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Critical operations capabilities in a high cost environment

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Abstract

Many manufacturing firms, driven by the goal of beating the competition, have relocated their manufacturing operations from a high to a low cost environment, creating issues for the western social welfare. In order to maintain manufacturing in high cost environments, firms located in such environments must improve their competitiveness.

Research has shown that firms need to be able to identify, develop and improve the operations capabilities that have the highest impact on the competitiveness. However, there is presently no coherent and contemporary framework of operations capabilities in the literature. There is also a lack of knowledge about operations capabilities in a high-cost environment. Therefore, the purpose of this research is to investigate critical operations capabilities in a high-cost environment.

This purpose has been addressed through two studies. The first investigated critical operations capabilities in a general environment, and was conducted through a systematic literature review (Paper I). The second study investigated critical operations capabilities in a high cost environment and was conducted through a focus group (Paper II) and a multiple case study (Paper III).

The result of this research is a framework of operations capabilities in a high cost environment. The framework includes seven dimensions and 23 operations capabilities. Specifically, the dimensions are: cost, quality, delivery, flexibility, service, innovation and environment. The findings revealed that quality is considered as the most critical dimension in a high cost environment, while environment is considered as the least critical in a high cost environment. The findings also revealed two additional operations capabilities in the empirical data, which are ‘flow efficiency’ and ‘employee flexibility’.

This research contributes to the current body of knowledge by introducing a novel perspective and original thinking about operations capabilities in a high cost environment. The framework of operations capabilities could support both practitioners and researchers in the identification and development of critical operations capabilities for winning strategies in a high cost environment.

Keywords: capabilities, priorities, high cost environment, operations strategy.

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I would like to express my sincere gratitude to my boyfriend, Christian. Thank you for your moral and emotional support. Thank you for always encouraging me and never holding me back. Your love and respect are my joy.

And finally, last but by no means least, I would like to thank my colleagues and all the Ph.D. students. Thank you for all the free time together and your friendship.

Cinzia Sansone

List of appended papers

Paper 1

Sansone, C., Hilletofth, P., and Eriksson, D. (2017). "Critical operations capabilities for competitive manufacturing: a systematic review", *Industrial Management and Data Systems*, Vol. 117 No. 5, pp. 801-837.[1]

Paper 2

Sansone, C., Hilletofth, P., Eriksson, D., and Bengtsson, L. (2017). "Evaluation of operations capabilities in high cost environment", Manuscript submitted for review (under review). [2]

Paper 3

Sansone, C., Hilletofth, P., and Eriksson, D. (2017). "Critical operations capabilities for competitive manufacturing: a multiple case study", Manuscript submitted for review (under review). [3]

[1] An earlier version of this paper was presented at the 23rd EurOMA Conference, Trondheim, Norway, June 2016.

[2] An earlier version of this paper was presented at the 7th International Conference on Operations and Supply Chain Management, Phuket, Thailand, December 2016.

[3] Earlier versions of this paper were also presented at the International conference on Industrial and System Engineering (IConISE), Bali, Indonesia, August 2017; the 24th EurOMA Conference, Edinburgh, Scotland, July 2017 and the 23rd EurOMA Conference, Trondheim, Norway, June 2016.

Contents

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Competitive advantage: "*A firm is said to have a competitive advantage when it is implementing a value creating strategy not simultaneously being implemented by any current or potential competitors*" (Barney, 1991, p. 102).

Competitive priority: These are objectives which guide the management actions towards the building of operations capabilities (Koufteros et al., 2002). In other terms, they are desired capabilities, i.e. those that a firm wants to have in the future or on which emphasis should be placed (Größler and Grübner, 2006).

Cumulative (or sand-cone) model: In the cumulative or sand-cone model, operations capabilities are built on each other in a cumulative manner and developed simultaneously (Größler and Grübner, 2006; Schoenherr et al., 2012).

Dynamic capability: *"The term 'dynamic' refers to the shifting character of the environment;* [in which these capabilities are developed and generated], […]. *The term 'capabilities' emphasizes the key role of strategic management* [management actions] *in appropriately adapting, integrating, and re-configuring internal and external organizational skills, resources and functional competences to change in environment."* (Teece and Pisano 1994, p. 538).

High cost environment: *"The distinction between high and low cost* [environment] *has always been implicitly a distinction between high and low wages."* (Ketokivi et al., 2017, p. 20).

Operations capability: *"A plant's contribution to a company's success factors in competition, i.e. the strengths of a plant with which it wants to support corporate and marketing strategy and which help it to succeed in the marketplace."* (Größler and Grübner, 2006, p. 459). In other words, they are realized capabilities, i.e. capabilities attained after the implementation of management actions (Koufteros et al., 2002).

Operations strategy: *"Operations strategy is the pattern of strategic decisions and actions which set the role, objectives and activities of operations"* (Slack et al., 2004, p. 67). *Strategy* is a broad term related

to a long-term perspective and is the concern of senior management in the organization, while *operations* are detailed, complex, related to day-to-day problems and carried out by those at lower levels of the organization (Slack, 2005).

Resource-based view: One that offers a strategic perspective in understanding how a firm's resources and capabilities affect its performance (Wernerfelt, 1984; Barney, 1991).

Resource: *"Anything which could be thought of as a strength or weakness of a given firm. More formally, a firm's resources at a given time could be defined as those (tangible and intangible) assets which are tied semipermanently to the firm"* (Wernerfelt, 1984, p. 172).

Trade-off model: In this model, some operations capabilities are strategically more important than others. In the trade-off model, operations capabilities are distinct and developed in isolation, one at a time (Sum et al., 2012).

1 Introduction

This chapter presents the introduction of the research, including the background, motivation, purpose and scope of the research.

1.1 Background of the research

In a fast-changing competitive environment, firms have to deal with an accelerated pace of innovation, the globalization of markets and increasing customer expectations (Hilletofth, 2009; Wang and Cao, 2008). These pressures have increased the awareness of competitive priorities and operations capabilities among firms (Phusavat and Kanchana, 2007). Competitive advantage is derived from the business strategy and should later be applied to the operations strategy (Figure 1) (Hayes and Wheelwright, 1984; Hill, 1995; Hilletofth, 2010; Hilletofth, 2011; Flynn et al., 1999; Frohlich and Dixon, 2001). The link between business strategy and operations strategy is fundamental to achieving a competitive advantage (Skinner, 1969).

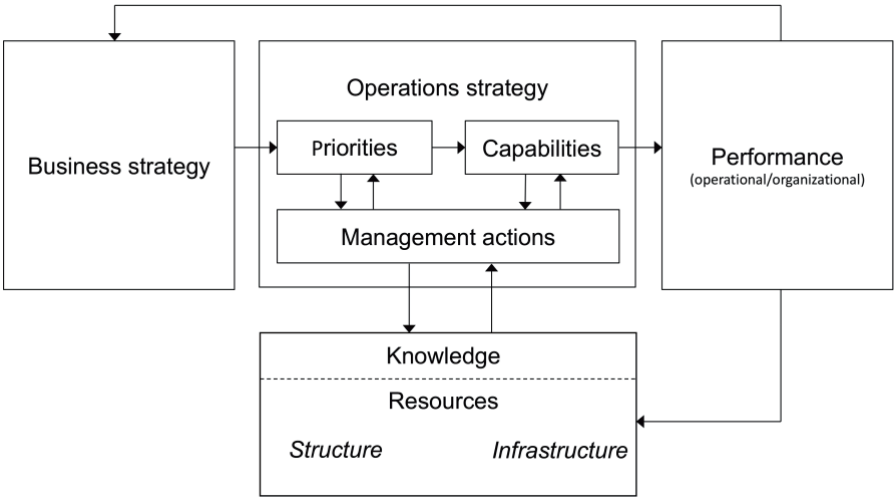

Figure 1 Operations strategy, capabilities and performance (Based on Frohlich and Dixon, 2001; Größler and Grübner, 2006)

Two main elements are essential to defining of an operations strategy (Dangayach and Deshmunk, 2001; Leong at al., 1990; Platts et al., 1998). The first element refers to what the operations function is intended to accomplish and can be defined as priorities that a firm wants to have to compete (Hayes and Wheelwright, 1984; Miller and Roth,

1994; Platts *et al*., 1998). In other terms, priorities are *desired capabilities*, i.e. those that a firm wants to have in the future or areas that should be emphasized (Größler and Grübner, 2006). The priorities (or objectives) guide management actions towards developing the most appropriate operations capabilities (Koufteros et al., 2002). The second element refers to a pattern of decisions that a firm makes, which determines the actual capabilities of the operations system (Hayes & Wheelwright, 1984; Miller & Roth, 1994; Platts et al., 1998). In other words, operations capabilities are *realized capabilities*, i.e. those that are attained after the implementation of management actions (Koufteros et al., 2002).

The objective of companies is to develop hard-to-imitate capabilities, which help a firm stand out among its competitors. Researchers have argued that operations capabilities form the primary basis for competition between firms (Swink and Hegarty, 1998). Management actions are based on knowledge and limited resources which the company owns. Management always makes decisions under the regime of finite resources and not all capabilities can be maximized (Größler and Grübner, 2006). Therefore, operations capabilities emphasize the role of strategic management in adapting and integrating resources to match customer expectations (Koufteros et al., 2002).

1.2 Motivation of the research

Numerous manufacturing firms, motivated by a desire to gain a competitive edge, have relocated their manufacturing operations to low cost environments (Ketokivi et al., 2017; Wiesemann, et al., 2017; Jensen and Pedersen, 2012). This trend has become an established business practice and has been ongoing since the 1960s (Jensen and Pedersen, 2012), creating serious issues for the western social welfare.

In order to maintain manufacturing in high cost environments, firms located in these environments must be able to improve their overall competitiveness. Research has shown that operations capabilities are a fundamental requisite for determining the firm's strategy and competitiveness (Phusavat and Kanchana, 2007). Therefore, firms need to identify, develop and improve those operations capabilities that have the greatest impact on overall competitiveness (Größler and Grübner, 2006). The development of operations capabilities can support the

achievement of the highest possible level of performance along different dimensions such as cost, quality, delivery and flexibility (Boyer and Lewis, 2002; Rosenzweig et al., 2003, Hilmola et al., 2015).

The existing literature in the operations management field includes plenty studies on operations strategy in which critical priorities and operations capabilities are identified (Hallgren, 2007; Größler and Grübner, 2006; Frohlich and Dixon, 2001; Leong et al., 1990). Nonetheless, this is done from a general perspective and specific environments like high cost, are not emphasized. Firms located in high cost environments are facing major challenges in dealing with the competition located in low cost environments. Although this problem is generally acknowledged, the literature has a gap concerning the identification and development of operations capabilities in such an environment.

Several frameworks of operations capabilities have been proposed in the literature (Frohlich and Dixon, 2001, Miller and Roth, 1994). However, these frameworks have not been updated over the past few decades, and do not take the high cost environments into consideration (Reitsma et al., 2017; Sansone et al., 2016; Sansone and Hilletofth, 2016; Hallgren, 2007). The lack of a coherent and contemporary framework of operations capabilities in a high cost environment, can be regarded as a failure to develop valuable operations capabilities for this specific environment. A failure to recognize operations capabilities may drastically decrease a firm's competitiveness (Phusavat and Kanchana, 2007).

1.3 Purpose of the research

As discussed above, a significant shift of manufacturing from high to low cost environments has taken place in the past three decades. To maintain manufacturing in high cost environments, firms located in these environments must improve their competitiveness. Firms need to be able to identify, develop and improve those operations capabilities that have the greatest impact on overall competitiveness. There is so far no coherent and contemporary framework of operations capabilities. There is also a lack of knowledge on operations capabilities specifically in a high cost environment. Thus, the purpose of this research is:

To investigate critical operations capabilities in a high cost environment.

In order to fulfill the purpose, two research questions have been formulated. The first step in fulfilling the purpose is to investigate the operations capabilities dimensions in a high cost environment. The need to identify and develop these dimensions has been stressed by many researchers (Alsmadi et al., 2011). These dimensions also evolve over time, so that it is necessary to investigate them continuously with updated and current information (Karim et al. 2008). Thus, the first research question is:

> RQ1. What are the critical operations capabilities *dimensions* in a high cost environment?

The second step in fulfilling the purpose is to investigate critical operations capabilities in a high cost environment. These capabilities can be regarded as the firm's strategic advantages, which can only be developed through long-term investment. The development of these capabilities should be aligned with the business and operations strategy (Chang et al., 2002). Thus, the second research question is:

> RQ2.What are the critical *operations capabilities* in a high cost environment?

The progression between the research questions is that the first question provides an understanding of the dimensions that a firm chooses to compete with in the specific context of high cost environment. Based on these dimensions, the firm develops the appropriate operations capabilities. The second research question provides an understanding of the capabilities that a firm needs to develop in order to be competitive in a high cost environment. Hence, answering the research questions should help to reveal the critical operations capabilities in a high cost environment and thus fulfill the purpose of this research.

1.4 Scope of the research

This research belongs to the operations management research field and investigates critical operations capabilities in a high cost environment (Figure 2).

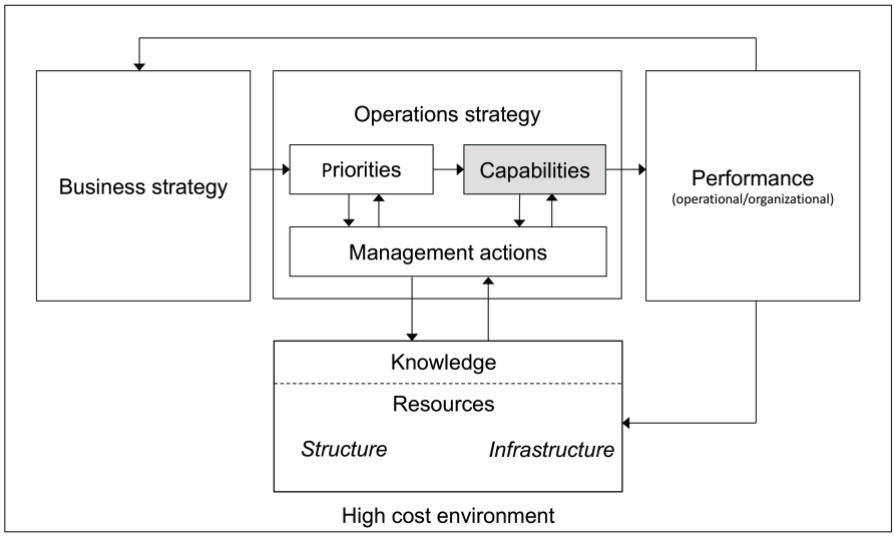

Figure 2 Scope of the research

The research focuses on operations capabilities within the operations strategy area. The research also focuses specifically on a high cost environment. The high cost environment is limited to Sweden and to manufacturing companies.

1.5 Outline of the thesis

This licentiate thesis consists of six chapters and three appended papers. The remainder of this thesis is structured as follows:

In **Chapter 1**, the introduction of the research is presented, including the background, motivation, purpose and scope of the research.

In **Chapter 2**, the frame of reference is presented, including the concepts of operations strategy, operations capabilities, and high cost environment.

In **Chapter 3**, the research methodology of the study is presented, including the research process, strategy and explanation of its quality.

In **Chapter 4**, a summary of the appended papers is presented, including an outline of all appended papers in this thesis. It also includes an overview of the connection between each paper and the research questions.

In **Chapter 5**, a discussion of the findings is presented, and the research questions are addressed.

In **Chapter 6**, the conclusions are presented, including contributions and implications, limitations and further research.

2 Frame of reference

This chapter presents the frame of reference, including the concepts of operations strategy, operations capabilities, and high cost environment.

2.1 Introduction to the frame of reference

As explained earlier, this research focuses on operations capabilities within the operations strategy area. The research also focuses specifically on a high cost environment. Hence, these three areas will be further explained and defined within the frame of reference (Figure 3).

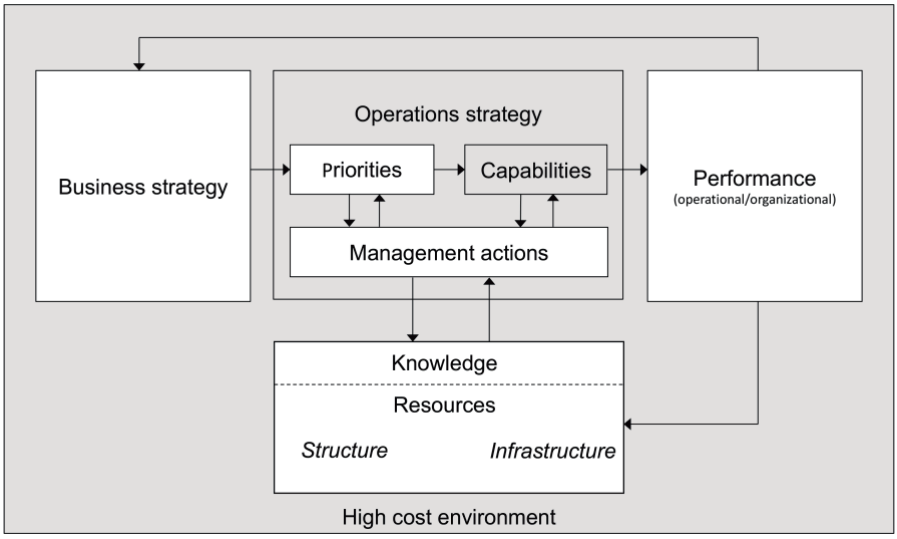

Figure 3 Components of the frame of reference (in grey)

Operations capabilities are part of the operations strategy, which in turn is influenced by the environment in which it is implemented, i.e. high cost.

2.2 Operations strategy

The operations strategy plays an important role in developing a competitive advantage for the firm. The investigation of operations strategy was introduced in 1969, with the important initial contribution of Skinner. He (1969, p. 139) defined *strategy* as

> *"a set of plans and policies by which a company aims to gain advantages over its competitors."*

During the last few decades, several operations strategy definitions have been proposed which follow different lines of thinking and highlight different aspects of operations strategy (Filho et al., 2015). According to Slack et al. (2004 p. 67) *operations strategy* is:

> *"the pattern of strategic decisions and actions which set the role, objectives and activities of operations."*

The use of the term 'pattern' implies consistency in strategic decisions and actions over time (Barnes, 2008). *Strategy* is a broad term that refers to a long-term perspective and is the concern of senior management, while *operations* are detailed, complex and carried out by those at lower levels of the organization (Slack, 2005). Therefore, it is important to distinguish between operations and operational. *Operational* is the opposite of strategic, while operations constitute the parts of the organization that satisfy customer needs and includes the resources that create products and services (Slack, 2005). In other words, operations strategy is defined as:

> *"a set of goals, policies and self-imposed restrictions that together describe how the organization proposes to direct and develop all the resources invested in operations so as to best fulfil (and possibly redefine) its mission"* (Hayes et al., 2006, p. 33).

This definition incorporates the *resource-based view*. In this view, the resources of an organization are used to gain a competitive advantage. Distinctive resources that yield operational superiority or help to create a superior market position enable the organization to generate superior profits (Alsmadi et al., 2011). In other words, it offers a strategic perspective in understanding how firm's resources and capabilities affect performance (Wernerfelt, 1984; Barney, 1991). The firm's resources are identified as the source of its capabilities, which in turn represent the main source of the firm's competitive advantage (Größler and Grübner, 2006). Hence, *resources* are internally measured factors of competition (Koufteros et al., 2002) and a *resource* refers to:

> *"anything which could be thought of as a strength or weakness of a given firm. More formally, a firm's resources at a given time could be defined as those (tangible and intangible) assets which are tied semipermanently to the firm.* (Wernerfelt, 1984, p. 172)

In other words, resources, as distinct from capabilities, are something a firm possesses or has access to, not what a firm is able to do (Größler and Grübner, 2006). Resources can be tangible, for example, specialized production systems, and intangible, for example, the level of training of workers. In general, a 'balance' between available resources and used capabilities is necessary to achieve high performance (Größler and Grübner, 2006). In conclusion, the resource based view offers a strategic perspective to understanding how resources and capabilities affect a firm's performance (Wernerfelt, 1984).

2.1.2 Operations capabilities

Miller and Roth (1994) proposed a taxonomy of operations capabilities. With more than 1000 citations, their taxonomy has become one of the most influential frameworks in the operations strategy literature and has been used and improved in many later studies (e.g., Frohlich and Dixon, 2001). Typical and commonly used dimensions of operations capabilities are also included in the initial taxonomy of Miller and Roth (1994) which contain cost (price), quality, flexibility, delivery, and service (Table 1). Even if some studies also suggest innovation and sustainability as critical dimensions of operations capabilities (Krause et al., 2001, Longoni and Cagliano, 2015), most of the research stresses the five dimensions mentioned above (Miller and Roth, 1994, Frohlich and Dixon, 2001).

As can be seen in Table 1, each dimension includes one or more defined capability. Quality has undeniably become an essential factor in global competition (Alsmadi et al., 2011). Firms that do not pay attention to this dimension run the danger of losing market share and declining profits (Alsmadi et al., 2011; Zhao et al., 2002). Quality includes the capabilities of offering consistent quality (conformance) and providing high-performance products (performance). Flexibility is the firm's

ability to set up resources in response to environmental changes (Alsmadi et al., 2011). This dimension includes the capabilities to make rapid design changes and/or introduce new products quickly (design flexibility), to respond to swings in demand (volume flexibility), and to deliver a broad product line. Delivery includes the capabilities to deliver products quickly (delivery speed), and to deliver on time (delivery dependability). On time delivery is one of the requirements for fulfilling customer's needs, and fast delivery can also help a firm to win orders in the current highly competitive environment (Alsmadi et al., 2011; Zhao et al., 2002). Service is growing in importance; in fact, providing more value-added services can help a firm to enrich the relationship with its customers (Zhao et al., 2002). In addition, the service dimension includes helping the customer after the product has been delivered, such as reparations, installation, etc. (after sales service), reaching customers in dispersed geographic/national locations (broad distribution), and increasing sales through effective advertising and promotion. The price dimension includes the capability to compete on price (low price).

Table 1 Taxonomy of operations capabilities (Frohlich and Dixon, 2001; Miller and Roth, 1994)

Dimension	**Capability**	**Intended outcome**
Price	1.Low price	Compete on price
Flexibility	2.Design flexibility	Make rapid design changes and/or introduce new product quickly
	3. Volume flexibility	Respond to swings in volume
	4. Broad product line	Deliver a broad product line
Quality	5. Conformance	Offer consistent quality
	6. Performance	Provide high performance products
Delivery	7. Delivery speed	Deliver products quickly
	8. Dependability	Deliver on time (as promised)
Service	9. After sale service	Provide after sale service
	10. Broad distribution	Distribute the product broadly
	11. Advertising	Advertise and promote the product

Concerning the relationship among different capabilities, there are two common models, the trade-off model and the cumulative (or sand-cone) model. In the *trade-off model*, some operations capabilities are strategically more important than others, and they are distinct and developed in isolation one at a time (Sum et al., 2012). As such, managers need to be selective in their focus. It has been argued that the trade-off model may lose relevance in the current business environment, which is characterized by advanced manufacturing technologies and intense global competition, that has put more pressure on firms to excel in multiple capabilities (Sum et al., 2012). In the *cumulative model*, operations capabilities are built on each other cumulatively and developed simultaneously (Größler and Grübner, 2006; Schoenherr et al., 2012). With this perspective, manufacturing systems allow for simultaneous improvements in more than one capability (Größler and Grübner, 2006). Firms that develop multiple capabilities outperform those firms that target only specific capabilities (Sum et al., 2012).

The current debate is centered on whether these capabilities represent a set of choices that firms need to consider as based on trade-offs, or whether they can be pursued cumulatively in combination, a specific sequence or as a progression (Schoenherr et al., 2012). A major assumption of this present research is that capabilities are cumulative. This assumption is based on the 'law of cumulative capabilities', which states that improvement in certain capabilities can amplify certain others; it is evident that operations capabilities are related to each other (Größler and Grübner, 2006). The relationship among operations capabilities need to be taken into consideration when formulating operations strategies for improving the firm's performance.

The concept of capabilities is sometimes related to the concept of competences. However, the literature does not distinguish clearly between these two concepts (Größler and Grübner, 2006). Some authors consider the two terms 'competence' and 'capability' as synonymous, and numerous authors have used them interchangeably (Ray and Ramakrishnan, 2006). A common understanding of these terms has still not been achieved, and they remain ambiguous and controversial. In this research, the term 'capability' was selected, which seems to be the more commonly used term in the operations

management literature (Größler and Grübner, 2006). At an overall level, *capabilities* are defined as:

> *"a plant's contribution to a company's success factors in competition, i.e. the strengths of a plant with which it wants to support corporate and marketing strategy and which help it to succeed in the marketplace."* Größler and Grübner, 2006, p. 459)

Capabilities enable a firm to exploit its resources to generate profits, and these capabilities are generated after defining certain priorities or objectives and the implementation of certain management actions. Consequently, the generation of capabilities affect the performance of a firm. On the one hand, capabilities are developed to achieve specific priorities or objectives. On the other hand, once the capabilities have been developed, the achievement of these objectives is measured in the form of performance scores (De Toni and Tonchia, 2001). For example, if the objective is to reduce cost, the level of low-cost manufacturing reflects the performance of a firm regarding its cost capability (De Toni and Tonchia, 2001; Größler and Grübner, 2006).

In this research, operations capabilities are implicitly dynamic. According to Teece and Pisano (1994, p. 538), *dynamic capabilities* emphasizes two aspects:

> *"The term 'dynamic' refers to the shifting character of the environment;* [in which these capabilities are developed and generated], […]. *The term 'capabilities' emphasizes the key role of strategic management* [management actions] *in appropriately adapting, integrating, and re-configuring internal and external organizational skills, resources and functional competences to change in environment."*

2.1.2 High cost environment

This research focuses on a high cost environment. The interplay between the events studied and their environment is fundamental for research (Sayer, 1992), and two fundamental manufacturing environments are high and low cost. Yet, the distinction between these two environments is generally not well defined in the literature.

According to Green and Ross (2012), one way to determine whether a country is high or low cost is to use some form of price parity index. The most well-known is the Big Mac index. By using this index, it is possible to get an approximate distribution of relative cost levels and identify countries that normally have a high cost environment (Green and Roos, 2012). The Big Mac index is centered on "*the notion that in the long run exchange rates should move towards the rate that would equalise the prices of a basket of goods and services around the world. Average prices should be lower in poor countries than in rich ones because labour costs are lower."* (Green and Roos, 2012, p. 24). Therefore, *"the distinction between high and low cost* [environments] *has always been implicitly a distinction between high and low wages"* (Ketokivi et al., 2017, p. 20). Based on the Big Mac index, the highest cost countries are Switzerland, Norway and Sweden (The Economist, 2017).

The differentiation between high and low cost environments is also related to the different ways of competing. Green and Roos (2012), outlined some of them, as summarized in Table 2.

Table 2 Differences between high and low cost environments (Green and Roos, 2012).

Parameter	**Low cost environment**	**High cost environment**
Normal basis for competition	Lowest cost	Highest value for money
Focus	Efficiency	Efficiency and effectiveness
Time horizon	Short term	Long term
Innovation focus	Tactical problem solving	Strategic innovation
Innovation behavior	Arbitrage	Value creation and value appropriation
Government policy tools	Supply side	Demand side
Mindset	Owner	Custodian
Profit use	Pocket	Re-invest

In a low cost environment, the basis for success is to compete on price and to have the lowest cost. This means focusing on efficiency (doing what you do as well as possible). This often results in a focus on productivity and reduces the risk of introducing new things into the operations system (Roos and Kennedy, 2014). In a high cost environment, on the other hand, the basis for success is to compete on superior value for money. This means focusing on effectiveness (doing the right operations or activities). This often leads to a focus on innovation and the identification of smarter ways to do operations or activities (Roos and Kennedy, 2014).

3 Research methodology

This chapter presents the research methodology, including the research process, strategy and explanation of its quality.

3.1 Research process

The purpose of this research was to investigate critical operations capabilities in a high cost environment. Accordingly, two research questions were formulated (Figure 4). In order to fulfill the purpose and answer the two research questions, two studies were conducted. Both research questions were covered in each study.

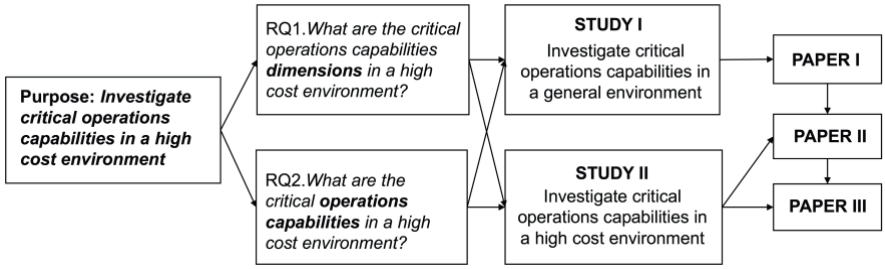

Figure 4 Introduction to the research

The first study investigated critical operations capabilities in a general environment. The study was conducted through a systematic literature review which yielded a framework of operations capabilities. The first study was reported in Paper I.

The second study investigated critical operations capabilities in a high cost environment. The study was conducted through a focus group and a multiple case study, yielding a framework of operations capabilities in a high cost environment. The second study was reported in Paper II (focus group) and Paper III (case study).

The process by which the research activities for the licentiate were carried out are presented in Figure 5. This research was conducted between August 2015 and December 2017.

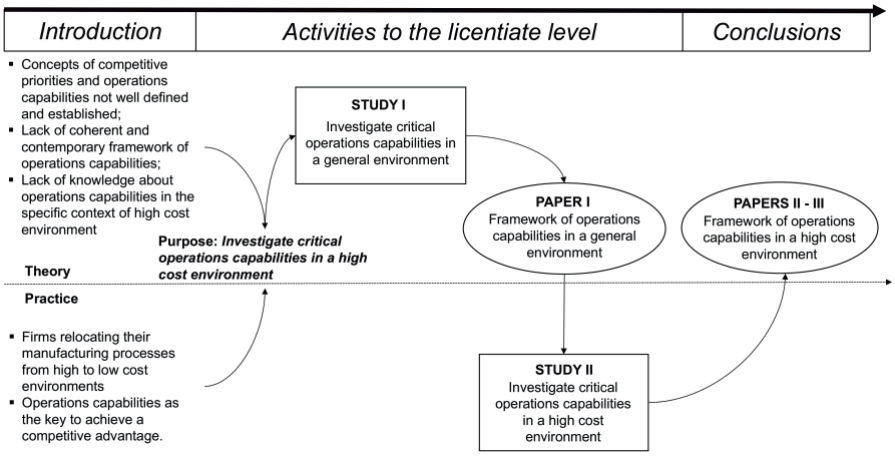

Figure 5 The research process

The output of the first study was a framework of operations capabilities in a general environment. This framework became the starting point for the second study. The empirical data collected during the second study further revised and reinforced the framework developed in the first study. The specific output of the second study was a framework of operations capabilities in a high cost environment.

In more detail, the framework of operations capabilities in a high cost environment was:

- Developed initially through a systematic literature review (Paper I)
- Evaluated in and revised for a high cost environment through a focus group study (Paper II)
- Further revised for a high cost environment through a multiple case study (Paper III).

Based on the empirical data collected through the second study, the framework of operations capabilities was revised to adapt it better to the high cost environment context.

3.2 Research strategy

The first research strategy was a *systematic literature review* (Paper I). The purpose of Paper I was to investigate operations capabilities in a

general environment (Table 3). The essence of the systematic literature review was to establish a protocol for identifying, selecting, and reviewing literature that is relevant to the specific purpose (Ashby et al, 2012). The output of Paper I was a framework in which the critical operations capabilities that had been identified in the literature, were defined and discussed.

Table 3 Research strategies

	Study 1	**Study 2**	
	Paper I	***Paper II***	***Paper III***
Purpose	Investigate critical operations capabilities in a general environment	Evaluate critical operations capabilities in a high cost environment	Investigate critical operations capabilities in a high cost environment
Research strategy	Systematic literature review	Focus group study	Multiple case study
Data collection	Database searches	Questionnaire Group discussion	Semi-structured interviews Workshops Observations Documents
Data analysis	Qualitative data analysis	Quantitative data analysis Qualitative data analysis	Qualitative data analysis Within-case analysis Cross-case analysis

The second research strategy was a *focus group study* (Paper II). The purpose of Paper II was to evaluate critical operations capabilities in a high cost environment. Through a focus group study, it was possible to evaluate critical operations capabilities in a high cost environment, asking the participants specific questions to encourage discussion around the initial framework of operations capabilities presented in Paper I.

The third research strategy was a *multiple case study* (Paper III). The purpose of Paper III was to investigate critical operations capabilities in a high cost environment. The benefits of multiple case study research

were related to the possibility of focusing on different cases, retaining a holistic and real-world perspective (Yin, 2014) and identifying similarities and differences across the cases.

A more detailed research process description is found in Figure 6. The systematic literature review (Paper I) was the backbone of this thesis and supported the data collection and data analysis in the focus group study (Paper II) and the multiple case study (Paper III). The data collection and analysis is further described below.

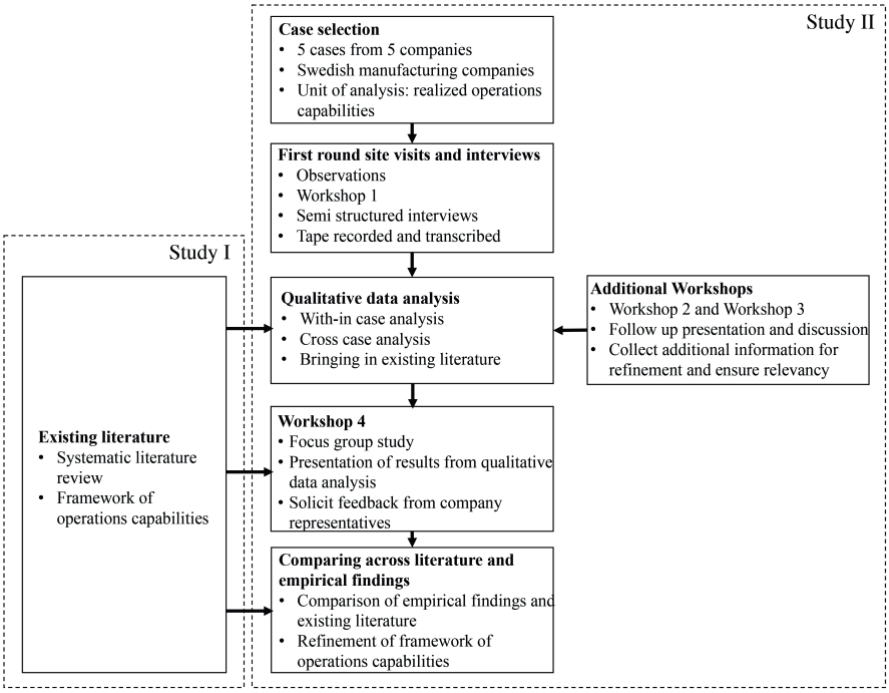

Figure 6 The research process in detail

3.2.1 Data collection

In the systematic literature review, papers were searched from the Scopus academic database. The three main concept terms used in the search were: 'operations strategy', 'competitive priorities' and 'competitive capabilities'. Different synonyms were defined in order to detect all relevant papers for each of these terms. The synonyms constituted the set of search terms (keywords) used in the systematic literature review. The identified search terms were combined into

search strings using Boolean logic. Based on different inclusion and exclusion criteria, two screening processes were conducted. The first (abstract review) consisted of reviewing only the abstract of each paper. The second screening process (paper review) involved reading the entire paper. The final sample included 157 relevant papers, which were clustered according to the competitive priorities and operations capabilities they discussed.

In the focus group study, two moderators led the discussion on the topic of operations dimensions and capabilities. In total, 14 managers from five Swedish manufacturing companies participated. During the session, a questionnaire was used to evaluate the framework of operations capabilities developed in the systematic literature review. The questionnaire included 21 questions, which were related to the 21 operations capabilities included in the framework. Each participant was asked to rate the operations capabilities using an interval scale from 1 to 5. After the questionnaires had been collected, the focus group continued with a group discussion. During the discussion, each participant had a turn to comment on the questionnaire and the framework. One of the moderators was designated as a note keeper to provide field notes and write down all inputs from the participants without critical evaluation. At the end of the session, the moderators also used a flip chart to summarize the session with the participants.

In the multiple case study, the sample included five manufacturing companies located in Sweden, which had been selected by the investigators through theoretical sampling. Data was collected through semi-structured interviews, workshops, observations, and documents provided by each company. The semi-structured interviews were conducted with case company representatives. All the respondents were part of the management team in their respective company. The interviews provided an in-depth understanding of operations strategy and the capabilities developed within each case company. In total, 59 semi-structured interviews were conducted in the five involved companies. The workshops helped the investigators to collect data, provide an overview of different topics (for instance the implemented operations strategies, challenges in a high cost environment, as well as a contextual understanding of the topic studied), work-in-progress as well as final findings, and to receive feedback from the company

representatives. The observations focused on the manufacturing facilities, which helped the investigators to study the production systems of the various companies, making it possible to contextualize the findings. Additional documents were provided by the companies, in order to collect supplementary contextual information.

3.2.2 Data analysis

In the systematic literature review, both a descriptive and a content analysis were conducted. In the latter, the papers were categorized according to the operations capabilities derived from the material under examination, employing an iterative process of category building, testing and revising, by constantly comparing categories and data (Seuring and Gold, 2012). All relevant information was entered into a spreadsheet, yielding a broad overview of operations capabilities, extrapolated from the literature. In the descriptive analysis, the papers were analyzed through certain statistical tools. The final sample was also analyzed according to several variables, such as year of publication, the specific journal, and applied research methodologies.

In the focus group study, the data analysis included two phases. The first concerns the analysis of results from the questionnaires. The data was coded by means of a ranking system. The data was entered into a spreadsheet for analysis. Mean values were calculated in terms of dimensions and capability levels, and standard deviations were calculated for capabilities. The second phase concerns the analysis of the group discussion. In the first step, one of the moderators was designated as a note keeper. In the second step, the investigators read through the notes and transcriptions to familiarize themselves with the data. In the third step, information was categorized into the main categories (referring to dimensions) and subcategories (referring to capabilities) and labelled with the same terminology as the main framework. In the fourth step, during the process of data analysis, the investigators further discussed the findings to gain a better understanding. In the fifth step, the investigators used some follow-up meetings with the participants to further discuss the findings.

In the multiple case study, the data analysis was based on the link between the data collected in the case studies and the initial framework of operations capabilities. The framework shaped, led and gave a sense

of direction when analyzing the data. The qualitative data analysis began with a within case analysis. Accordingly, the first step was to develop a case study description for each company. The qualitative data analysis continued with a cross-case analysis, which focused on finding patterns, commonalities and differences between the literature and the empirical data from the case companies. This was achieved by comparing data across cases for each of the operations dimensions and capabilities.

3.3 Research quality

Validity and reliability are important criteria in establishing and assessing the quality of research (Bryman and Bell, 2011). In Table 4, these criteria are related to the appended papers.

Internal validity refers to the conclusiveness of the results (Williamson, 2002). In this research, internal validity was improved by using multiple sources of evidence and adopting triangulation during the entire research process (Voss et al., 2002). Three types of triangulation are commonly used: source, investigator and method (Karlsson, 2009). Source triangulation consisted of gathering information from multiple respondents. This triangulation supported a cross-checking for consistency of the data collected. Investigator triangulation was applied throughout the research process by involving two to four investigators during data collection and data analysis. Investigator triangulation enabled a comparison between findings, so as to check consistency. Method triangulation was applied in this research by conducting, for example, semi-structured interviews, observations, a group discussion, and using a questionnaire. The advantage of method triangulation is related to the idea that if different research methods are used, the researcher can take advantage of the strengths and offset the weaknesses of each (Williamson, 2002). In Paper I, the systematic literature review followed a predefined structure. The paper selection was based on predefined criteria which were outlined by more than one investigator. In Paper II, source triangulation was ensured by involving 14 managers from different companies in the focus group session. Method triangulation was ensured by conducting a questionnaire and a group discussion during the focus group session. In Paper III, source triangulation was ensured by involving more than 59 managers from 5 different companies. Method triangulation was ensured by adopting

different data collection techniques (semi-structured interviews, observations, workshops) in the multiple case study.

Table 4 Quality criteria in relation to the appended papers

	Paper I	**Paper II**	**Paper III**
	Systematic literature review	***Focus group***	***Multiple case study***
Internal validity	Bias reduction, investigator triangulation	Bias reduction, source triangulation, investigator triangulation, method triangulation.	Bias reduction, source triangulation, investigator triangulation, method triangulation.
External validity	Conclusions based on the initial selection of more than 2000 papers within the operations strategy area.	Conclusions based on the framework developed and presented in Paper I.	Conclusions based on the framework developed and presented in Paper I.
Reliability	Structured process, guidelines and explanations are provided.	Structured process, structured questionnaire, guideline for group discussion.	Structured process, case study description, guideline for the semi-structure interviews.

External validity refers to the generalizability of the research findings (Williamson, 2002), meaning that the results are valid in a similar setting beyond the studied objects (Karlsson, 2009). There are two different types of generalization: statistical and analytical. The first is the approach usually adopted in survey research; the second is adopted when previously developed theory is used as a template for comparing the empirical results of the study (Yin, 2014). In terms of statistical generalization, the findings of this research cannot be extrapolated and generalized at least not to a large degree. The limited set of companies and participants involved in this study do not allow for a wide-ranging data collection. The operations capabilities identified in a high cost environment might not be suitable for the entire set of companies

located in Sweden, or in other high cost environments. However, it can be stated that the empirical findings nevertheless broaden the empirical basis of research on operations capabilities in a high cost environment. In terms of analytical generalization, previously developed theory is used as a template for comparing the empirical findings (Yin, 2014). The findings of this research are built upon a framework of operations capabilities presented in Paper I, which was developed through a systematic literature review. The review included an initial sample of more than 2000 papers within the operations strategy area.

Reliability refers to obtaining consistent, stable research results with the ability to replicate (Williamson, 2002). It is important to ensure the replication of the research by providing the reader with all information regarding how the research was conducted. The data collection and data analysis is supported by all the evidence, so as to increase transparency. Paper I includes guidelines and a detailed explanation concerning the systematic literature review, the sample of papers analyzed is provided in the appendix of Paper I. Papers II and III include guidelines and detailed explanations about the procedure of the focus group study and multiple case study. Moreover, all the semi-structured interviews were recorded and transcribed, which allows easy access to the raw data. Furthermore, the researcher developed interview guides and case study descriptions, which are not included in this thesis. More detailed information can be found in the appended papers.

4 Summary of appended papers

This chapter presents a summary of the appended papers, including an outline of all appended papers in this thesis. It also includes an overview of the connection between each paper and the research questions.

4.2 Paper I - Critical operations capabilities for competitive manufacturing: a systematic review

The purpose of Paper I was to investigate critical operations capabilities in a general environment. This purpose was addressed by conducting a systematic literature review. The research was conducted during March 2015, and the final sample included papers published between 1991 and 2015. However, the basic body of identified literature comprised 157 papers. The data analysis revealed that, in spite of the differences in terminology, there is general consensus in the literature that the main dimensions are: cost, quality, delivery, flexibility, service, innovation and environment (Table 5).

Table 5 Framework of operations capabilities in a general environment.

Dimension	Capability	Definition
Cost	Total cost	Ability to reduce production and distribution costs.
	Productivity	Ability to optimize the utilization of manufacturing resources (machines, equipment, and labor) and increase their output.
Quality	Performance	Ability to provide products and processes at the desired high level of performance.
	Conformance	Ability to offer products and manufacturing processes that correspond to the specifications, which help to ensure defect free products.
	Durability	Ability to offer products that withstand hard use over an extended period of time.
Delivery	Dependability	Ability to provide reliable delivery by meeting schedules or keeping promises.
	Speed	Ability to provide fast delivery and respond quickly to customer orders.
Flexibility	Volume Flexibility	Ability to change production volume and respond rapidly to volume changes.

	Production Mix Flexibility	Ability to change the range of products in the production and respond rapidly to changes.
	Customization Flexibility	Ability to adjust the product according to customer requirements and needs.
	Broad Product Line	Ability to offer a wide range of products, with a large number of features.
Service	Customer Service	Ability to add value to the product by providing product information and making the product easily available and obtainable.
	After Sale Service	Ability to add value to the product after the purchase by providing effective after sale services, and delivering appropriate technical assistance and product support.
	Advertising	Ability to market and promote the product, and improve the company's image.
	Broad Distribution	Ability to make the product available to a larger group of customers.
Innovation	New Product	Ability to develop and introduce updated or novel products to the market.
	New Technology	Ability to develop and implement updated and novel technologies.
	New Service	Ability to develop and present updated and novel services to the customers.
	New Market	Ability to create, expand and develop products and services, as to reach additional groups of customers.
Environment	Environmental Friendly Products	Ability to produce products with a reduced negative or even positive environmental impact.
	Environmental Friendly Processes	Ability to have processes with a reduced negative or even positive environmental impact.

Among these, five (cost, quality, delivery, flexibility, service) have long been recognized in the literature, while two (innovation, environment) are just starting to gain recognition. Firms consider these dimensions as competitive priorities in the formulation of operations strategy. In total, 21 critical operations capabilities were identified. The identification of innovation and environment as additional competitive dimensions, resulted in the inclusion of six more operations capabilities. Innovation included the capabilities 'new product', 'new technology', 'new service', and 'new market', Environment included 'environmentally friendly processes' and 'environmentally friendly products' (Table 5). Except for delivery, all the other dimensions were modified.

Contribution: The paper was co-written with Hilletofth. Sansone was responsible for the data collection and analysis. Eriksson contributed with comments and improvements.

4.3 Paper II - Evaluation of operations capabilities in high cost environment

The purpose of Paper II was to evaluate critical operations capabilities in a high cost environment. This purpose was addressed by conducting a focus group study that included 14 managers from five Swedish manufacturing companies. The research process was based on the evaluation of the framework of operations capabilities presented in Paper I. Paper II included quantitative (questionnaire) and qualitative (group discussion) data collection and analysis.

Table 6 Evaluation of operations capabilities in a high cost environment

Dimension	Capability	Mean ($\bar{x}$)	Standard deviation (σ_2)
Quality	Conformance	4.64	0.50
Quality	Performance	4.36	0.84
Cost	Total Cost	4.29	0.99
Delivery	Dependability	4.29	0.99
Service	Customer Service	4.07	0.83
Innovation	New Product	4.07	0.83
Quality	Durability	4.00	0.96
Delivery	Speed	3.93	0.83
Service	Distribution	3.93	0.83
Innovation	New Technology	3.79	1.19
Flexibility	Production Mix Flexibility	3.71	0.73
Flexibility	Customization Flexibility	3.71	0.83
Flexibility	Broad Product Line	3.71	0.73
Cost	Productivity	3.64	1.08
Innovation	New Service	3.57	0.94
Service	Advertising	3.50	1.09
Service	After Sale Service	3.36	1.15
Innovation	New Market	3.36	0.84
Flexibility	Volume Flexibility	3.29	0.83
Environment	Products	3.29	0.99
Environment	Processes	3.00	0.55

The quantitative data analysis revealed that none of the dimensions and capabilities received a value of importance lower than 3. Hence, all the

dimensions and capabilities included in the existing framework were considered critical by the 14 managers who participated in the focus group study. However, the results of this paper showed that different emphasis was placed on the different dimensions and capabilities (Table 6).

The qualitative data analysis revealed that all the operations capabilities and dimensions were discussed and supported in the focus group session. The group discussion also revealed the importance of two additional operations capabilities: flow efficiency and employee flexibility. Flow efficiency was included in the cost dimension while employee flexibility was included in the flexibility dimension.

Based on Ling Tay (2016), flow efficiency was defined as the ability to optimize the movement of products through all processes and operations. Based on Wright and Snell, (1998), employee flexibility was defined as the extent to which employees possess skills, which enable the firm to pursue strategic decisions. Based on the data collected through a focus group session, this study developed an updated version of the operations capabilities framework, which is more suitable for a high cost environment (Table 7).

Table 7 Framework of operations capabilities in a high cost environment

Dimension	Capability	Definition
Cost	Total cost	Ability to reduce production and distribution costs.
	Productivity	Ability to optimize the utilization of manufacturing resources (machines, equipment, and labor) and increase their output.
	Flow efficiency	Ability to have an optimized movement of products through all processes and operations.
Quality	Performance	Ability to provide products and processes at the desired high level of performance.
	Conformance	Ability to offer products and manufacturing processes that correspond to the specifications, which help to ensure defect free products.
	Durability	Ability to offer products that withstand hard use over an extended period of time.

Delivery	Dependability	Ability to provide reliable delivery by meeting schedules or keeping promises.
	Speed	Ability to provide fast delivery and respond quickly to customer orders.
Flexibility	Volume flexibility	Ability to change production volume and respond rapidly to volume changes.
	Production mix flexibility	Ability to change the range of products in the production and respond rapidly to changes.
	Customization flexibility	Ability to adjust the product according to customer requirements and needs.
	Broad product line	Ability to offer a wide range of products, with a large number of features.
	Employee flexibility	Ability to which employees possess skills, which enable the firm to pursue strategic decisions.
Service	Customer service	Ability to add value to the product by providing product information and making the product easily available and obtainable.
	After sale service	Ability to add value to the product after the purchase by providing effective after sale services, and delivering appropriate technical assistance and product support.
	Advertising	Ability to market and promote the product, and improve the company's image.
	Broad distribution	Ability to make the product available to a larger group of customers.
Innovation	New product	Ability to develop and introduce updated or novel products to the market.
	New technology	Ability to develop and implement updated and novel technologies.
	New service	Ability to develop and present updated and novel services to the customers.
	New market	Ability to create, expand and develop products and services, as to reach additional groups of customers.
Environment	Environmental friendly products	Ability to produce products with a reduced negative or even positive environmental impact.
	Environmental friendly processes	Ability to have processes with a reduced negative or even positive environmental impact.

Contribution: The paper was co-written with Hilletofth. Sansone was responsible for the questionnaire and Hilletofth for the focus group

discussion. Eriksson and Bengtsson contributed with comments and improvements.

4.4 Paper III - Critical operations capabilities for competitive manufacturing: a multiple case study

The purpose of Paper III was to investigate critical operations capabilities in a high cost environment. This purpose was addressed by conducting a multiple case study including five Swedish manufacturing companies (Table 8).

Table 8 Cross-case analysis in relation to the literature

Dimension	***Capability***	***A***	***B***	***C***	***D***	***E***	***Lit***
Cost	Total cost	✓	✓	✓	✓	✓	✓
	Productivity	✓	✓	✓	✓	✓	✓
	Flow efficiency	✓		✓			
Quality	Performance	✓	✓	✓	✓	✓	✓
	Conformance	✓	✓	✓	✓	✓	✓
	Durability	✓	✓	✓		✓	✓
Delivery	Dependability	✓	✓	✓	✓	✓	✓
	Speed	✓	✓	✓	✓	✓	✓
Flexibility	Volume Flexibility	✓	✓	✓	✓	✓	✓
	Production Mix Flexibility	✓	✓	✓	✓	✓	✓
	Customization Flexibility	✓	✓	✓	✓	✓	✓
	Broad Product Line	✓	✓	✓		✓	✓
	Employee flexibility	✓		✓	✓	✓	
Service	Customer Service	✓	✓	✓	✓	✓	✓
	After Sale Service	✓		✓	✓		✓
	Advertising		✓		✓	✓	✓
	Broad Distribution	✓		✓	✓	✓	✓
Innovation	New Product	✓	✓	✓	✓	✓	✓
	New Technology	✓	✓	✓		✓	✓
	New Service				✓	✓	✓
	New Market				✓	✓	✓
Environment	Environmental Friendly Products	✓	✓	✓	✓	✓	✓
	Environmental Friendly Processes	✓	✓	✓	✓	✓	✓

The research process was based on investigating the framework of operations capabilities presented in Paper I. Paper III includes a within-case analysis for each company involved, and a cross-case analysis. Hence, the empirical findings were related to the existing framework of operations capabilities (Table 8).

In the literature, four of the dimensions included in the framework (cost, quality, delivery and flexibility) are considered as the four basic ones (Hallgren, 2007). In the multiple case study, the main dimensions taken into consideration were: cost, quality, delivery, flexibility, service, innovation and environment (Sansone et al., 2017).

The case study revealed that all seven dimensions and the 21 operations capabilities discussed and identified in the literature were supported in the case study. This study also revealed the importance of two additional operations capabilities: flow efficiency and employee flexibility. Flow efficiency was included in the cost dimension while employee flexibility was included in the flexibility dimension.

Contribution: The paper was co-written with Hilletofth. Sansone was responsible for the data analysis and Hilletofth for the data collection. Eriksson contributed with comments and improvements.

4.6 Summary of the papers' contributions

An overview of the main contributions from the appended papers, in relation to the two research questions, is provided in Table 9.

Table 9 Main contributions from the appended papers, in relation to the research questions

	RQ1: What are the critical operations capabilities *dimensions* in a high cost environment?	**RQ2: What are the critical *operations capabilities* in a high cost environment?**
Paper I	The literature review revealed that, in spite of the differences in terminology, there is general consensus in the literature that the main dimensions can be expressed in terms of: cost, quality, delivery, flexibility, service, innovation and	In total, 21 critical operations capabilities were identified. Noteworthy was the identification of innovation and environment as additional competitive dimensions, which resulted in the inclusion of six more operations capabilities.

	environment. Among these, five (cost, quality, delivery, flexibility, service) have long been recognized in the literature, while two (innovation, environment) are just starting to gain recognition.	Except for delivery, all other dimensions were modified and upgraded.
Paper II	All the dimensions discussed and identified in the literature were discussed and supported in the focus group study. The focus group study revealed that all seven dimensions were critical in a high cost environment (all received a value of criticality higher or equal than 3). The most critical dimension was quality while the least critical was environment.	All the operations capabilities discussed and identified in the literature were discussed and supported in the focus group session. The group discussion revealed the importance of two additional operations capabilities: flow efficiency and employee flexibility. Flow efficiency was included in the cost dimension while employee flexibility was included in the flexibility dimension.
Paper III	All the dimensions discussed and identified in the literature were discussed and supported in the multiple case study. The multiple case study revealed that all dimensions were critical in a high cost environment.	All the operations capabilities discussed and identified in the literature were discussed and supported in the multiple case study. This study also revealed the importance of two additional operations capabilities: flow efficiency and employee flexibility. Flow efficiency was included in the cost dimension while employee flexibility was included in the flexibility dimension.

5 Discussion

This chapter presents a discussion of the findings, and the research questions are addressed.

5.1 General discussion

The environment in which a firm competes, affects the formulation of the operations strategy and the development of different operations capabilities, which in turn affects the firm's operational and organizational performance (Boyer and Lewis, 2002). Nowadays, different relocation processes have been gaining increased attention among researchers and practitioners. The past three decades have witnessed waves of offshoring by manufacturing from a high cost environment towards low cost environments (Yin et al., 2017). It is understandable that this trend has been a serious concern for companies located in high cost environments. Earlier research has focused only on identifying operations capabilities in general contexts. Therefore, the research underlying this thesis intended to investigate operations capabilities in specifically in high cost environment, by presenting a framework of operations capabilities suitable for this particular context. The framework was based on the literature, and was thereafter updated and modified on the basis of empirical data collected from companies working in a high cost environment (Table 7).

5.2 Operations dimensions in a high cost environment

The taxonomy of operations capabilities proposed by Miller and Roth (1994) has become one of the most influential frameworks in the operations strategy literature and has been upgraded in many later studies (e.g., Frohlich and Dixon, 2001). Only cost, quality, delivery and flexibility are considered to be the four basic dimensions (Avella et al., 2001; Hallgren, 2007). These four are discussed by Skinner (1978), Hayes and Pisano (1994), Leong et al. (1990) and others. In addition to these four dimensions, the systematic literature review revealed three additional ones, namely service, innovation and environment, presented in Paper I. Papers II and III showed that the dimensions identified and presented in Paper I were considered critical in a high cost environment. Moreover, in Paper II, it was revealed that the most critical dimension in a high cost environment is quality, while the least critical dimension in a high cost environment is environment.

Cost plays a significant role in the competition between companies located in low and high cost environments. In previous studies, cost is considered to be the most important dimension. However, organizations that compete only on cost are not as effective as those which emphasize other aspects as well (Bolivar Cruz and Espino Rodriguez, 2008). However, in this research, the most critical dimension was quality. The rule "quality before cost" presented by Hay and Williamson (1991) seems to be valid in a high cost environment. Service was already included in the taxonomies of Miller and Roth (1994) and Corbett (1996). However, Paper I showed that it was mostly absent in the literature. Based on the findings from Paper I, Paper II and Paper III, both service and innovation seemed to be overlooked in the four basic dimensions of Hallgren (2007) as well as the key dimensions discussed by Avella et al. (2001). In Paper II, both service and innovation received a higher criticality value than flexibility, which belonged to the four basic dimensions found in the literature. In Paper II, environment received the lowest criticality value in this study, but was still rated higher than 3 and considered critical. In Paper III, it is demonstrated that environment is starting to gain recognition among managers in a high cost environment.

5.2 Operations capabilities in a high cost environment

In the taxonomy of Miller and Roth (1994), only eleven operations capabilities were identified. Paper I presented 21 operations capabilities, which were then considered critical in a high cost environment in Papers II and III. In these papers, two new capabilities were identified: flow efficiency and employee flexibility, which were not included in the initial framework presented in Paper I. Based on the findings from Papers II and III, flow efficiency was included in the cost dimension; and employee flexibility was included in the flexibility dimension.

Flow efficiency was related to the concept of resource efficiency and productivity in lean practices. The focus was based on the idea of increasing productivity by increasing output or/and reducing inputs to improve overall profitability (Ling Tay, 2016). Based on this logic, this capability was then included in the productivity capability in the framework of operations capabilities. However, in the literature, it has

been argued that a resource-based approach to efficiency can cause problems and increase waste (Ling Tay, 2016). Hence, it is interesting that the managers discussed the inclusion of a 'flow efficiency' capability in the framework. According to Ling Tay (2016), flow efficiency focuses on the value adding activities with respect to throughput time. Therefore, flow efficiency measures how well a flow unit moves through all the processes across the operations context.

In a fast changing business environment, the most suitable individual behaviors focus on being flexible and learning new skills such as openness to change, knowledge-sharing, creativity, and autonomy (Camps et al., 2016). Flexible employees perform better under conditions of high turbulence. Employee flexibility, as part of effective organizational learning, has been considered fundamental to dealing successfully with environmental turbulence (Camps et al., 2016).

5.3 Answering the research questions

The research questions and answers are summarized in Table 10. The two research questions were answered from the findings of all three appended papers.

Table 10 Answering the research questions

RQ1: What are the critical operations capabilities *dimensions* in a high cost environment?	**RQ2: What are the critical *operations capabilities* in a high cost environment?**
The operations capabilities dimensions identified in this research are: cost, quality, delivery, flexibility, service, innovation and environment. This research has shown that all seven dimensions are considered critical in a high cost environment, however with a different emphasis. The findings revealed that quality is considered as the most critical, and environment as the least critical.	The operations capabilities identified in this research are 23. This research has shown that all 23 operations capabilities are considered critical in a high cost environment, however with a different emphasis. Among these 23 capabilities, 21 were identified in the literature, and 2 in empirical findings.

6 Conclusion

This chapter presents the conclusions of this research, including contributions and implications, limitations and further research.

6.1 Fulfillment of the purpose

The purpose of this research was to investigate critical operations capabilities in a high cost environment. In order to fulfill the purpose, two research questions were formulated. The research questions were covered in two sequential studies. The first study investigated critical operations capabilities in a general environment, while the second study investigated critical operations capabilities in a high cost environment.

The findings revealed that companies located in a high cost environment develop different operations capabilities to gain competitive advantage. The investigation of operations capabilities revealed that companies located in a high cost environment tend to prioritize operations capabilities linked to quality, such as performance, conformance and durability. Moreover, due to the high labor cost that characterizes the high cost environment, companies work on increasing employee flexibility. Employees are always a precious resource for companies. Training sessions support employees in gaining knowledge and skills which are fundamental to the overall competitiveness of the company. The introduction of a new emerging environmental dimension has revealed new operations capabilities which are generally based on the reduction of environmental issues. In the same vein, new operations capabilities have been introduced in a new innovation dimension, such as a new market, and a new service. Innovation has increased its complexity, by adding market and service features. In a high cost environment, companies do not simply develop innovative products and technologies, but also innovative services and they identify new market niches. Furthermore, the findings also revealed that flow efficiency has gained a considerable attention amongst companies in a high cost environment.

Operations capabilities need to be updated so as to adapt more effectively to the current environment. The investigation conducted for this research has emphasized the dynamic nature of operations capabilities. Capabilities need to be updated according to the environment in which they are developed. Thus, the investigation

enabled updating the knowledge on operations capabilities, and introducing a high cost environment perspective.

6.2 Contributions

This research shows that companies develop different operations capabilities to be more competitive in a high cost environment, and these capabilities are related to different dimensions such as cost, quality, delivery, flexibility, service, innovation and environment. All the companies involved in this research acknowledged the criticality of these dimensions and the capabilities included, by showing interest in applying the framework in a more practical setting. Firms located in high cost environments are facing great challenges in managing the competition from firms located in low cost environments, and operations capabilities are a fundamental requisite for gaining a competitive advantage.

The overall research contribution is an increased understanding of operations capabilities in a high cost environment. The research touches upon several related areas, such as operations capabilities, operations strategy, and operations management. The research contributes to the current body of knowledge by introducing a novel perspective and some original thinking about operations capabilities. The first contribution is related to the ongoing process of gaining knowledge on the topic of operations capabilities. According to Frohlich and Dixon (2001), operations strategy is a dynamic process; this indicates how operations capabilities and their dimensions keep changing over time (Sansone et al., 2017). Therefore, it is vital to both modernize and identify new operations capabilities that assist the current competitive environment more efficiently.

The second contribution is related to the substantiation of operations capabilities dimensions and the evaluation of critical operations capabilities in a specific environment. In relation to the manufacturing relocation process that has been ongoing during the last few decades (Jensen and Pedersen, 2012) and the significant movements of manufacturing from high to low cost environment, it is fundamental for both researchers and practitioners to identify the most and the least critical dimensions and operations capabilities when formulating their

operations strategy. This could have only been done by validating and evaluating the operations capabilities in a specific context.

6.3 Implications

This research provided an overview of critical operations capabilities in a high cost environment. The investigation of these operations capabilities can benefit both practitioners and researchers in different ways.

The findings revealed that companies in a high cost environment prioritize quality operations capabilities. Practitioners need to be aware of the criticality of these capabilities. Companies should be ready to adopt different tools and techniques to measure quality and improve operations capabilities such as performance, conformance and durability. The introduction of a new operations capability such as employee flexibility implies that practitioners need to consider employees as a fundamental resource within the company. Companies need to investing on their education and training, so that employees become multi-skilled. Employees cannot always be replaced by automation. For practitioners, the discovery of an emerging environmental operations dimension, is associated with the fact that customer demands have changed over time and companies need to be ready to adapt to remain competitive. Practitioners need to create manufacturing capabilities that are able to reduce the environmental impact, and it is also very likely that this will necessitate educating employees, or a new type of employee with a different skillset. Moreover, the identification of new capabilities such as new services and a new market have increased the complexity of the innovation dimension. Companies not only need to develop new products and technologies, but to create and develop new services for customers, that will add value to the company. Companies also need to create new market opportunities. Practitioners in turn should develop capabilities that expand and develop products and services, so as to reach additional groups of customers.

The findings provide a new and updated set of operations capabilities in a high cost environment. The research has demonstrated that these capabilities need to be updated continuously, based on the environment in which they are developed. This also implies that the investigation of

operations capabilities in a different environment (i.e. low cost environment) can emphasize different operations capabilities. Hence, researchers investigating operations capabilities could adopt the framework of operations capabilities presented in this research as a tool for future comparison. Moreover, in this research, new operations capabilities have been identified on which the scientific community need to focus. More knowledge can still be created in order to support practitioners in developing these new operations capabilities.

On the one hand, proactively managing the development of different operations capabilities in a high cost environment requires some entrepreneurial skills. On the other hand, helpful knowledge from the scientific community could support companies in developing operations capabilities for winning operations strategies. This means that, even though this research has expanded on current knowledge, more research is still needed to paint a complete picture of the field (Eriksson, 2015).

6.4 Limitations and further research

As in any research, there are limitations to the generated findings. A framework of operations capabilities in a high cost environment has been developed. However, what is not outlined is how these capabilities should be managed and how they affect the various decision categories (Hayes and Wheelwright, 1984). Moreover, the research only focused on investigating critical operations capabilities in a high cost environment. This does not necessarily mean that these capabilities are critical in a high cost environment as a whole. Since the sample was limited to only five Swedish manufacturing companies, a large-scale investigation of critical operations capabilities in a high cost environment is advisable. Besides, this research did not take into consideration the size of the companies, the specific industry and the products offered. These variables, if taken into consideration, might alter the findings. Indeed, this research should be considered as a step towards creating a more complete understanding of the phenomenon at hand (Eriksson, 2015).

Three suggestions are recommended particularly for further research. The first suggestion concerns a large-scale investigation of critical operations capabilities in a high cost environment. Surveys are most

suitable for generating data from which generalizations can be made. It would be useful to include a larger sample of companies located in a high cost environment and to evaluate the framework of operations capabilities in the specific context. This would contribute to the generalizability of the conclusions drawn.

The second suggestion concerns the investigation of critical operations capabilities in a low cost environment. The replication of this study in a different context could help us to understand its relevance and also to find similarities and differences between high and low cost environments. Companies would benefit from such a study by gathering more information about the two different environments; by helping them in the formulation of a winning operations strategy or by guiding them through a hypothetical relocation process.

The third suggestion concerns the investigation of critical operations and their performance implications. Prior empirical research has shown that the development of operations capabilities can support highest level of performance along different dimensions such as cost, quality, delivery and flexibility (Boyer and Lewis, 2002; Rosenzweig et al., 2003). It is thus important to apply a measurement and assessment tool for each operations capability and dimension. Finally, it should be possible to find a link between operations capabilities and the company's operational and organizational performance.

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