter & van der Linde, 1996; Chan, 2005; Fraj et al., 2013).

2.4 A critical perspective of Lean

Lean has been criticized for the over optimistic rhetoric used by academic authors that argues that Lean can lead to wonders. This critique is a general discussion regarding theoretical management systems. The emphasis in this discussion is that aspects that exist in reality such as sociological and psychological phenomenon often are neglected (Stewart, 1996). Williams et al. (1992) are also critical and argue that research that optimistically has evaluated Lean was not based on reliable empirics. For example some research is deficient because it does not regard the wider external perspective such as market and economic conditions (Williams et al., 1992).

Delbridge (1998) argues that implementation of Lean leads to a more stressful working environment and that the predominant concerns of this management are to achieve greater control and power over the employees. Although, on the contrary some research indicates that employees that have experienced an implementation of Lean have positive attitudes towards the new system (Groebner & Merz, 1994).

One of the basic assumptions of Lean is that it contributes with financial benefits and this is discussed by Lewis (2000). From a competitive perspective he reasons that the financial benefits should be regarded with caution because Lean does not automatically create sustainable competitive advantage. It has the possibilities to do so but at the same time Lean also has the possibilities to diminish long-term sustainability and flexibility within the firm (Lewis, 2000).

Further on several authors have highlighted that a successful implementation also is dependent on different critical internal organization factors such as; employee involvement, investment in training, management strategies etc. (White et al., 1999; Achanga et al., 2006; Hines et al., 2008).

3 Theoretical Framework

In chapter three the theoretical framework is presented. The first section introduces the theory of Lean with the origin of the management system, followed by the tools and principles it consist of today. In the second section the process and formulation of Green Strategies in SMEs is described developed with the four Generic Competitive Environmental Strategies.

3.1 Lean

3.1.1 Toyota Production Systems

Toyota Production System (TPS) was developed in Japan after the Second World War with its main goal to reduce costs by eliminating waste through its systematic principles and tools. The first step in working with TPS is defining what value the firm actually produces to the customer (both internal and external) (Liker, 2004). This is useful in order to detect and eliminate all features of process that do not add value i.e. waste (Liker, 2004).

The ultimate goal in TPS is to achieve the best quality, at the lowest cost, in the shortest lead time. A combination of methods is used in order to achieve this. Two of the pillars in the system are *Just-in-time* and *Jidoka*. Just-in-time intends to synchronize the pace of the processes in the firm to the customer demand i.e. minimize inventory. This reduces the cost for keeping stock as well as making it easier to detect errors in quality. Jidoka focuses on the quality in each function of the process, meaning that all errors should be found and handled when they occur. It is important to continuously question why errors occur and find the root of the problem (Liker, 2004).

3.1.2 Lean Thinking

The term Lean was first coined by Krafcik (1988) in 1988 and derives from the Toyota Production System (TPS) (Shah & Ward, 2007). The Toyota Way/Lean is highly integrated with TPS, however it extend beyond the systematic tools and includes the culture of continuous improvements and investments in employees needed to achieve the full potential of the system (Liker, 2004). To change an organizational culture into a Lean culture requires a highly committed management that supports employees to resolve problems, communicate and to continue to improve processes. The active involvement management is necessary in order to achieve a change that will sustain over time and not return to “normal” after implementing Lean (Liker, 2004). Hence, both the philosophical and practical perspectives are crucial in order to succeed with the implementation of Lean in a firm (Shah & Ward, 2007).

With Lean thinking the technical tools and principles of TPS can be adjusted to various types of companies, in both the production and service sectors. Lean management differs from general process improvements (e.g. raw material, R&D, service) that most firms aim at in the sense that Lean is more comprehensive. Traditionally, processes are improved by examining each step on its own rather than reviewing the whole chain. Lean however, promotes both systematic tools where all functions are mapped and scrutinized separately as well as in relation to the entire firm, and a culture of continuously questioning the value that each activity adds. Functions that do not add value to the customer should be eliminated (the customer defined as the end customer as well as internal customers e.g. the following unit in the chain) (Liker, 2004).

Hence, although Lean is often associated with practical tools aiming at reducing waste through methods like standardization or just-in-time, the strength in Lean rather lies in the commitment from the management that is required in order to achieve a culture change (Liker, 2004). Lean thinking must permeate the management in order to achieve a change that will sustain over time and become a competitive business that creates value for its customers and the society (Liker, 2004).

3.1.3 4P Model

The foundation of Lean management is the 4P model that includes four areas that needs to be included in the transformation into Lean; *philosophy, process, people and partner* as well as *problem solving* (Liker, 2004). According to Liker (2004) most companies focus on *the processes* that aim at eliminating waste and increasing efficiency in production. However in order to achieve long-term competitiveness this is not enough and will likely solely result in short-term benefits (Liker, 2004). The 4P model is divided into the 14 management principles by Liker (2004) (see figure 2 below). All principles need to be adjusted to the specific firm and for their specific purpose, working with continuous improvements, learning and innovation is necessary for this purpose (Liker, 2004).

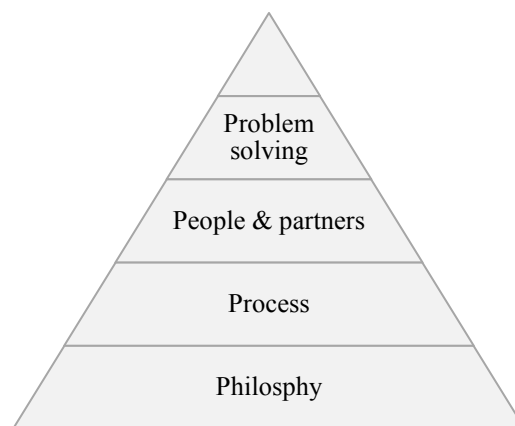


Figure 2. Illustration of the 4P-model. Source: Liker (2004).

3.1.4 Philosophy - Long-term

The foundation of Lean management and the 4P model is the long-term philosophy. Every company needs to define a purpose for which it exists, that goes beyond generating profit, that everyone in the organization are able to accept and work towards. All management principles should be based on this purpose, as well as commitment to employees, customers and society (Liker, 2004). Although the philosophy is fundamental in Lean, many companies implement Lean in order to achieve a positive financial outcome. However, in order to be able to reduce costs and sustain competitiveness the long-term perspective and responsibility sense of responsibility must permeate the management thinking (Liker, 2004:77):

“Base your management decisions on a long-term philosophy, even at the expense of short-term financial goals”

Employees that feel a sense of commitment to their workplace work towards continuously improve quality and reduction of waste, this strategy will according to Lean lead to implementing long-term profits (Liker, 2004). Especially when managing a firm in a changing business environment, the firm needs to create a culture of continuous learning that involves all members of the organization (Liker, 2004).

3.1.5 Process

The second part of the 4P model pertains the processes (the tactical and operational level of Lean), which is the part that often is thought of as “Lean”. This section has been divided into 7 principles and focuses on eliminating waste in the process, however these need to be improved continuously (Liker, 2004). The principles are; use only reliable, thoroughly tested technology that serves your people and processes, use visual control so no problems are hidden, standardized tasks form the foundation for continuous improvements and employee empowerment, build a culture of stopping to fix problems, to get quality right the first time, level out the workload, use “pull systems” to avoid overproduction and create continuous process flow to bring problems to the surface. According to Liker (2004) all firms have non-value-adding parts in their processes, i.e. waste that could be eliminated. These sources of wastes have been summarized to eight areas; overproduction, waiting, unnecessary movements of goods and transports, over processing, excess inventory, defects and unused employee creativity (Liker, 2004).

3.1.6 People and Partners

The third step in the pyramid refers to the personal relationships towards leaders, employees and business partners. In order to create and develop leaders in the company, these should rather be internally recruited than externally since it is important that a leader has a full understanding of the daily work as well as the overall philosophy to be able to motivate employees. In addition to leadership, the firm needs to develop a culture based on the values of the company that is deeply integrated in the daily work. By focusing on developing employees they will be able to strengthen the company philosophy and work harder if they have the knowledge and tools to do so. Teamwork should also be promoted to achieve the goals of the firm (Liker, 2004). By creating a respectful and long-term relationship towards external partners and suppliers this leads to positive effects for both parties (Liker, 2004). Working with partners that are engaged and have knowledge about the firm increases the quality of the service, at the same time as partners and suppliers are rewarded with new and larger orders. Generally Lean promotes external relationships where trust and engagement grows over time (Liker, 2004).

3.1.7 Problem Solving

The final stage of the pyramid concerns problem solving and is crucial toward achieving changes that will sustain over time and for the firm to be able to adjust in a turbulent business environment (Liker, 2004). A learning organization is created through constant reflection, questioning about how things are done and understanding problems when they occur in order to directly eliminate the cause of the problem. Decisions should be made slowly by consensus, thoroughly considering all options; implement decisions rapidly. To be able to detect errors it is important to use appropriate measurements in all parts of the firm, which makes it easier to set clear goals and motivate employees to work with improvements and

receive rewards for it. Models like the PDAC-cycle² are useful for this purpose and contribute to creating a learning organization and culture of continuous improvements. When everyone is working towards one common goal, small improvements in all steps of the firm eventually lead to big improvements that benefit the whole firm (Liker, 2004).

3.2 Green Strategy in SMEs

3.2.1 Environmental Factors Addressed in a Green Strategy

Nulkar (2014) presents a theoretical framework for the process and formulation of environmental strategies in SMEs that simultaneously create competitive advantage. Since no firm included in this study has more than 10 employees they are classified as SMEs according to the common definition of a maximum of 250 employees (Ayyagari et al., 2007). On a fundamental level the model (see figure 4 p. 14) aims at addressing the firm's capabilities to innovate and direct the organization towards green missions that originate from initiatives by managers but aims at permeate the whole business. The strategy focuses on green innovation in the sense of constructive problem solving, where the solutions aim at reducing both costs and environmental impact in a long-term perspective. The Green Strategic process also includes an approach in the planning step that addresses internal and external environmental factors, which are important to reflect on to gain a competitive advantage. (Nulkar, 2014)

All companies must primarily comply with current environmental *laws and regulations* in the market. This put pressure on companies to be dynamic and observant in the political field. Secondly the climate and *environment itself* is an important factor. Systems and processes within SMEs must be designed with a focus on reducing environmental impact and use of natural resources. The main focus is to reduce internal effects of the production in form of pollution and emissions of greenhouse gases. Consumer demand for transparency and sustainability in the production process that is affecting the environment has according to previous research increased. Nulkar (2014) argues that the purpose with the *customer* factor is to help identifying a group of customers and how to satisfy their demand. As an actor on the market there is a *risk of environmental mistreatments* and to violate environmental regulations or laws can be costly and destructive for the firm. Hence, in order to avoid this risk the green strategic management process has to be proactive. (Nulkar, 2014)

SMEs are often characterized by a constrained budget and because of that it may be challenging to keep up with industrial development and new standards that require rapid change. This aspect also requires constructiveness and companies to adapt current information respecting progress among competitors and the industry. Innovative environmental technologies are something that SMEs must consider and there are two distinct ways to view these innovations; either as a needless cost or as a strategic investment that can realize benefits from being an "early mover" in the market (Nulkar, 2014). Public opinion and consumer awareness are affected by *social initiatives* such as None Governmental Organizations. Elkington (1994) argues that businesses should not ignore or underestimate the power of Public opinion, or any stakeholders, since it may have high impact ability on consumer behavior. In addition Nulkar (2014) presents the *financial stakeholders* such as investors and insurers. These actors can judge an environmental aspect because of its potential connection to risk. Leadership is one of the most critical factors to succeed with the Green Strategy Process and it is also the main driver when implementing an ethical standpoint.

² The PDAC-cycle refers to the model of *Plan, Do, Act* and *Check*.

Ethical motives and approaches within the company require a strong visionary capability of management (Nulkar, 2014).

3.2.2 Generic Competitive Environmental Strategies

Orsato (2006) goes in line with Nulkar (2014) and argues that companies who implement a Green Strategy can accomplish simultaneous effects where increased profit can be one of them. There are several ways to create competitive advantages from environmental considerations. Orsato (2006) distinguish four generic ways for a company to formulate a Competitive Environmental Strategy. These generic strategies often merge and to reinforce a Green Strategy, using several of them parallel may be a strategy in itself. It is possible to use each of them isolated, therefore each strategy is presented secluded in the model (see figure 3).

The *Eco-Efficiency* strategy is suitable for companies that are in the need of both reducing environmental impact and costs. This means; “Develop capabilities to continuously productivity of their organizational processes while decreasing the environmental impact and the cost associated with them” (Orsato, 2006:132). This strategy also goes beyond the individual firm and opens up for wider industrial system that is able to optimize according to “ecological principles of optimizing” (Orsato, 2006:133). In practical terms this stands for collaboration, waste in one firm can be a useful resource in another firm, and the allocation is labelled as closed-loop system.

The second strategy, *Environmental Cost Leadership*, aims at reducing both environmental impact and costs in sectors where the customers are not willing to pay extra for added value. The product in this case is often in form of a function and the management must focus on developing innovative processes and systems but it can also be in form of modifying existing products or launching something new. Developing new clever techniques of manufacturing can besides from lower cost also lead to a unique competitive position or even in a long-term perspective reform the industry (Orsato, 2006).

Eco-branding is another tactic that can be defined as “a firm differentiates itself from its competitors when it provides something unique that is valuable to buyers beyond simply offering a low price” (Orsato, 2006:134). This is a straightforward approach that intends to generate competitive advantages. For realizing this strategy three requirements must be fulfilled; trustworthy information about the company’s environmental actions must be available for consumers, the customer must be willing to pay for the added value (created from Eco-branding) and the differentiation must be hard to imitate for competitors (Orsato, 2006).

Generally the fourth approach, *Beyond Compliance Leadership*, essentially intends to achieve more than required by law and implement environmental or ethical standards on a voluntary basis, this goes beyond organizational processes. The strategy also involves displaying this initiative of sustainable brilliance in public with the purpose to increase a positive image among stakeholders and consumer. Going beyond compliance leadership can be implemented by certification of some kind of Environmental Management Systems, for example by reporting according to Global Reporting Initiative or get ISO-certification and it can also be viewed as a communication strategy (Orsato, 2006).

To understand the connection between the strategies they can be paired together. Environmental cost Leadership and Eco-efficiency both attempt to reduce costs while Beyond Compliance Leadership and Eco-branding can be defined as differentiation strategies.

In terms of processes, Eco-efficiency and Beyond Compliance leadership focus on the organization while Eco-branding and Environmental cost Leadership centre products and services. Eco-efficiency can be suitable as a starting point since it helps to focus and prioritize. In general Eco-branding and Beyond Compliance Leadership are more problematic for SMEs because they often require innovative thinking and relative comprehensive changes (Orsato, 2006).



Figure 3. Generic Competitive Environmental Strategies. Source: Orsato (2006:131).

3.2.3 Green Strategic Process and Formulation in SMEs

Planning by set missions and goals of the business is central in the Green Strategy Process in SMEs and it is the first element out of six in the model created by Nulkar (2014). For the purpose of this study the model used for illustrating the Green Strategy process also focus on internal and external factors that is affecting the development of a strategy in the firm. Lastly how to position the firm and how to formulate various generic Competitive Environmental Strategies is connected to the strategy process (see figure 4).

The initial planning step in developing a green management strategy is to state the central direction by setting *Mission and Goals*. How to reach the main goal is directed by the company’s vision, and the vision is realized by transformation into more tangible objectives that should be both precise and measurable. It is also important to communicate all these concepts through the whole organization. The next step of the process is to broaden the business perspectives and do an external *situation analysis* (see 3.2.1). To get relevant focus tools such as stakeholder analysis and estimation of macro-environmental factors are used. The purpose with this step is to forecast potential external and internal effects and to identify

strengths and weaknesses of the firm in relation to the business environment it exists in (Nulkar, 2014).

After conducting an external analysis the next step is making the *Strategic Choices*, which according to Esty & Winston (2006) in an environmental context, means positioning the firm with a differentiation strategy based on environmental performance or producing to lower costs relative to competitors through environmental improvement (Esty & Winston, 2006). The concept of strategic positioning in this theoretical model is a development of Porter’s (1980) traditional competitive strategies of how to position the company in a competitive environment. The cost strategy is preferable for SMEs and the differentiation strategy include customer focus in terms of communicating to a specified target group (Nulkar, 2014).

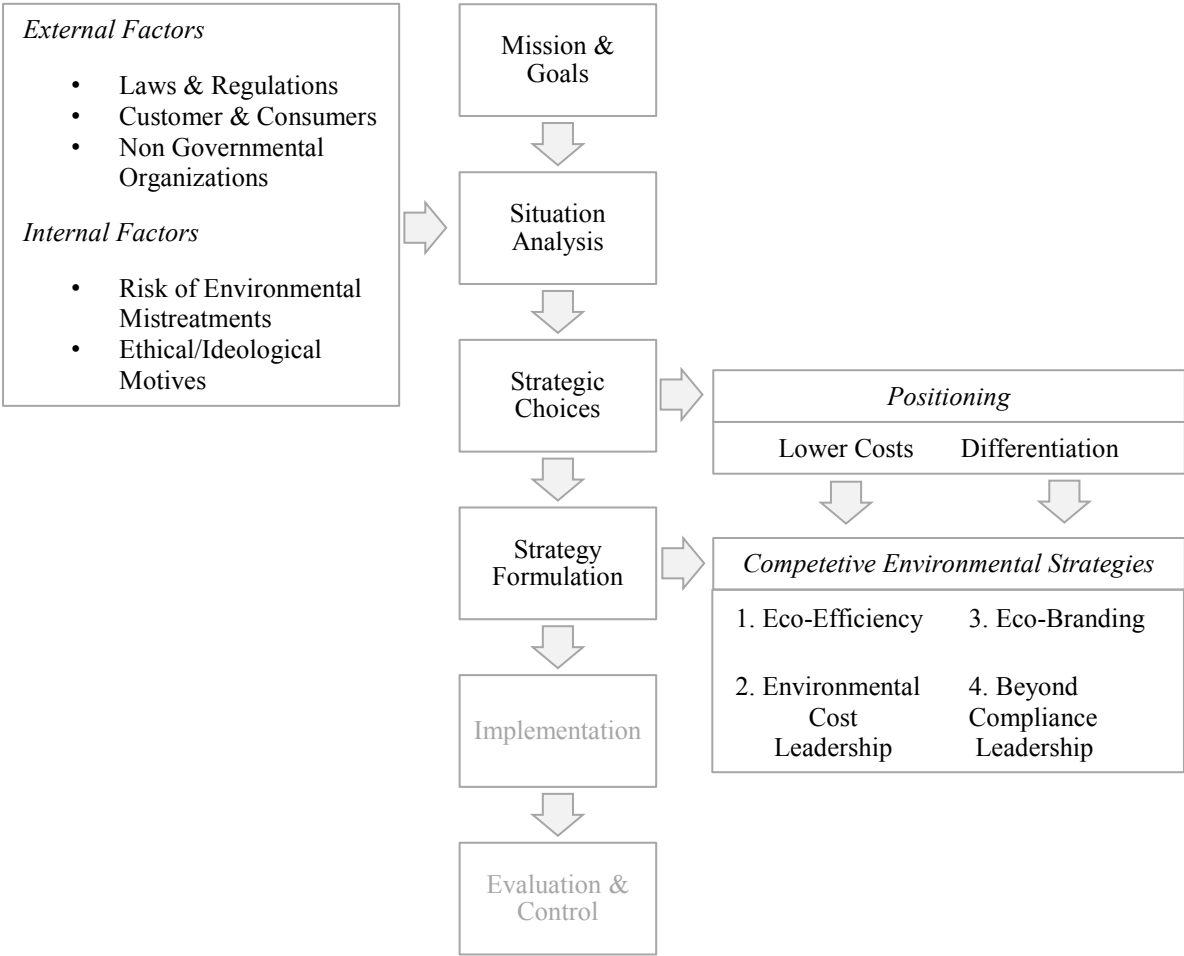


Figure 4. Process & Formulation of a Green Strategy. Source: Nulkar (2014); Orsato (2006); own modification.

To understand and continuously follow strategic choices a *Strategy formulation* is required (Nulkar, 2014). The strategic formulations can be expressed according to Orsato’s (2006) framework, the four Generic Competitive Environmental Strategies; *Eco-efficiency Environmental cost Leadership, Eco-branding and Beyond Compliance leadership* (see figure 3). The *implementation* is a risky part of the process because it may be difficult to achieve the desired outcome or to position the strategy. One important factor to reduce the risk of failing the implementing in SMEs is to enhance the human resource. It is important that the workforce is engaged in the overall process because the purpose is that new strategic

decisions are encompassed by everyone in the company. In order to motivate and engage it is important to define incentives or milestones. The workforce should also be included in the planning process that is an ongoing project that runs parallel with the action process. Furthermore the top management must be committed and it should also work as inspiration and the strategy can effect be mediated at regular meetings. Lastly an important part of the process is updated reflection in form of *Evaluation and control* (Nulkar, 2014). However, the last two steps in the model will not be reflected in this study.

4 Method

Chapter four describes and argues for the chosen methodology used in each step of the study. At first a thorough literature review was conducted in order to position the study and to determine relevant theories. This was followed by collection of empirical data through 16 in-depth interviews with farm managers. Finally the empirical data was presented and analyzed.

4.1 Qualitative Approach

This study has a deductive approach meaning that it has a theoretical foundation that is tested empirically (Bryman, 2008). The method is qualitative which enables the capturing of rich data in a natural setting to create an understanding of a complex phenomenon (Bryman, 2008; Robson, 2011; Trost, 2011). The purpose is rather subordinate the possibility to generalize in favor of subjectivity since certain complex problems cannot be fully understood by numbers (Bryman, 2008). When examining and describing a strategy, which is a way of capturing how people think and reason, a qualitative approach is appropriate (Trost, 2011). Further, the use of multiple case studies has become an established method within management studies since it provides deep insights to a small number of units (Bryman, 2008; Robson 2011). This method is chosen to achieve the aim of this study. The choice is supported by previous research as well, for example Johnson (2004) used in-depth multiple case studies when studying strategies in SMEs.

The theoretical reasoning, comparison and connections that evolve naturally in the process are a few of the strengths in a qualitative approach (Bryman, 2008; Robson, 2011). However, all scientific methods are subject to challenges that need to be considered and managed. When conducting a study with a relatively small number of samples the risk of these units not being representative for the group increases, which might generate a misleading result. Even when making a random selection within a population, the chosen population needs to be problematized to minimize the risk of choosing a population that may not be representative (Bryman, 2008). This risk has been considered in this study in choice of units within the reference group which is further developed in chapter 4.3.1 Choice of objects. The hazard of subjectivity is apparent throughout the entire research process and cannot be completely eliminated. However subjectivity requires understanding from the researchers and this has been regarded in a serious way by the researchers (Bryman, 2008).

4.2 Formulating the Theoretical Framework

4.2.1 Literature Review

The initial phase of this study was a literature review, systematically conducted in order to fully understand the research field, both today and historically. This review of previous research made is possible to identify a research gap and to develop the conceptual theoretical framework for the study by connecting established theories.

Table 1. Search words used in the literature study. Source: own modification.

Search words			
<i>Management +</i>	<i>Lean +</i>	<i>SME +</i>	<i>Farm +</i>
Strategic	Agriculture	Env. strategy	Management
Decision-making	Green	Strategic management	Strategies
	Env. strategy	Leadership	Operational
	Green strategy		

The main databases used for the literature search were; *Primo*, *Unisearch* (available through Linköping University) and *Google Scholar*. A combination of search words was used in order to find appropriate research which is presented in table 1.

4.2.2 Choice of Theory

The theory of Lean (see chapter 3.1) was chosen to provide an understanding of the origin and core principles of the management system that serves as the foundation of Lean Lantbruk. The presentation of the theory of Lean is complemented with practical information of Lean applied in agriculture in both chapter 5.1 Empirical Background as well as in a detailed table in appendix 1 where the 17 Modules of Lean Lantbruk are presented.

The theories used in the field of management often originate from areas such as sociology, economics or psychology (Alvesson & Deetz, 2000). The main theory Green Strategies in SMEs (see chapter 3.2) is a general strategy process model within strategic management. The model also includes dimensions of Porters traditional positioning strategies and four Generic Competitive Environmental Strategies adjusted to fit SMEs (Porter, 1980; Orsato, 2006; Nulkar, 2014). For the purpose of achieving the aim in this study the model of the general strategy process is limited to focusing on the four first steps within the strategy process i.e. *Mission & Goals*, *Situation Analysis*, *Strategic Choices* and *Strategy formulation* (Nulkar, 2014). The last two steps in the model, *Implementation* and *Evaluation & Control*, are excluded since the purpose is not to measure or control the realization of the strategy, rather to capture tactical and operational strategies. The strategy formulation is extended with the four Generic Competitive Environmental Strategies presented by Orsato (2006); *Eco-efficiency*, *Environmental Cost Leadership*, *Beyond Compliance Leadership* and *Eco-branding*. The reason for relating these theoretical descriptions of environmental strategies is to help answer the research question by identifying climate efficiency strategies on the farms.

Since the theoretical model of Green Strategy has not been especially designed for an agrarian context, the external factors in the *Situation Analysis* have been modified in order to be relevant for Swedish agricultural firms. Among the external factors the definition of the customer has been extended to include both consumers and customers since the primary buyer of the product may vary being the end consumer directly meanwhile others market the product through the cooperative to a retailer who sells to the end consumer. Since the supply chain may vary quite a lot this would also effect who the firms view as their customer. In addition, the aspect of financial stakeholders has been excluded since the existence of environmental strategies is rarely relevant for this stakeholder, e.g. banks, in small Swedish agricultural firms. Further, the natural environment and biological operating conditions has been excluded as an aspect on its own since it is highly integrated in all parts in a farm.

4.3 Empirical Data

4.3.1 Choice of Interview Objects

This multiple case study includes 16 objects, eight farms that have implemented Lean and additional eight reference farms. The chosen number is sufficient to generate a nuanced empirical result in a qualitative study. Since the purpose is not to generalize findings but to describe and create understanding, including additional objects would not necessarily contribute with more than what can be captured by the eight main units plus references. (Bryman, 2008; Trost 2011). This amount is also supported by previous studies, for example Andersson and Andersson (2014).

The first selection of objects was limited to firms that have joined the project of Lean Lantbruk and that are located in the region of Västra Götaland, Sweden. Further, this sample was restricted to the group entering the project in 2012 in order to receive a group of farms that had completed their 18 month programme by the time they participated in this study. This sample consisted of 21 farms, out of which nine firms were randomly selected and contacted by telephone. One farm declined to participate in the study because of a negative attitude towards Lean Lantbruk.

In order to strengthen the validity of this study a group of reference companies, meaning firms that have not participated in Lean Lantbruk, were included in the study. The two comparative groups are used to minimize the risk of observing results that are general trends rather than effects generated by Lean Lantbruk. The selection of the reference farms was made based on the characteristics of the eight chosen Lean companies, a well-established method often used in statistics called matched sampling (Rubin, 1973). The purpose is to receive two comparable and equivalent objects by choosing each pair with precision (Rubin, 1973). For this study each Lean company was matched with a reference farm located in the region of Västra Götaland and similar characteristics with consideration to: enterprises, tillable land, cattle, number of employees and the natural prerequisites such as plains or forest. The reference companies were found through a local advisory firm who provided information and suggestions for suitable farms. Two or three suggestions of reference farms for each Lean company were defined, out of which one was randomly selected.

4.3.2 Collection of Data

A week before the collection of empirical data a pilot interview was conducted with a farm that is currently participating in Lean Lantbruk. This is a method used for ensuring the quality and enables the interviewers to test the structure, interpretation and understanding. It also allows for reformulating the questions if necessary (Robson, 2011).

The interviews took place between 2nd of March and 18th of April 2015 and consisted of in-depth face-to-face interviews with the farm manager at each farm. Each farm visit lasted for approximately 60 minutes and the interviews were semi-structured, meaning structured by open questions in a predetermined order (Robson, 2011). In order to be able to manage and compare the empirical findings in a multiple case study it is beneficial to structure the interview, although the open questions allow for follow-up questions and clarifications (Robson, 2011; Bryman, 2008). More specifically, the interview followed a themed questionnaire structured according to the theoretical model of Green Strategy Process (see figure 4 in chapter 3.2.3 and appendix 2), which is beneficial when managing and comparing

the collected data from multiple cases (Trost, 2011). The themes were chosen from relevant parts of the strategy process model however with focus on climate efficiency. What actions on the farms that is classified as climate efficient are based on the section within Lean Lantbruk focusing on reduction of environmental impact (see appendix 1) as well as the Swedish advisory programme *Greppa Näringen* that promotes sustainable agriculture (www, Greppa Näringen, 2; www, Lean Lantbruk, 4).

In order to obtain necessary data for answering the research question regarding the adherence to climate efficiency strategies at the farms the interview questions mainly focus on the operational level, and less direct focus on strategic management which has a long-term perspective. This is in line with the method used by Koeijer et al. (2003) who examines effects of strategic management on technical efficiency at farms by focusing on operational management procedures. It is also supported by the studies of Harling & Quail's (1990) that show that strategies are not always formulated, but in some cases shaped by a series of actions. This method is suitable for this study since SMEs does not necessarily have clearly formulated long-term strategies, although there might be an unspoken strategy.

The method of using in-depth interviews in management research is supported by previous studies (see Rougoor et al., 1998; Nuntamanop et al., 2013), and is also perceived to provide sufficient data needed to answer the research question (see chapter 1.3). However, even though in-depth interviews have the potential to capture multiple dimensions there are challenges associated with the method. The respondent might in the interview situation feel pressured and respond to the questions in a way he or she assume that the interviewers wants to hear (Kvale & Brinkman, 2009). This has been taken into account when conducting the study and affected the design of the interview, for example by creating a relaxed and open atmosphere by conducting the interview at a location chosen by the manager as well as starting each meeting with an introduction of everyone present. Each interview was recorded and later on transcribed.

Apart from the primary empirical data, secondary data in the form of literature, articles, reports and websites has been collected and used. Financial information (presented in chapter 6.1) has been collected through annual reports. The turnover has been chosen for the purpose of providing a sense of the size of the company. However, this measure only includes revenues from the main enterprises.

4.3.3 Presentation of Data

Initially all 16 farms included in the study are described with information concerning *production, field, pasture, livestock, employees, hours/years* and *turnover* to provide the reader with an understanding of the companies. The large amount of empirical material in form of the transcription from the interviews has been managed with thematic coding relevant for answering the research question. By structuring the data through categories the relevant findings was highlighted (Rubin & Rubin, 2005). Within each category, themes and keywords were carefully distinguished through coding of the material with focus on Green Strategy, a method suggested by Rubin and Rubin (2005). The identified keywords are presented in tables (see chapter 5.3.1-5.3.6) with the purpose to give a summary that is easy to grasp and this is an appropriate way to manage results in qualitative studies according to Robson (2011). The tables with keywords are complemented with a description in text and quotes to highlight important details and nuances. The overall structure of the results is in accordance with the modified themes from the questionnaire and relevant parts of the Green Strategy process.

Lean companies and reference companies are presented separately in the three main sections; Mission & Goals, Situation Analysis and Strategy Formulation.

4.3.4 Analysis of Data

The unit of analysis in this study is the Lean farms, which are compared to the reference farms. In order to facilitate the understanding of the analysis process for the reader it is structured according to the central theoretical model of this study, the Process & Formulation of a Green Strategy and this design of an analysis is suggested by Trost (2011). The aim throughout the whole exploration is to link the empirical findings with the theoretical framework. The aim is also to identify and highlight similarities and differences between Lean and reference farms and in this process the keywords are central.

The first part of the analysis (see chapter 6.1) focuses on the first two steps in the process of a green strategy; Mission & Goals and Situation Analysis. This part is built on reasoning in text and is contextual for the second part (see chapter 6.2) of the study which is the core analysis. In the core analysis the results are identified and categorized according to the four Generic Competitive Environmental Strategies. This section includes a complementing table (see table 9 in chapter 6.2.1) with purpose to provide a summarized picture of the various Competitive Environmental Strategies that exist on each farm. There are differences in the extent to which these strategies are used. To clarify the distinction the application of respective strategy is graded according to the scale low, medium or high. These grading's are relatively measures in comparison to each other.

4.4 Ethical considerations

Ethical considerations have been taken into account throughout the whole process according to Bryman's (2008) recommended principles. There has been focus on consistent and clear communication regarding the purpose and the performance of the study to avoid misunderstandings. Each respondent were informed that all material is used confidentially and aware of the choice to refuse the recording of the interview. In addition, the respondents were sent a copy of the transcription to approve the information gathered during the interview, as well as an opportunity to add and/or remove information. In addition to the ethical consideration this approach increases the scientific quality (Kvale & Brinkman, 2009; Trost, 2011). Finally, the interviews were planned and completed with considerations to the increase in workload for Swedish farmers during the spring, when the crop season starts, and were therefore planned to take place prior to planting.

5 Empirics

This chapter contains a presentation of the empirical findings concerning the Green Strategy process and formulation gathered from the interviews. Initially background information of the programme of Lean Lantbruk is concisely declared, followed by a brief description of each farm. The empirical findings are presented in tables with key words and complementary text.

5.1 Empirical background

5.1.1 Background & Purpose - Lean Lantbruk

Lean has previously been used to improve firms within in a wide set of industries. The project Lean Lantbruk is enacted through a cooperation between several Swedish advisory organisations, associations and research institutions that are connected to the agricultural sector. Activities within Lean Lantbruk started in 2010 and are divided into three phases; method development, national mobilization and implementation of Lean Lantbruk on agricultural firms. Federation of Swedish farmers own the project but the Agricultural society of Halland is the driving unit where most of the work has been carried through (www, Lean Lantbruk, 2). In addition several agricultural advisers have been trained to become Lean coaches. In 2011 the first six Swedish farms entered the 18-month Lean programme and today 97 farms have started their Lean journey (Pers. com. Andersson, 2015).

The aim with Lean Lantbruk is to increase competitiveness, increase efficiency and promote continuous improvements in agricultural firms. Competitiveness is defined as (www, Lean Lantbruk, 2):

- Profitability
- Long-term persistent
- Climate efficient
- Environmentally efficient
- Keep a huge animal welfare
- Development of leaders and employees
- Improve capability and timeframe of assimilating new knowledge and technology

The overall objective with the Lean initiative is to generate growth at Swedish agricultural firms (www, Lean Lantbruk, 4).

5.1.3 The programme

In order to achieve a change that will sustain over time in the specific firm working with Lean requires practice (www, Lean Lantbruk, 1). The programme Lean Lantbruk is designed to last for 18 months and it is decomposed to 17 modules (See appendix 1). It includes monthly lectures and appointments with visits at the farm by a Lean coach that provide custom made guidance for how each farm can work with Lean in their firm. However, the role of the coach is only to provide the tools that the farm needs in order to find solutions to the challenges that they perceive (www, Lean Lantbruk, 1, 3, 4). The total cost of the programme amounts of 47 000 SEK. Briefly, the Lean programme in agrarian context focus on: customers in the production process (what does the customer pay for and what creates values), reduction and prevention of losses and waste of resources by finding the root cause of the slack and lastly it

high lights robust, sustainable and stable systems and to achieve changes it is important to engage all people in the company (www, Lean Lantbruk, 4). A summary of the Methodology in the Lean Lantbruk programme is illustrated in figure 5 below.

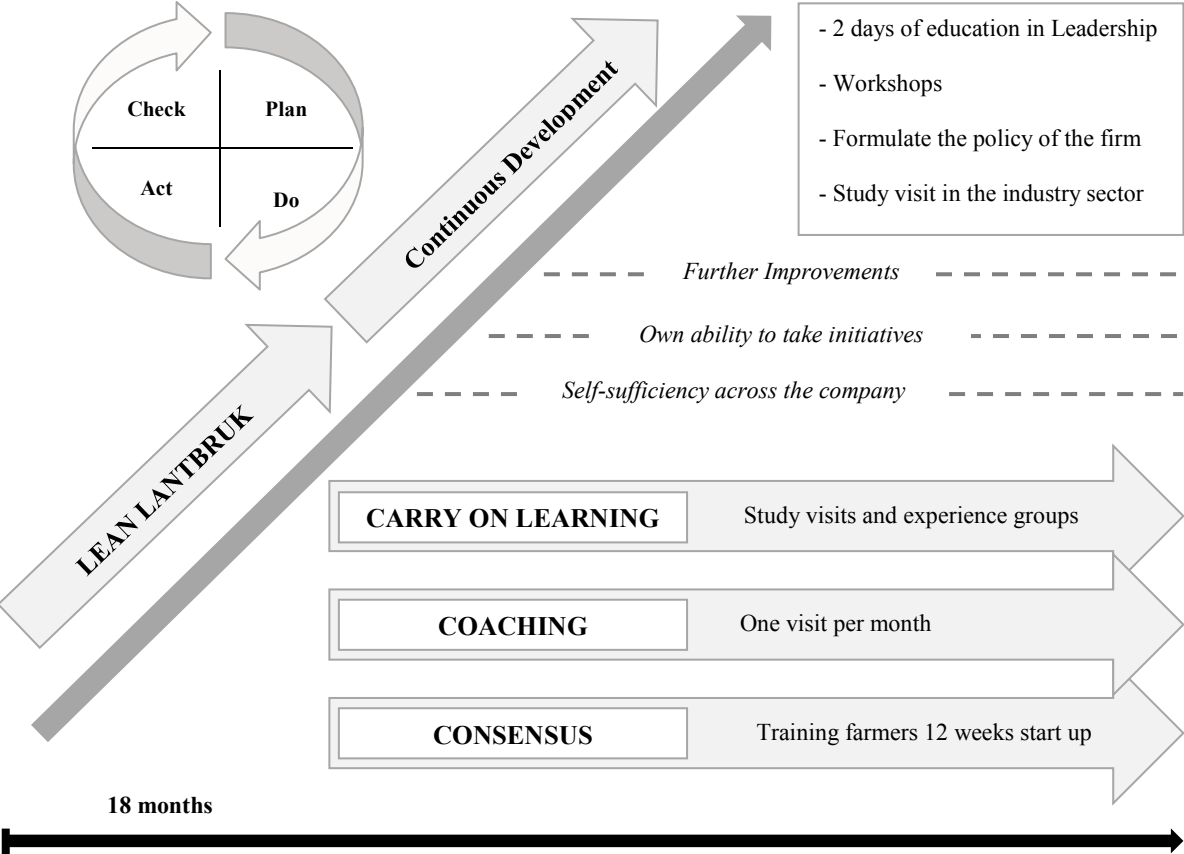


Figure 5. The elements in Lean Lantbruk. Source: www, Lean Lantbruk, 4.

5.2 Description of Case Companies

An overview of selected parameters that characterize each farm is presented in Table 2. The chosen parameters aim at providing a brief description of the case companies included in the study and consist of; main production, hectares (both tillable and pasture), livestock, employees, annual labor requirement expressed in hours per year and the company's annual turnover. The turnover is an average for the past three years and has been adjusted for revenues generated from forestry which has been excluded. This measure only includes revenues from the main enterprises. Livestock represents the production, such as numbers of dairy cows in a dairy production and numbers of steers or bulls in a beef production. Each Lean farm is presented next to the matching reference farm (R).

Table 2. A brief description of the case companies included in the study. Source: Farm 1-8, 1R-8R.

Farm	Production	Tillable land (ha)	Pasture (ha)	Livestock	Employees	Hours/year	Turnover 1000 SEK
1	Crop	334	-	-	1-2	2700	4 922 ³
1 R	Crop	300	-	-	1-2	2700	3 010
2	Dairy	80	15	75	2-3	3500	3 115
2 R	Dairy	137	50	80	2	3600	3 040
3	Beef	250	400	1100	3-5	8000	14 383
3 R	Beef	300	480	480	2-3	6000	5 735
4	Dairy	300	50	90	5	10800	6 325
4 R	Dairy	300-550	80	500	10	20000	18 385
5	Dairy (eco)	320	90	280	5-6	10360	12 025
5 R	Dairy (eco)	500	100	160	7	14000	10 699
6	Beef		100	300	3	5500	4 167
6 R	Beef	350	25	700	3	5400	10 754
7	Dairy	150	50	120	3-4	5400	4 954
7 R	Dairy	160		100	1-2	2750	-
8	Dairy	190		120	3-9	6000	5 643
8 R	Dairy	120	40	180	4-5	8100	6 442

³ Farm 1 has recently changed from broken fiscal year to calendar year. Hence, the turnover represents 18 months.

5.3 Results

5.3.1 Mission & Goals – Lean Companies

In order to recognize a strategy the underlying mission and goals need to be understood. During the programme Lean Lantbruk all companies have defined clear goals with the business, in table 3 keywords of their current mission and goals are presented.

Table 3. A presentation of the Mission and Goals expressed by the Lean companies. Source: Farm 1-8.

Farm	Mission & Goals
1	Survival, Financial stability
2	Lowest production cost in the region, Optimize cost and revenues, Competent labor, Healthy animals
3	Maintain farm size, Control the whole chain, Deliver high quality meat
4	Farm in balance, Efficiency, Profitable, Limited working hours
5	Expand, Pleasant work environment, Limited working hours
6	Quality of life, Profitability, Manage the property, Develop the business
7	Highest production in local area, Financial stability, Pleasant work environment
8	Profitability, Next generation, Pleasant work environment, Limited working hours

A majority of the farms mainly expressed financial goals such as survival, profitability and optimization of costs and revenues. Several of the firms perceive a general trend towards larger farms and they have grown in recent years. The current phase affects the goals and this has in several cases led to a need to stabilize the business rather than to grow. Farm 1 has recently changed to solely crop production and currently aims at creating a financially stable company. In addition to focusing on efficiency the beef farms strive to develop the business in the sense of expanding into several business areas or controlling additional parts of the chain, for example distribution. The dairy farms on the other hand primarily focus on efficiency in production, for example farm 4 express increased efficiency in production as the only possibility to increase profitability, except growing, since they are producing a primary product for a mature market:

“It is a primary production and it is a settled market. Then it is all about cost effectiveness and it will always be about that, cost effectiveness, you can get paid for innovations but it is like, if you are at the bottom, whatever it is, minerals, oil, or what the heck it is, milk. It is those who are effective that...” (Farm 4)

In addition to financially related goals, the working environment is expressed as an important aspect by several managers, implying limited working hours and a pleasant work environment for themselves and the employees. Farm 8 aims at passing on the farm to the next generation, meanwhile farm 4 is working towards creating a business that easily can be sold within 5 years.

5.3.2 Mission & Goals – Reference Companies

In table 4 the keywords for the mission and goals for each reference company is presented.

Table 4. A presentation of the Mission and Goals expressed by the reference companies. Source: Farm 1R-8R.

Farm	Mission & Goals
1 R	Viable firm, Maintain current level
2 R	Survival, Maintain small-scale
3 R	Profitable, Expand, Continuous improvement
4 R	Profitable, Expand
5 R	Survival, Viable, Develop the farm
6 R	Survival, Expand
7 R	Profitable, Expand
8 R	Survival, Animal welfare, Environmental friendly, Efficiency

The reference companies mainly express financial and size related mission and goals. Four farms expect to grow in size, either number of animals or buildings/land, while three farms aim at maintaining the current size and rather focus on increasing efficiency and to achieve balance in the firm. Farm 8R explicitly express goals related to animal welfare and the environment, mainly to reduce use of antibiotics and environmental impact in the crop production.

“Well, of course I want a business that manages to support myself. And I am not ashamed when I say that I will not make money, but I am not going to do all my work for free. Because I think that what we do is important and you should get paid for it. I think that we all try to focus on, well you know, we aim at always prioritizing the animals and to be careful with antibiotics and, you know, this kind of long-term environmental goals and think about what we do, both regarding crop production and manure and so on, because this is very important here...” (Farm 8R)

One farm, 2R, differs from the others concerning expansion since the aim is to maintain a small-scale farm and produce a local premium product and only to provide enough income to support the owner and the employee. Farm 7R expresses a desire to limit the current number of working hours.

5.3.3 Situation Analysis – Lean Companies

A situation analysis is conducted according to the Green Strategy process (see chapter 3.2.1). This analysis involves how the firm relates to internal and external factors. Table 4 contains a summary on if and how relevant factors in form of; expected future laws and regulations, risk for sanctions, expectations from consumers, expectation from customers, pressure from NGO:s and underlying ethics or ideology affecting the firm activities.

Table 5. A summary of the keywords describing Situation Analysis conducted by the Lean companies. Source: Farm 1-8.

Farm	Laws	Sanctions	Consumers	Customers⁴	NGO	Ethics/ Ideology
1	Identify, Affect	Routines	Ignore, No affect	National	No affect	-
2	Identify, Affect	Passive	Identify, No affect	National	No affect	Animal welfare, Landscape
3	Identify, Affect	Advisory, Routines	Identify, Affect	Local, Regional	No affect	Animal welfare, Work environment, Landscape
4	Identify, No affect	Routines	Identify, No affect	National	No affect	Optimization
5	Identify, Affect	Certified, Routines	Identifies, Affect	National	No affect	Animal welfare, Environment, Family
6	Identify, No affect	Passive	Identifies, Affects	Local	No affect	Animal welfare, Transparency
7	Ignore, No affect	Passive	Ignore, No affect	National	Affect indirect	Open field, Optimization
8	Ignore, Affect	Advisory	Ignore, No affect	National	No affect	Animal welfare, Small-scale

Laws

Concerning laws and regulation, six farms identify and to some extent follow the discussion regarding future requirement and four farms perceive that this factor affect the management of processes. Farm 1 works actively to reduce dependence on subsidies in order to be less vulnerable to changes in the political system. Meanwhile farm 3 and 5 are active in political discussions to influence laws and regulations. Farm 2 expects more extensive regulations regarding the environment and animal welfare, which in a relatively near future may force them to rebuild their livestock. This expectation is also supported by farm 8 that chose to not focus on future laws and regulations, but still is aware of that they will likely have to make new investments in their livestock in order to comply with upcoming rules. The rest of the farms express that there is no point in worrying (no affect).

Sanctions

In order to avoid potential sanctions for not following laws and regulations five farms work actively to avoid such penalties. The ecological farm (5) perceives the certification of KRAV and the quality programme by Arla (Swedish dairy cooperative) as a tool to help comply with current regulations, also farm 8 uses the quality programme by Arla as a tactic. Farm 3 use both yearly cross compliance and routines in form of an own data management system to avoid mistakes that lead to sanctions, meanwhile farm 4 focus on structure in the documentation.

⁴ The customer factor is categorized depending on the purchaser's catchment that each farm delivers to.

Consumers

Five farms try to identify patterns in consumer demand, although only three of these actively adjust their business operations to meet them. Farm 3 identifies demand for openness and transparency in the production system and responds to this by inviting consumers to the farm and selling beef through a shop at the farm. Another company (5) perceives a trend towards ecological milk and the added value of food produced in Sweden. Based on this they produce ecological milk, and makes the decision (ecological versus conventional) on a five year basis depending on consumer trends and financial compensation. A similar development towards the added value in Swedish food and more specifically locally produced food is identified by farm 6. Because of this they market their beef as a local brand in the area and reach out to consumers by visiting and marketing the beef in stores. Farm 2 and 4 identifies a trend towards ecological and locally produced dairy products as well as a demand for transparency in production, but it has not yet realized change in production system. Farm 1, 7 and 8 do not at all pay attention to consumer tendencies since they either perceive consumer behavior as irrational or that they pay attention to their customer (the industry) rather than the end-consumer.

Customers

In contrast to the dairy farms that deliver to a national cooperative, the beef farms market their products to the industry on a local and regional level. Farm 3 markets some of the beef at the farm and the rest to a regional slaughterhouse. Farm 6 is a part of a local cooperative that sells beef mainly within the local area. All firms perceive the dialogue between them and the customer to be one way communication, regardless if they sell to a cooperative that they are a member of or to an external buyer. Although farm 6 experience requirements given from their customer to be deficient, it is perceived as the producers in this case has to put pressure on the customer, rather than the other way around.

NGO

Concerning pressure from NGO:s the majority do not perceive pressure to such extent that it affect their business. One manager expresses that they have a positive relationship to for example environmental organization and another manager think that this kind of organizations have an effect on laws that in the next turn affect the business.

Ethics/ Ideology

Each firm, except farm 1, expressed some kind of value or ideology that determines or to some extent affects the business. Some of the highlighted values where the importance of animal welfare, the local and open landscape. Also the ideas about a sustainable production system considering environment and working conditions, as well as transparency in the production system were mentioned. Two farms view optimal use of resources and efficiency as an underlying ideology, implying that each input or effort must generate a value;

“My opinion is that ecological, or KRAV is a brand, it is a business concept the way I see it. I do not agree with everything that ecological stands for, or that it should be so much better than what I do. But, on the contrary I do believe in ‘adjustment of needs’, that we should strive for optimizing all inputs, and like that, when it comes to spraying and fertilizing and whatever it can be, forage and everything.” (Farm 4)

5.3.4 Situation Analysis – Reference Companies

In table 6 the keywords for the each factor in the situation analysis among the reference companies is summarized.

Table 6. A summary of the keywords describing Situation Analysis conducted by the reference companies.
Source: Farm 1R-8R.

Farm	Laws	Sanctions	Consumers	Customers	NGO	Ethics/ Ideology
1 R	Identify, No affect	Active, No routines	Ignore, No affect	National, Regional	Affect indirect	Environment, Property
2 R	Ignore, No affect	Passive	Identify, No affect	Local	Affect	Family, Lifestyle
3 R	Identify, No affect	Advisory, Routines	Identify, Affect	National	No affect	Animal welfare, Environment
4 R	Identify, Affect	Routines	Identify, No affect	Regional	Affect	Animal welfare
5 R	Identify, Affect	Active	Identify, No affect	Regional	No affect	Animal welfare
6 R	Identify, No affect	Advisory	Identify, Affect	Regional, National	Affect indirect	Environment
7 R	Identify No affect	Passive	Ignore No affect	National	Affect indirect	Animal welfare
8 R	Identify, Affect	Certified	Identify, No affect	Regional	No affect	Animal welfare

Laws

All reference companies except one identify and follow discussions regarding future rules and regulations. Expectations on future laws and regulations affect three of the companies and the manager of farm 5R and 8R engage actively in political discussions at a level of decision making. Farm 4R expresses that regulations regarding animal welfare limit their possibilities to expand. Another farm perceives long-term planning as difficult, referring to uncertainty of future laws.

Sanctions

The way to handle the risk of sanctions varies and two farms mention routines as an important support. Others use external help in form of advisors to avoid mistakes, for example in the planning process in the crop production or through cross compliance. Farm 8R views certification, for example Svensk Sigill, as a tool to meet the requirements of current laws and avoid mistakes. The crop farm highlights the importance of contracts in collaboration in order to avoid unnecessary risks. Two farms actively handle this risk. Farm 4R, perceive pressure to put down animals that are sick instead of treating them, since there is a risk that the animals will be found and the farm punished for mistreatment. Farm 5R gathers farmers in the local area to discuss, respond and adjust to specific rules.

Consumers

Six farms pay attention to consumer demand and trends in this behavior and four of these has identified a trend toward Swedish and locally produced food as well as transparency in the production. Two companies (3R and 7R) are considering changing the production system from conventional to ecologically due to the increase in consumer demand toward these kind of products. Firm 6R identifies a trend toward openness in production and responds to this by visiting the local grocery store in order to meet the consumers;

“Well, it is the consumers that keep us alive so we have to be responsive to them. Now and then we demonstrate the beef in stores and then you can listen to a bit of what they say. And it is actually very important because... Or now they want to rise the... It is obvious that if people buy less beef it will affect... The prices might fall... Or, after all you have to... You have to keep up with everything” (Farm 6R)

The trend towards transparency in the production process is supported by two milk farms and they respond to this by keeping the farm open for visitors and showing the production system. One farm expresses that even though it tries to respond to consumer demand, the manager claim that the consumers are irrational and it is therefore hard to meet the demand.

Customers

Farm 6R market their product directly to restaurant business or to a regional customer and two farms distribute to a national buyer. Half of the reference companies perceive a one way communication between them and their purchaser, regardless if it is a cooperative that they are a member of or an external buyer. Some farms experience a good dialogue with their buyer where requirements are discussed and two farms view themselves as the cooperative itself and view the retailer as the next step in the chain, however both perceive this relationship as complex. Farm 4R view the relationship with the rest of the supply chain as positive although it is difficult to affect pricing, meanwhile another farm describes the relationship as the retailer has all the power. One crop farm and one beef farm has diversification strategies and distribute to several clients, both regional and national.

NGO

Many firms perceive that NGO:s in the form of environmental organizations affect their business to some extent and most of them mean that they have mainly an indirect effect on the business by affecting political decisions, retailers and consumers. Firm 4R perceives a high pressure from environmental organizations with experiences of unannounced visits. The business leader of farm 8R acknowledges the importance of the discussion that this forum raises, but not the way the discussion takes form today.

Ethics/ Ideology

A majority of the farms that operate livestock products express animal welfare as the most important part of the business. Three farms express the importance of minimizing the negative impact on the environment. Farm 2R distinguishes by highlighting that working at a farm is a lifestyle rather than a profit making business and the most important aspect is to be able to keep it this way and pass it on to the next generation.

5.3.5 Strategy Formulation – Lean Companies

The strategy formulation of the firm is divided into three parts; *new energy system*, *machinery* and *production*. The first part *new energy system* refers to strategic management and captures thoughts regarding future energy supply, both sources of energy and most important criteria's when making a new investment. The second and third part captures the operational level, where *machinery* aims at describing what kind of machinery the farm has, how it is used and routines. Meanwhile *production* summarizes the most important factors in the firm strategy for achieving the optimal results when utilizing the production system.

Table 7. A presentation of the keywords describing the strategy formulation of the Lean companies.
Source: Farm 1-8

Farm	New Energy System	Machinery	Production System
1	-	Technology, Reduce fuel, Reduce time, Extensive regular maintenance	Optimal crop conditions
2	Solar energy, Wind power	Hire, Bind minimal capital, Follow-up fuel, Extensive and Routine maintenance	Forage, Routines, Animal environment, Feed advisory, Milk heat recovery
3	Biogas	Self-sufficient, Technology, Reduce fuel, Optimize logistics, Routine maintenance	Management, Routines. Animal health & environment, Feed advisory, Contracts, Forage
4	Solar energy	Self-sufficient, Bind minimal capital, Routine maintenance, Technology, Follow-up fuel	Advisory, Routines, Feed, Recruitment
5	Solar energy	Self-sufficient, High utilization, Eco-driving, Regular maintenance	Routines, Feed advisory, Forage, Biogas collaboration, Milk heat recovery
6	Biogas	Hire, Bind minimal capital, High utilization, Fuel sample, Eco-driving, Regular maintenance	Continuous improvement, Sales, Feed
7	Biogas	Hire, High utilization, Optimize logistics, Regular maintenance	Routines, Feed advisory, Forage
8	-	Hire, Bind minimal capital, Regular maintenance	Routines, Animal environment, Recruitment, Feed advisory

New Energy System

All farms, that have new investments in mind, would invest in some kind of renewable energy, mainly solar energy or biogas. What motivates solar energy is the never ending source of energy, the sun, as well as the large buildings with a roof surface suitable for solar panels. Although they think the investment is currently too big to be possible. Energy through biogas is the other alternative and it is motivated by a desire to use waste resources at the farm and turn it into energy that can be used at the farm, in order to be self-sufficient;

“Well, first of all it has to be profitable. It has to lower the energy costs. The energy costs we have today. And then it would be extra fun if we could, if we have access to our own energy source. So of course we have played with the idea of biogas, rotting and things but we are too small and it has not been any brilliant businesses these biogas plants...” (Farm 6)

Important criteria's for one of the farms that did not provide a specific answers of potential new energy systems where oil independency, reliability and user friendly. The second farm would prioritize profitability and environmental impact.

Machinery

Strategies regarding the machinery system are different and half of the Lean companies aim at hiring some or most machines instead of keeping them in-house. This reduces capital investments and allows for high efficiency in the use of the machinery that is kept. Three farms specialize in few machines that are used within the firm as well as providing custom services to other farms. Farm 7 choose to have few machines in-house, although the machines that they do buy need to be very flexible and well equipped in order to use them for the most common tasks. Farm 3, 4 and 5 are to a high degree self-sufficient and keep most machines themselves, although hire machinery services for special occasions. Mainly this aims at reducing the timeliness cost. Three of the farms view high utilization as an important part of their strategy for machinery. Also, the extent of maintenance of the machinery varies between the firms. Farm 1-4 have extensive and/or routinized maintenance, meanwhile the rest conduct regular maintenance although without any kind of routines. Two farms (3 and 7) optimize logistics in order to minimize driving at the farm. Five farms do to some extent follow-up or work towards reducing the use of fuel in their production, meanwhile farm 5 and 6 prioritize eco-driving as a strategy to minimize fuel consumption.

Production

In this section each company describes the most important parts of their strategy to achieve an optimal production. Six Lean farms perceive routines in the daily work to be crucial, implying that all tasks should be performed in the same way at the same time every day, no matter who is working. For example farm 5 mentions strict routines in the milking process to achieve the best possible results in the production. Management of farm 3 consists of a board including the leaders at the farm as well as external experts. For all farms that operate livestock production, the feed system is a main factor in order to achieve an optimal production, either referring to feed advisory or quality of the feed. Animal health is also important for achieving an optimal production and farm 3 uses routines, observing the calves' conditions twice a day as a tool to reassure healthy and growing cattle. Forage is the most important crop of the farm since it is used for feed.

Company 4 and 6 grow their own protein to a great extent. Farm 3 is considering introducing protein crops and farm 7 focuses on fertilizers to achieve a high level of protein in the forage. Farm 5 has biogas collaboration with farmers in the local area. The manure is transported to the common biogas plant that distributes gas to vehicles. They get back manure that has been enriched and transformed into better quality and substance. This is a new investment but also an important part of having access to high quality manure to ensure efficient crop production which is the key for optimal dairy production. Farm 6 describes a strategy including focus on sales and profitability through marketing and cutting costs by buying the cheapest inputs and producing goods that are demanded from the consumers.

Lean

To sum up the farms that took part in the Lean programme the managers perceive following keywords as positive affects; *Routines* (Farm 1, 2, 3, 6, 7), *Communication* (Farm 2, 4, 5, 6), *Thinking/mindset* (Farm 1, 5, 8) *Structure*, (Farm 3, 4, 6). Additionally constructive outcomes mentioned by single farms were; *Control*, *Pro-activity*, *planning* and *helpful for new employees*. Farm 1 mentioned a specific example of affects from Lean Lantbruk in the

previous livestock production. The introduction of routines to fill up the feed silos so they didn't waste energy running empty saved both energy and costs of an estimated value of 50 000 SEK, which financed the Lean programme.

5.3.6 Strategy Formulation – Reference Companies

In table 8 the keywords that captures the strategies of each reference company is introduced.

Table 8. A presentation of the keywords describing the strategy formulation of the reference companies.
Source: Farm 1R-8R.

Farm	New Energy System	Machinery	Production System
1 R	-	Collaboration, Service, Regular maintenance, Reduce fuel, Follow-up fuel	Optimization, Follow-up
2 R	Solar energy	Self-sufficient, Irregular maintenance	Feed advisory, Forage, Milk heat recovery, Self sufficient
3 R	-	Self-sufficient, Coordinating logistic, Regular maintenance	Animal health, Feed advisory,
4 R	Solar energy, Biogas, Wind power	Own & hire, High utilization, fuel samples, Logistic, Regular maintenance	Energy efficiency, Technology systems, Feed, Animal health, Routines, Recruitment
5 R	Solar energy	Self-sufficient and Collaboration, Customized, Follow-up fuel, Logistics, Regular maintenance	Animal health, Feed, Milk heat recovery, Education
6 R	Solar energy	Self-sufficient, Reduce fuel, Logistics, Regular maintenance	Animal environment, Feed advisory, Feed
7 R	Biogas	Hire, Technology, High utilization, Routine maintenance	Feed, Recruitment, Forage
8 R	Solar energy	Own & hire, High utilization, Extensive maintenance, Long-term, Technology, Reduce fuel, Logistics	Continuous improvement, Communication, Animal health, Feed advisory

New Energy System

Among the reference companies, all firms, which have been thinking about new investments, would choose either solar energy, biogas or wind power. Farm 4R has recently invested in an integrated system for energy using wood chips for all the buildings on the farm. Through a highly efficient system that farm has managed to reduce energy consumption while doubling the production. Similar to the Lean companies the reference companies argue that it is important to be self-sufficient and use the resources that are available in at the farm instead of wasting them. Farm 6R is gradually replacing the power-driven fan systems in the livestock barns into natural ventilation. The motive behind the change is animal health and a reduction of energy consumption. Farm 5R highlights the importance of a system that minimizes the effect on the environment. However, all reference farms mainly prioritize the financial aspect.

Machinery

Four of the reference companies are mainly self-sufficient in their machinery and only hire machinery services at special occasions, mainly to reduce the timeliness effect. For the rest of the farms the degree of self-sufficiency versus hiring varies. One farm mostly hires and only has a few machines in-house. Meanwhile farm 4R and 8R both hire and own machinery to an equal extent. Farm 1R collaborates with a neighbor and they buy all machinery together. Another farm is mainly self-sufficient but does also have a few well-developed collaborative arrangements. Since this farm also faces special natural conditions this requires customized

machinery. Three farms emphasize the importance of high utilization of the machinery as a part of their strategy.

Six firms express that they conduct regular maintenance, however without any routines. Logistics is taken into account by the two beef farms and one dairy farm. Farm 3R highlights the importance of communication between employees when coordinating logistics. One reference company has relatively recently rebuilt a large part of the farm and did at this stage take large consideration to logistics, which is supported by farm 6R who focuses on the optimal location of buildings and machinery to reduce unnecessary driving. All farms except two do to some extent work toward reducing use of fuel or follow-up fuel consumption.

Production

The strategies used among the reference companies to achieve optimal production vary. However all farms that have livestock express feed and/or feed advisory as a crucial part of their strategy. This requires a successful crop production, which is achieved in different ways. Some follow-ups are made but at the same time they are considered hard to evaluate. Farm 4R has collaboration with the neighboring farm and they share the use of land and make the crop planning as one unit. This improves the possibilities for adjusting to optimal forage production. Farm 5R is ecologically certified and has a high focus on healthy pasture, and grows protein crops for feed. Farm 7R also focuses on intense forage production with high levels of nitrogen and harvest four times per year.

Animal health and/or animal environment are expressed by five of the managers on livestock farms to be one of the most important efficiency factors. Two farms focus on recruitment of livestock. In addition to this farm 4R has a high focus on energy efficiency and use of technology. One of the business leaders at this farm has a background from working with Lean in the industry and has implemented several parts of Lean thinking in the business, but did not take part in Lean Lantbruk. One important part of their daily work is a database management system that is connected to the dairy barn which gives the employees continuous information about the herd; how much they eat, how much milk they produce etc. Farm 5R manages the business partly through a board on the farm that includes the business leaders as well as an external expert that supports the strive to move forward. The crop farm focuses mainly on optimization of for example use of machinery, as well as yearly evaluations although the crop production is hard to evaluate according to the manager at farm 1R.

6 Analysis

In chapter 6 an analysis is presented with a similar structure as in chapter 5, this chapter is structured as a Green strategy formulation and process. Starting with the overall goal and factors that influence the company, followed by the analysis in which the four Generic Competitive Environmental Strategies are identified, categorized and compared.

6.1 The Initial Steps in a Competitive Environmental Strategy

6.1.1 Mission & Goals

Within Green strategic management the planning process is central. The foundation is to define mission & goals, which are followed by a vision and finally a realization of the strategy. In order to succeed with the communication through the entire organization and to create a workforce that strives in the same direction, a leader with a clear vision and defined mission and goals are important (Nulkar, 2014). The role and involvement of the management is emphasized in the theory of Lean and is necessary in order for a strategy to sustain over time. The theory of Lean may be viewed as both a philosophy and a practical management tool, or a combination of them both. Since it includes a culture of continuous improvements it goes beyond the systematic practical tools in order to achieve the full potential of the system. The Lean philosophy consists of a mind-set of continuous improvements in quality and reduction of waste, which aim to generate long-term benefits. The long-term strategy may occasionally have to be prioritized at the expense of the short-term financial goals (Liker, 2004). The long-term thinking needs to be clearly defined as mission and goals in the theory of Lean as well as in Green strategies.

The empirical results in this study show that the companies that have implemented Lean and the reference companies differ in how they formulate their mission and goals. The Lean companies express to a higher degree defined and specific goals than the reference farms, which is most likely explained by the fact that the formulation of mission and goals is one of the first parts of the Lean Lantbruk programme. However, no difference is observed in the actual content of the goals between the two groups. A majority of the farms included in the study express financially related goals, such as profitability or financial survival. Objectives with a non-financial character vary within and between the groups and both Lean farms and reference farms mention for example goals related to working conditions, life-style and future generations. Only one farm (8R) expresses goals related to climate efficiency and reduction of environmental impact. This result is in line with previous research that shows that Lean does not affect the overall mission of the firms; the positive environmental effects are rather a result of a spill over effect (Dakov & Novkov, 2007; Moreira et al., 2010). It is however noteworthy that Lean Lantbruk put an emphasis on environmental concerns in the programme by including suggestions for climate efficient actions (see appendix 1). Despite this, Lean does not seem to affect the farms in terms of the development of missions or goals related to the environment. However, the implementation of Lean may still have effects concerning climate efficiency through the formulation of the farm strategy even though this may be unintended.

6.1.2 Situation Analysis

A vital part in developing a Green strategy consists of conducting an analysis of the external and internal factors that possibly could affect the firm. In addition to the manager's central role in succeeding with a planned strategy, a visionary leadership is also a critical factor when introducing ethical or ideological values in the business (Mintzberg, 2007; Nulkar, 2014). Similarly, the involvement of the management is highlighted when implementing Lean in order to achieve a transformation that will sustain over time (Liker, 2004). This part of the Lean philosophy may be related to the section of ideology and ethical values within the formulation and process of Green strategies. The empirical findings regarding the internal factor *Ethical Motives* indicate no difference between the Lean companies and the reference companies, and vary among the farms. For a majority of the firms with livestock production, animal welfare is a central value. Other identified key words were for example transparency, optimization, working environment and minimized impact on the natural environment. Although Lean has a long-term focus, the fundamental values that originates from the manager/owner does however not seem to have been affected concerning the climate impact of the firm by the participation in Lean Lantbruk.

The two factors *Laws & Regulation* (external) and *Risk of Environmental Mistreatments* (internal) are both based on rules and regulations that firms need to adjust to. Nulkar (2014) argues that in order to manage pressure from laws and regulations the company must be observant and flexible, and be proactive in their strategic management to avoid the risk of costly and/or destructive environmental mistreatments (Nulkar, 2014). A majority of the Lean companies perceive themselves as updated and reflective on regulations. Although, overall the way the business is actually affected by these factors differ mainly depending on the design of the production system and the natural conditions at the farm. Regardless of the level of awareness, most Lean companies are passive regarding handling expectations of future laws and regulations. Some farms however uses for example certification, advisory and internal control systems in order to avoid potential sanctions. Similar to the Lean companies, the reference firms follow the political debate concerning regulations to some extent and some participate actively in the political discussion. Internal aspects of ways to avoid the risk of costly environmental mistreatments does not differ from the Lean companies, except one farm (4R) that stands out by adjusting parts of the production system due to bad experiences with local NGO:s. In conclusion, there is no observed difference between Lean and reference farms in terms of external or internal factors. Although one of the core concepts in Lean is proactivity, it is exclusively concentrated on the working processes and seemingly not on political analyzing (Liker, 2014).

An important external factor within the situation analysis is the *Customer*. During the interviews the managers viewed the customer from two perspectives; the end consumer and the customer that the farmer markets the product to. A majority of the Lean farms makes an effort to identify consumer demand while the remaining farms do not reflect about this since it is perceived to be too many steps between them. In addition, consumer behavior is viewed as irrational and difficult to predict. One of the farms (5) has adjusted the production based on an identified increased demand for ecological milk, and in order to meet the demand by the end consumer converted the production system into ecological. Similarly, other farms identify trends towards ecological and locally produced products as well as transparency in the production system but have not yet acted on this observation.

Given the perspective that the customer serves as the following step in the supply chain the results reveal a distinction between beef farms and dairy/crop farms. The beef farms seem to produce a product with more potential for adding value to the product, for example high quality or local distribution. The two Lean farms that produce beef deliver to local slaughterhouses, sell their products as premium products and to some extent sell the product through a farm shop. The managers perceive that the more local the product the more influence they can have. However, based on the different prerequisites in beef and dairy production, dairy producers are more dependent on external partners since a majority of the individual farmers are not able to process the milk by themselves at the farm due to heavy investments. This holds for Lean companies as well as reference companies. The reference companies makes a similar analysis as the Lean firms with respect to that the consumer is perceived as irrational and unpredictable. According to Nulkar (2014) the consumer analysis mainly focuses on identifying a target group and trends in consumer demand. Lean also emphasizes the customer but with the production process in focus. All activities in the production system should add value to the customer but there is no focus on external stakeholder analysis (Liker, 2004). According to the farm managers, the complexity in this aspect is not to identify what consumers express that they demand. It is the actual consumer behavior that is difficult for the farmer's to adjust to since it is not perceived to be consistent.

Noticeably, the reference companies that operate dairy farms market their milk to local or regional dairies to a slightly higher degree than the Lean firms. Consequently their final product contains a higher degree of environmental values in the form of "locally produced". It cannot however be precluded that the reference companies may be situated within a catchment area for local and regional dairies, compared to the geographical situation for the Lean farms.

Similar to the Lean farms, the reference farms identify trends towards Swedish or locally produced food and demand for transparency in the production system. Another type of transparency and openness may be meeting the consumer in the local store and this strategy is realized by one reference farm (6R). Two other farms are considering changing the conventional production system into an ecological system. These trends identified in the agricultural sector seem to follow the general trend in society since consumer demand for transparent and sustainable production systems is increasing (Nulkar, 2014). In general, all ten dairy farms perceive the relationship with customers in industry, retailers and end consumers as complex.

According to Nulkar (2014) NGO's or public opinion has a high impact on consumer behavior regarding environmental concerns and should therefore be considered in the analysis (Nulkar, 2014). With respect to this aspect there is no difference between the Lean and reference farms. None of the farms essentially places great importance on this factor since they do not experience any direct influence on their farm. The empirical results indicate a slight difference in that a larger number of Lean companies have a more relaxed approach towards NGO's. In an agricultural setting the empirical findings differ from the described theory of Green strategies since the NGO's are mainly perceived by the managers to indirectly affect laws and regulations of the industry but not the consumers (Nulkar, 2014).

6.2 The Four Generic Competitive Environmental Strategies

6.2.1 The Strategic Choice - Positioning

Competitive Environmental Strategies in SMEs are strategies that create environmental benefits as well as competitive advantages simultaneously. The strategy focuses on green innovation in the sense of constructive problem solving with a long-term perspective that aims at reducing both costs and environmental impact (Nulkar, 2014). The overall aim with Lean Lantbruk is to enhance competitiveness, increase efficiency and promote continuous improvements within Swedish agricultural firms (www, Lean Lantbruk, 1). According to the theory of Competitive Environmental Strategies the positioning and formulation of a strategy is important, and there are four different types of Competitive Environmental Strategy (Nulkar, 2014). Positioning the firm implies a strategic choice to focus on either differentiation or reducing costs. The strategy of lowering costs refers to reducing costs in comparison to competitors and through environmental improvement. Differentiation on the other hand is a strategy that requires communication and marketing, specifying a target group and producing a premium product (Porter, 1980). In table 9 one or several of the four Competitive Environmental Strategies have been identified for each farm based on the empirical findings (Orsato, 2006). For the purpose of this study, the identified strategies have been classified at a low, medium or high level, which is a relative measure. The strategies may be planned or unintended and developed through a series of actions over time as suggested by Mintzberg (2007), and the farms strategies are identified based on the empirical findings.

Table 9. Competitive Environmental Strategies identified in the case farms. Source: Farm 1-8, 1R-8R.

Farm	Lower Cost		Differentiation	
	<i>Eco-Efficiency</i>	<i>Environmental Cost Leadership</i>	<i>Eco-Branding</i>	<i>Beyond Compliance Leadership</i>
1	Medium			
1 R	Medium			
2	Medium			
2 R			High	Low
3	High		High	
3 R	Medium			
4	Medium			
4 R	High	High	Medium	Low
5	High	High	High	High
5 R	Medium		High	High
6	High		Medium	
6 R	Medium	Low	Low	
7	Medium			
7 R	Low			
8	Medium			
8 R	Medium		Medium	Low

6.2.2 Eco-efficiency

Eco-efficiency refers to the "ecological principles of optimizing", meaning simultaneously reducing environmental impact and costs by continuously increasing productivity. This is achieved within the organizational processes as well as through collaboration with external

partners. Waste in one firm may be a useful resource in another (Orsato, 2006). The companies that produce milk or meat have two separated production systems at the farms, crop/forage and the livestock production, that in several ways are closed loop systems. This may be viewed as an Eco-efficient organizational process since waste in form of manure is efficiently used in a closed-loop system to produce forage (Orsato, 2006). All firms within this study except farm 2R state that they to some extent use an optimizing strategy to maintain a profitable production system. The strategy of Eco-efficiency has several similarities with Lean considering the focus on continuous development and reduction of waste. This result is supported by previous studies and in the research field of Green Lean (King & Lenox, 2001).

Although nearly every firm has an ambition to optimize, to some extent the processes to achieve this differ, partly due to natural environmental conditions and personal characteristics. Given the empirical results a difference between how Lean companies and reference companies formulate their strategies has been identified. Module 8 in the programme of Lean Lantbruk (see appendix 1) highlight waste identification, advice for energy use as well as cost efficiency and reduction in greenhouse gas emissions. Farms that have implemented Lean do to a higher extent integrate the methods presented in module 8 in Lean Lantbruk in their firms.

Regarding machinery, three Lean farms (5, 6, and 7) and three reference farms (4R, 7R, and 8R) express a high degree of utilization of the machinery which is in line with Eco-efficiency. Only one of the farms that mention high utilization is self-sufficient regarding machinery (5). The rest of the farms that focus on high utilization do to some extent hire machinery services or collaborate in various ways in order to increase efficiency. This is one kind of external collaboration that is a factor in the Eco-efficiency strategy. Four firms perform extensive and/or routinized maintenance which is in line with the recommendations of Lean Lantbruk and the philosophy of Lean in order to increase efficiency. Six of the reference companies state that they conduct regular maintenance on machinery although without structured routines.

A majority of the Lean farms perceive routines as one of the most important parts of their general strategy to achieve an optimal production and not only as a tool for machinery maintenance. For example one of the key factors at farm 5 is strict daily routines in the milking process and farm 3 has routines to assure animal health in form of inspections of the entire herd twice a day. Only one of the reference farms, 4R, has stated that routines are an important part of the overall business strategy to achieve best possible results in the production. Noteworthy is that the manager at farm 4R has a background in the industry and therefore extensive experience of working according to Lean principles. Within Lean the importance of structure and routines is highlighted since this reduces slack and waste and therefore saves costs (Liker, 2004).

An important aspect of climate efficiency according to Lean Lantbruk is the follow-up of fuel consumption regarding the machinery (www, Lean Lantbruk, 4). Only a few farms follow-up fuel consumption regularly and no difference has been observed between the two groups of farms. Several managers state that they do not see the purpose of this action since they perceive the situation as if they cannot change the way or extent of driving at the farm. Farm 5 and 6 on the other hand work with fuel reduction through education and promotion of eco-driving in the workforce instead of focusing on measurements of fuel consumption. This strategy aims at lowering costs and is based on a change of organizational thinking, a way of finding the cause of the problem in order to reduce unnecessary fuel consumption. This is a

mind-set well developed in the Lean philosophy and in Lean Lantbruk (Liker, 2004; www, Lean Lantbruk, 4). The two firms with mainly crop production (1, 1R) are less complex with a relatively minor workload and a relatively long production period for the central parts of the production system. Because of this, the need for routines is lower in comparison to the firms with livestock production according to the farm managers.

6.2.3 Environmental Cost Leadership

Adopting a new energy system generally requires innovative thinking and is associated with extensive investments and risks. According to the theory of Competitive Environmental Strategies, Environmental Cost Leadership may reduce costs in the long-term and for example reduce the risk of being dependent of oil and sensitive to future political decisions related to the natural environment (Orsato, 2006). Eight farms mention solar energy as the main potential energy system if the farm would make a new investment, and five farms mention biogas. Regarding plans for future energy systems there is no distinction between the Lean farms and reference farms. Both systems make use of available resources at the farm, and might possibly reform the industry in the future. Solar energy is an innovative system that uses the natural energy from the sun. It is suitable in a farm setting that usually has large available roof areas on the farm buildings for solar panels. Biogas is a more process orientated system that could be integrated in the production system and generate positive synergy effects.

Two of the farms in this study have recently invested in new energy systems. All farms that operate livestock use the manure as fertilizers in the crop production but farm 5 has taken the use of this resource one step further. In collaboration with farmers in the local area they have invested in a biogas plant. The manure is gathered from all the farms and is processed into gas that is sold as fuel meanwhile the rest product, the processed manure, is distributed back to the farmers where the enriched manure is used as an even more efficient fertilizer. The purpose with the investment is according to farm 5 long-term profitability. Simultaneously it is a technique that utilizes an organic energy source in a way that is beneficial for the environment. In addition, farm 4R has recently invested in a highly integrated energy system with biomass as fuel, which has increased efficiency to the extent that they have managed to double the production volume and at the same time reduced energy costs. Given the strategy of Environmental Cost Leadership the firm aims at reducing both environmental impact and costs in areas where consumers are not willing to pay extra for added values (Orsato, 2006). This may require finding new solutions, processes or systems and farm 5 and 4R serve as examples of a realization of this strategy and is therefore classified as adopting this strategy at a high degree. Farm 6R is gradually changing its production system by introducing natural ventilation in all livestock buildings instead of energy intensive fan systems. This can also be classified as an Environmental Cost Leadership strategy but at a low degree in this case no risky, disruptive or costly investment are required. The remaining 14 farms express a future goal to make these investments, although they cannot be classified as having an Environmental Cost Leadership strategy today. However, according to Mintzberg (2007) some of these farms can be defined as having an intended strategy that is not yet realized.

6.2.4 Eco-Branding

Eco-branding is a strategy that falls under the category of differentiation rather than lowering costs. The company focuses on producing a product with added value in order to create a competitive advantage. However, in order for the consumer to be able to pay a premium price

for the product the added value needs to be communicated and the information trustworthy (Orsato, 2006). According to the empirical results this type of strategy seems to have been adopted by nine of the companies who have chosen to deliver their product through either a local or regional supplier, or to produce an ecological product that creates added value associated with environmental benefits. Out of these eight companies, five are reference companies (2R, 4R, 5R, 6R, and 8R). However, this noticeable difference between Lean and reference farms in the empirical findings may be affected by the companies' possibilities of differentiating their product due to geographical conditions, such as processing industry in the area. Farm 5 and 5R are Ecological dairy farms implying that they have a high level of an Eco-branding strategy that affects the production system. Three out of four beef producing companies differentiate their product as well. This may be explained by the character of beef production that enables for the farm to differentiate since it is able to control the entire chain. In addition, the added value of beef products may be easier to affect with regards to different levels of quality compared to milk, which is a primary product. Small dairy producers have limited possibilities to process milk at the farm. Hence, these firms are more dependent on industry buyers and their preferences. Farm 3 has developed a sales channel on the farm, which adds value to the product in terms of the experience an idyllic surrounding when buying the beef. The high level of locally produced products gives a high level of the Eco-branding strategy. Farm 6 has developed a strategy to market the beef in the region and meeting the customer in store instead of at the farm. Hence, the degree of Eco-branding is to be viewed as medium. Farm 6R also meet and listen to the consumers in stores and delivers a certain volume of the beef directly to restaurants. The product is in this case sold as a premium product with added value as Swedish quality meat and no specific local value. The degree of Eco-branding is therefore low. This Eco-branding strategy has emerged from innovative thinking and by analysing the market demand. It may require new focus areas in the business and some changes in the traditional production systems. Trustworthy information about the product is the core of this strategy (Orsato, 2006). This is achieved through personal interaction with the consumers and by providing a transparent production system. Several farms, both Lean and reference, emphasize that they have a production system that they are proudly willing to display.

6.2.5 Beyond Compliance Leadership

The strategy of Beyond Compliance Leadership refers to doing more than the law requires, for example by implementing environmental or ethical standards on a voluntary basis. This creates an opportunity to differentiate the firm/product and displaying sustainable initiatives to the public and by this increasing the positive image of the firm (Orsato, 2006). According to the results, farm 2R, 4R and 8R are certified by Svensk Sigill, a quality certification scheme that includes controls. The main reason for this is however that the suppliers require that their producers are certified by Svensk Sigill which later can be used for marketing the milk to the consumers. Since the standard does not directly focus on the environmental impact of the firm and in these cases are not voluntary for the firms, the identified level of Beyond Compliance Leadership strategy among 2R, 4R and 8R is classified as low. No substantial difference has been observed between the Lean companies and the reference companies. Farm 5 and 5R are ecologically certified according to KRAV and the label is perceived as a voluntary environmental/ethical standard. Farm 5 also expresses that the KRAV certification system is also used as a tool to comply with current regulations.

7 Conclusions

Based on the analysis, the following chapter aims at answering the research question stated in the introduction: How does Lean affect strategies concerning climate efficiency within Swedish agricultural firms?

This study shows that the implementation of Lean in Swedish agricultural firms lead to an overall increase in routines which reduces waste of resources, i.e. increases efficiency. The routines are by the managers at the farm expressed as a general strategy in the production processes in order to generate maximum profit. Further, the routines that increase efficiency and reduce slack in the production system lead to an increase in climate efficiency.

The increased amount of routines among the Lean companies lead to an unintended increase of the strategy Eco-efficiency, although Lean does not seem to have affected the environmental awareness of the farm. Effects in climate efficiency are rather to be viewed as a spill-over affect, which is supported by previous research (Florida, 1996; Dakov & Novkov, 2007; Moreira et al., 2010; Pampanelli et al., 2014). Based on this study, Lean does not seem to affect other green practices among the Competitive Environmental Strategies as suggested by Dues et al. (2013).

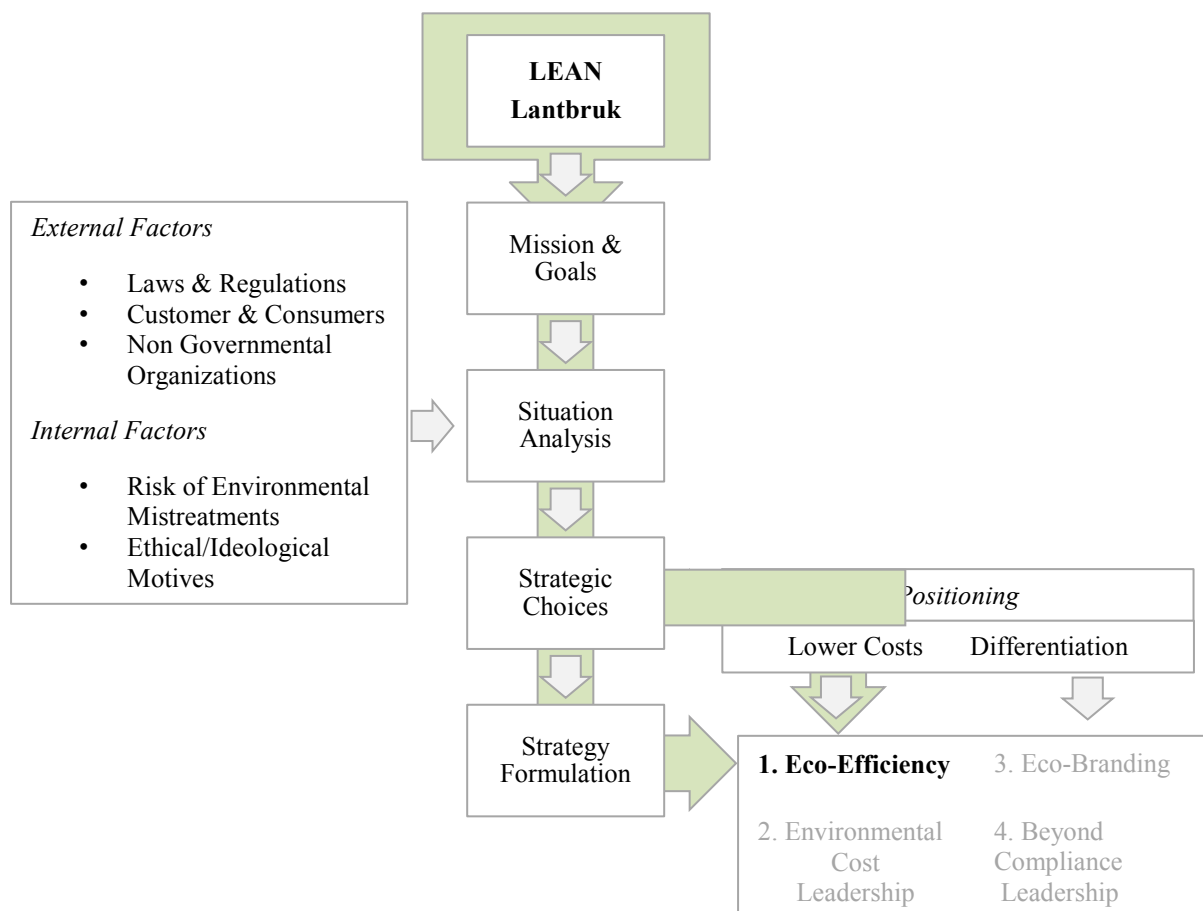


Figure 6. A concluding model of the strategy process of the companies that have joined Lean Lantbruk. Source: own modification.

8 Discussion

In this chapter a discussion is provided regarding the relationship between routines in farm management and reduction in greenhouse gas emissions with the conclusions presented in the previous chapter as a starting point.

The link between routines and its effects on the climate impact of the firm depends on the particular production system at the farm that the routines relate to. Within Lean there is a focus on improvements within the existing production system. Meaning finding ways to utilize the resources of the firm in a more efficient way, without necessarily needing to make large investments or major changes. With that perspective, all routines that lead to reduction of waste of resources has a given positive financial and environmental impact. Although the link between routines and reduction of greenhouse gases has been strengthened by the results of this study, it could be argued that there are other measures that would affect the environmental impact of the firm to a greater extent. For instance regarding machinery, routines may be used for follow-ups on fuel consumption, planning of logistics or introduction to Eco-driving. However, the positive effects of these routines are limited and will only reduce carbon emissions to a certain extent. By using a completely different source of fuel the environmental impact could perhaps be reduced to a greater extent. As discussed, routines in Swedish Agricultural firms as an affect from implementing Lean will likely not be the only solution to the challenges related to the climate and environment. However, there seems to be a need for green activities that have simultaneous positive financial and environmental effects.

Previous research argues that Lean improves both efficiency and reduces the environmental impact of the firm (Klassen & McLaughlin, 1996; Porter & van der Linde, 1996; Chan, 2005). However, the way Lean is used seems to vary between different industries. This study concludes that the most essential outcome from Lean in the agrarian sector is routines. In for example the metal industry reducing lead times is central to achieve efficiency and in health care Lean rather focuses on communication (Martinez & Lu, 2013; Ng et al., 2015). The ability to adjust the use of Lean to make it suitable in various industries is however one of the fundamental ideas in Lean (Martinez & Lu, 2013). In the agrarian sector the use of routines is expressed as a tool to achieve best possible results. For example one beef farm mentions that they routinely check the health of the calves twice a day. Within dairy and beef production the animals are the part of the production that relatively emits the most greenhouse gas emissions. Hence, one important part in order to be climate efficient in animal production is to create a proactive production system that ensures good growth and low mortality (Melin, 2013). Routines seem to generate several positive effects such as increase animal health and profitability as well as lower climate efficiency.

One of the most important resources within a firm is the human resources. A prerequisite for a successful implementation of new routines is an engaged management and willingness within the whole company to adapt changes in the working process, i.e. a new mind-set (Liker, 2004). The farm managers included in this study have expressed that routines that aim at increasing efficiency has also had a positive effect on the communication between employees and the structure at the workplace. This may be especially important when there is an increase or change in the workforce, which considering the general development within Swedish agricultural firms will become more important in the future with larger units (www, SJV, 1). In order to achieve the benefits of Lean, it is crucial that employees are involved in

this and work accordingly. This is expressed by the managers at the Lean farms that perceive a positive outcome of Lean in the communication between employees.

Routines may also be beneficial when collaborating with external partners, since clear and understanding of the working processes are important to achieve efficiency. Routines also reduces the risk of human error that can lead to negative consequences (Liker, 2004). This is beneficial when it comes to complying with laws and regulations in order to avoid sanctions, which is perceived by the managers at the farms in this study as a complex area in the agricultural sector.

Previous research shows that the implementation of Lean is adjusted and focused on different areas of the firm depending on the character of the organization. In order to receive a successful result it has to be adjusted to the specific industry and firm. According to Martinez & Lu (2013), when implementing Lean in health care the central part of Lean has been communication, meanwhile in manufacturing industries the main focus has been to shorten lead time. This study contributes with an understanding of the implementation of Lean within Swedish agricultural firms and the specific finding that the central part in these firms has shown to be use of Lean tools that develop routines, which lead to increased efficiency.

Additionally, this study shows that the farms that have implemented Lean have developed more structure and routines in the working processes compared to the reference farms. This finding may become increasingly important and current due to the structural changes in the Swedish agricultural sector toward larger and fewer units that requires a new type of management.

This study also contributes to the discussion of sustainable development in the Swedish agricultural sector, resource efficiency being one way of achieving this. It is becoming increasingly important to find ways to integrate sustainability also in business strategies due to increased awareness among consumers and sharpened future environmental regulations concerning the production system within agricultural companies.

Previously, many researchers have used a quantitative method when studying the effects of Lean (Shah & Ward, 2007). However, in this study a qualitative method is used focusing on soft values in form of the strategy formulation and process which serves as a necessary complement to e.g. the financial effects of Lean in order to understand all dimensions of the implementation of Lean. On a more practical level, Lean Lantbruk is a relatively new and unexplored project that therefor needs to be evaluated in relation to the defined goals for the programme. This may (hopefully) help to improve Lean Lantbruk to achieve the full potential of Lean in Swedish agricultural firms.

9 Future Research

In the final chapter gives a few suggestions for future research that are based on the findings in this study.

Since this study is limited to the effects of Lean on strategies concerning climate efficiency, there has been no focus on the perspective of employees, such as their role in the implementation of Lean or attitudes towards it. Based on the empirical material of this study it is evident that employees play a big role in a successful implementation of Lean. According to the leaders of the firms, the implementation of Lean has been appreciated by a majority of the employees because of the positive effects on communication, structure and routines at the farm. This has been especially beneficial for new employees since this facilitates the process of becoming integrated in the firm. This is an area regarding the implementation of Lean in small businesses that need further research.

However, in previous research in other industrial sectors Lean has been criticized for having a negative impact on the working environment and on individual employees. The arguments are mainly that the restructuring of the organization is stressful and not a healthy working environment in the long-term (Delbridge, 1998). By also including the human aspect when studying environmental strategies that simultaneously can increase profitability of the firm this would relate to the triple bottom line-theory (including social, environmental and financial aspects). There is a need of future research within the business and management field to connect all these three aspects rather than discussing the issues isolated. In order to be able to develop a sustainable way of managing the Swedish agriculture business, there is a need of a more open minded and interdisciplinary focus within future research in this field.

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Personal messages

Farm 1

Owner/Manager, Crop producer
 Personal meeting, 2015-03-02

Farm 1 R

Owner/Manager, Crop producer
 Personal meeting, 2015-03-11

Farm 2

Owner/Manager, Dairy producer
 Personal meeting, 2015-03-13

Farm 2 R

Owner/Manager, Dairy producer
 Personal meeting, 2015-03-18

Farm 3

Owner/Manager, Beef producer
 Personal meeting, 2015-03-10

Farm 3 R

Owner/Manager, Beef producer
 Personal meeting, 2015-03-20

Farm 4
Owner/Manager, Dairy producer
Personal meeting, 2015-03-12

Farm 4 R
Owner/Manager, Dairy producer
Personal meeting, 2015-03-20

Farm 5
Owner/Manager, Dairy producer
Personal meeting, 2015-03-11

Farm 5 R
Owner/Manager, Dairy producer
Personal meeting, 2015-03-06

Farm 6
Owner/Manager, Beef producer
Personal meeting, 2015-03-05

Farm 6 R
Owner/Manager, Beef producer
Personal meeting, 2015-03-05

Farm 7
Owner/Manager, Dairy producer
Personal meeting, 2015-03-16

Farm 7 R
Owner/Manager, Dairy producer
Personal meeting, 2015-04-18

Farm 8
Owner/Manager, Dairy producer
Personal meeting, 2015-03-04

Farm 8 R
Owner/Manager, Dairy producer
Personal meeting, 2015-03-17

Hans Andersson
Professor in Business Administration/Economics, Swedish University of Agricultural
Sciences
Personal meeting, 2015-06-11

Johan Rockström
Professor in Environmental Science, Stockholm University
Lecture “Global food production to feed a growing population within planetary boundaries”,
2014-09-05

Appendix 1 – The 17 Modules of Lean Lantbruk

Appendix 1 summarizes the 14 management principles in Lean management according to Liker (2004), translated into 17 modules that the Lean Lantbruk programme consists of (www, Lean Lantbruk, 4). It is structured in chronological order of the programme that lasts for 18 months. Module 8 (waste identification) is the part of Lean Lantbruk that focuses on reduction of environmental impact.

17 modules of the programme		
1.	Introductory meeting	A two-day theoretical introduction to Lean by the Lean coach with the business leader/ leaders and employees. The philosophy and practical tools are presented.
2.	Coach visit at the farm	Leaders and employees meet and describe the current state at the farm and formulate future values and principles needed to reach the defined goal. Presentation of Lean-thinking: customer focus, reduction of resource waste, solid systems and engagement. Farms are offered a company visit at an industrial company in a different sector that has implemented Lean.
3.	Philosophy	The philosophical fundament of a long-term with four dimensions; values, principles, methods and results are presented and the principles are the central characteristic of Lean described as Liker's 14 principles (modified to the agrarian setting).
4.	Current state	<i>Value stream mapping</i> is used to chart processes and flows of information and material. Captures current state at the farm and questions activities, e.g. unused creativity, communication and routines, focusing on various processes, such as leadership and production sectors.
5.	Action plan	A PDCA-cycle (<i>Plan, Do, Check and Act</i>) is used for structuring action plans. Employees need to be integrated in the implementation and practical tools for how to act are constructive problem solving, dialogues, prioritizing, identifying the cause of problems and continuously improvements.
6.	Visualization	A vital part and a tool to highlight problems and detect areas with potential for improvement. Displaying clear, relevant information also simplifies the work with other tools and stabilizes systems. Simple, creative solutions such as boards and colour schemes makes for example follow-ups easier (e.g. machines, cow fertility or workforce planning). It also promotes meetings by the board, creating an open environment for dialogues and team building.
7.	5S	The 5S (<i>Sort, Standardize, Systematic Arrangement, Shine and Sustain</i>) organizes the workplace and requires time and support from the manager. Aims at reducing waste of time, labour and material by organizing and ensuring that everything is placed properly. It enables continuous improvements and follow-ups with inspections as well as displaying good examples.
8.	Waste identification	Checklists are used to find slack or risks, with different lists for different areas of the firm. Environment & energy is divided into different segments such as production

		flow and machines, occupational health and safety etc. Signals indicating waste are unclear communication, overburden, overspill, unused creativity, waiting etc. Climate and energy is emphasized and six viable advises for reducing greenhouse gas emissions and a relatively extensive program for smart energy use on agriculture firms, developed by the Ministry of Agriculture and Forestry in Finland 2010. The energy program actually offers farmers in Finland an opportunity to develop their energy consumption in a more climate-friendly and cost effective direction. The material presented in Lean Lantbruk is a part of the Finnish programme and a guide for Swedish Lean farmers of how to manage a long term development of energy efficiency and increase the use of renewable energy sources.
9.	Logistics	Identify all transportation and driving on the farm to be able to optimize these operations.
10.	Standards	Annual activities are outlined and strive to balance heavy workload and establish systems for less frequently performed tasks. Standards involve distributing areas of responsibilities with for example lists and other type of tools that are used as reminders. The aim is to secure quality, safety for employees and efficient introduction for new employees. However, some processes involving work with animals and crop production are limited in the extent to which they can be standardized.
11.	Preventive support	Another part of thinking long-term and being a learning organization is working proactively with maintenance and prevention. Main focus is on machinery and technology used on the farm, such as tractors and milking equipment. Proactive work for structuring operator maintenance and monitoring operating time is promoted, and for this the OEE-formula (Overall Equipment Effectiveness) is used in order to oversee and compare key indicators of the utilization of machinery and equipment.
12.	Setup times	Lean Lantbruk intends to reduce set up times and increase the portion of time that creates actual value. The method used in this step is called SMED (<i>Single-Minute Exchange of Die</i>), it fosters a rapid changeover one of the keys for reducing bottleneck and time waste and improve the workflow.
13.	Set goals	SMART-goals are used, meaning that a goal must be <i>Specific, Measurable, Accepted, Realistic</i> and <i>Time limited</i> . Setting goals should encourage and stimulate the workers and ensure that everyone is pulling in the same direction. Measurable and achieved goals are tangible that can be a useful argument for farmers in the contact with external stakeholders for example at a bank meeting related to new investments.
14.	Appraisal	Individual appraisal between the manager and the employees discusses for example the performance of the company, future planning, the employees' personal goals and ambitions, as well as the managers' expectations of the employee. The purpose of the dialogue is to encourage openness, transparency, commitment and involvement among the people at the farm.
15.	Tools and tips	Tools and tips
16.	Material for new employees	Introduction material for new employees.
17.	Administration	Administration improvements.

Appendix 2 – Interview Guide

1. Background

- 1.1 How old are you?
- 1.2 How long have you been running the business?
- 1.3 How many family members are active in the business?
- 1.4 How many working hours does the business require each year?
- 1.5 How many employees do you have?
- 1.6 What kind of education do you have?
- 1.7 Are you using any kind of advisory service? If so, what kind?

1. A. Only Lean-farms

1. a. During which period did you take part of Lean Lantbruk?
1. b. Briefly describe what you think has been positive and negative about Lean.
2. c. Do you have any examples of how Lean has changed the business?

2. Long-term goals

- 2.1 What are the long-term goals of the business?
- 2.2 How do you expect the business to develop in the future?

3. Plan of action and use of resources

3.1 Energy

- 3.1.1 What kind of energy system do you have at the farm (farm building, residence etc.)?
- 3.1.2 What criteria's motivated these choices and why?
- 3.1.3 How do you support the energy system with "fuel" and why?
- 3.1.4 What criteria's would be important if you would invest in a new energy system today?
- 3.1.5 Why are these criterias important?

3.2 Machinery

- 3.2.1 What criteria's are the most important when buying new machines?
- 3.2.2 Why are these criteria's important?
- 3.2.3 What is your plan with the machinery? Why?
- 3.2.4 How do you use the machinery in the best possibly way?
- 3.2.5 How do you follow up on fuel consumption? Why?
- 3.2.6 How do you follow up on transportation and logistics? Why?
- 3.2.6 How many hours have the machines been driving when you exchange them?
- 3.2.7 Do you perform maintenance on a regular basis?
- 3.2.8 Who do you deliver to and who do you buy from?

3.3 A Livestock buildings

- 3.3.1 A What kind of ventilation do you have in the livestock buildings and why?
- 3.3.2 A What routines/systems do you have for maintenance and cleaning of ventilation, lighting, water etc. and why?
- 3.3.3 A Do you have a system to take care of the heat generated by the milk, dishwasher or manure? If so, why?

3.3 B Buildings - crops

- 3.3.1 B What kind of ventilation system do you have in the buildings and why?
- 3.3.2 B What routines/systems do you have for maintenance and cleaning of ventilation, lighting, water etc. and why?

3.3.3 B Do you have a drying plant? What kind and why?

3.3.4 B What criteria's would be important if you would invest in a new drying plan?

3.4 Livestock

3.4.1 In what way do you work in order to achieve best possible results in the livestock?
Why?

3.4.2 How do you plan the ration?

3.4.3 Do you buy feed? If so, where from? Why?

3.4.4 What kind of manure management system do you have?

3.4.5 In what way do you make use of the manure?

3.5 Crop production

3.5.1 How do you plan the crop rotation and why?

3.5.2 In what way do you work in order to achieve best possible result in the crop production?

3.5.3 Do you have access to manure? Why?

4. Situation analysis

4.1 In what way do expectations of future laws and regulations affect your business planning?
Why?

4.2 In what way do expectations of future demand from consumers/customers affect your
business planning? Why?

4.2 In what way do expectations of future demand/requirements from buyers in the industry
affect your business planning? Why?

4.3 In what way does demands/requirements and expectations of future
demands/requirements from different associations, such as environmental organisations?
Why?

4.4 In what way do you to reduce the risk of potential sanctions from not following laws and
regulations?

4.5 Is there any ethical/ ideological aspect that affects your business planning?