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Critical operations capabilities in a high cost environment: a multiple case study

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Abstract. Operations capabilities have been a popular research area for many years and several frameworks have been proposed in the literature. The current frameworks do not take specific contexts into consideration, for instance a high cost environment. This research gap is of particular interest since a manufacturing relocation process has been ongoing the last decades, leading to a huge amount of manufacturing being moved from high to low cost environments. The purpose of this study is to identify critical operations capabilities in a high cost environment. The two research questions were: What are the critical operations capabilities *dimensions* in a high cost environment? What are the critical *operations capabilities* in a high cost environment? A multiple case study was conducted and three Swedish manufacturing firms were selected. The study was based on the investigation of an existing framework of operations capabilities. The main dimensions of operations capabilities included in the framework were: cost, quality, delivery, flexibility, service, innovation and environment. Each of the dimensions included two or more operations capabilities. The findings confirmed the validity of the framework and its usefulness in a high cost environment and a new operations capability was revealed (employee flexibility).

1. Introduction

Firms need to develop operations capabilities to maintain a long term competitive advantage [1] and achieve highest level of performance [2] Operations capabilities have been a popular research area for many years, and several frameworks have been proposed in the literature. However, the current frameworks do not take specific contexts into considerations, i.e. high cost environment.

The environment in which a firm compete affects the formulation of the operations strategy [3]and, subsequently the development of different operations capabilities. Considering the manufacturing relocation process that has been ongoing the last decades, from high to low cost environments [4] it is fundamental to investigate the topic of operations capabilities within the specific context of high cost environment.

The purpose of this study is to identify critical operations capabilities in a high cost environment. In order to satisfy this purpose, the following research questions were formulated: What are the critical operations capabilities *dimensions* in a high cost environment? What are the critical *operations capabilities* in a high cost environment? In order to answer these research questions and fulfil the purpose, a multiple case study was conducted and three Swedish manufacturing firms were selected.

2. Theoretical framework

This study was based on the investigation of an existing framework of operations capabilities [5]. The framework consists of seven dimensions of operations capabilities: cost, quality, delivery, flexibility, service, innovation, and environment (Table 1); these dimensions include two or more specific operations capabilities, for a total of 21 operations capabilities. The framework is based on a systematic literature review, including more than 150 papers.

Table 1. Framework of operations capabilities [5].

Dimension	Capabilities	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.

3. Research methodology

In order to analyse the framework in a real setting and specific context [6], a multiple case study was conducted. Three Swedish manufacturing firms were selected through a theoretical sampling. The unit of analysis was limited to operations capabilities developed in the case companies.

The data collection was carried out through more than 30 semi structured interviews, approximately ten interviews per case company. The interviews were carried out by three investigators at the respective companies, and lasted for approximately 60 minutes each. Different managers from different departments were interviewed, this helped to gain a more holistic perspective. The semi structured interviews represent the primary data; however, secondary data was also collected, i.e. documents and observations.

The data analysis was carried out through a content analysis within each case study and through a cross-case analysis. Hence, the data collected in the case companies was compared with the existing framework of operations capabilities presented in Section 2. For each of the case company, a case study description was developed; this helped to gain a general overview of the dimensions and operations capabilities developed in the specific case company. Later on, a cross-case analysis was initiated and the link between the cross-case analysis and the selected framework of operations capabilities was further investigated.

The research quality was assured by assessing the criteria of validity and reliability. The first one was achieved by adopting data triangulation and investigator triangulation. The second one was achieved by developing a case study description for each one of the case companies, which included all relevant information for this study.

4. Findings

The findings revealed that all the dimensions included in the specific framework were considered critical by all the case companies involved in this study.

Table 2. Findings company Gamma.

Capabilities	Case Gamma	Source
Total cost	Cost is an important factor for the company. A lot of effort is put on product improvement processes (PIP), the goal is to reduce the cost of a manufacturing product.	I2, I3, I4, I5, I7, I8, I12
Productivity	In order to increase productivity and improve efficiency, the company is focusing on automation.	I7
Performance	In order to increase the performance of a product, the company adopts PIPs. In this way, it is possible to make small changes and improvements per time to increase the performance and quality.	I2, I3
Conformance	The company uses lean as a method to increase sustainable quality and offer to their customers conformed and high-quality products.	I4, I5
Durability	In order to offer durable quality products, the company is adopting lean methods.	I4
Dependability	The goal of the company is to achieve high delivery precision and dependability.	I7, I9, I11
Speed	The company put a lot of effort on offering a fast delivery. The company, indeed, is present in more that 20 countries. This helps the company to increase its dependability and speed.	I4, I9
Volume and production mix flexibility	Volume and production mix flexibility have been improved by shortening the lead time and moving the company's facilities closer to the customers.	I3, I4
Customization flexibility	The manufacturing processes are designed to simplify customization, the customer have a big impact on the product design outcome.	I8
Broad product line	In order to satisfy the customers' demand, the company is working with the customer to improve its product line.	I8
Employee flexibility	The company believes that by investing on employees training and knowledge, it is possible to achieve high level of flexibility.	I2, I3
Customer service	For the company, it is important to always be service-minded in order to be more competitive.	I3, I7
After sale service	Provide after sale service to the customer is a good way to earn customer trust.	I5, I7
Broad distribution	In order to be able to distribute the product broadly in a fast way, the company has moved its facilities closer to the customers.	I3, I7
New product and technology	The company is involving different employees in brainstorming activities, in order to identify different improvements areas. The company believes that new products or new technologies can be created by small changes and improvements to already existing products or technologies. This is part of the Lean philosophy adopted by the company. In general, more than 130 engineers work every day with identifying innovative products and technologies. This is a key factor in order to be competitive in Sweden.	I3, I5, I9, I10
Environmental friendly products and processes	The company is working with continuous improvements to offer environmental friendly products and to reduce energy consumption in the manufacturing processes.	I3

In case company *Gamma*, 18 of the operations capabilities, included in the framework, were considered critical. The operations capabilities not discussed in the interviews were: ‘advertising’; ‘new service’ and ‘new market’ (Table 2). In case company *Delta*, 18 of the operations capabilities, included in the framework, were considered critical. The operations capabilities not discussed in the interviews were: ‘durability’, ‘broad product line’, and ‘broad distribution’ (Table 3). In case company *Epsilon*, 19 of the operations capabilities, included in the framework, were considered critical. The operations capabilities not discussed in the interviews were: ‘after sale service’ and ‘broad distribution’ (Table 4).

From an overall perspective, all dimensions and capabilities included in the framework were discussed in the case companies. One new capability was identified in all the case companies involved in this study, which was ‘employee flexibility’. During the interviews, this capability was mentioned and discussed by the respondents. A commonality among the three case companies was to focus on increasing knowledge and skills of the employees. According to the respondents, in the long term, firms can increase the quality of their products and processes by focusing on the knowledge and skills of their employees. Employees are a fundamental resource for any firm, investing in their education is of vital importance to be competitive in a high cost environment. To achieve a high employee flexibility is part of an effective learning organization.

Table 3. Findings company Delta.

Capabilities	Case Delta	Source
Total cost	The company focus on reduction the total cost, the company believes that in order to reduce cost, it is important to focus on automation.	I2, I3, I4, I5, I7, I9
Productivity	The company is working on reducing wastes in the production and increasing efficiency by using less material bust still offer good products.	I7
Performance	The company is working in offering high performance products, the company has, indeed invested in updating existing machines and technologies to increase the quality level.	I5, I6, I8, I10, I11
Conformance	Have good quality product and conformed to the specifications, it is important in order to win the competition.	I3, I4
Dependability	Delivery precision is one of the most important factor in the company. In order to have high dependability, the company is working with forecasting. The delivery precision is now over 90%, delivery on time is important to be competitive.	I2, I4
Speed	In order to offer a fast delivery, the company is working on reducing the lead time.	I6, I9
Volume and production mix flexibility	The company believes to be quite good in responding to customers' demands, regarding both volume flexibility and production mix flexibility.	I2, I4, I6
Customization flexibility	The company works in producing customized products that satisfy customers' requirements.	I6
Employee flexibility	The company constantly invest on its employees' knowledge. They believe that having well trained and multi skilled employees is a key aspect for achieving high quality and flexibility.	I3, I5
Customer service	Offering good service to the customers is an important factor to gain customers' trust and win the competition.	I2, I4
After sale service	The company plans different meetings to always improve their after-sale service.	I2, I4
Advertising	The company has a really strong brand reputation; this helps them to gain more trust from the customers.	I3
New product and technology	Nowadays competition is strongly related to innovation; the company works in connection with universities, machine manufacturers, to be able to develop new products and new technologies.	I9, I10
New service and market	Service is a key factor to win the competition in high cost environment. Hence, the company is working on understanding the customers' needs and offer more suitable services for both current customers and new customers.	I2, I4
Environmental friendly products and processes	The company thinks that having environmental friendly products and processes are important factors to win the competition in a high cost environment. However, it becomes of high priority only when it supports cost reduction.	I2

Table 4. Findings company Epsilon.

Capabilities	Case Epsilon	Source
Total cost	The company works on reducing total cost by reducing, for example, the lead time and the setup time. Automation is very important.	I3, I4, I9
Productivity	The company works on improving productivity by increasing the efficiency in the manufacturing process. The company sets a goal of increasing productivity 10% more each year.	I2, I3, I4, I7
Performance	The company focus on offering high performance and quality products.	I2
Conformance	The company always works on offering products which correspond to the customers' specifications. This is a really challenging task, this because the customers' specifications change throughout the process.	I2, I3, I5, I6, I7, I8, I9, I10
Durability	The company focus on offering durable products, its products have a long-life time.	I3, I4, I5, I6, I7
Dependability and speed	The company needs to be able to deliver the product fast and according to the agreements in order to be competitive. Speed and dependability in the delivery are highly important, indeed the company works on reducing lead times, setup time and inventories in order to be able to provide short and dependable deliveries.	I2, I4, I5, I6, I7, I8
Volume and production mix flexibility	The company needs to improve its volume and production mix flexibility to cope with rapid changes in the market and survive the competition. This is done by reducing lead time and adopting continuous improvement techniques.	I2, I4, I9
Customization flexibility	It is important to always satisfy the customers. Therefore, the company is working on offering customized products.	I2
Broad product line	In order to satisfy different customers, the company offers a wide range of products	I4, I6
Employee flexibility	The case company focus on achieving high flexibility. It is important to train the employees to achieve different skills. Having more knowledge and skills helps the employees to respond and adapt faster to different types of situations.	I7
Customer service	The company offers good customer support and service. This is presented in different countries in order to satisfy different customers' areas.	I7
Advertising	The company puts a lot of effort in advertising and improving its brand reputation. Advertising is based on the company's high-quality products.	I2, I4, I5
New product, technology, and service	In order to be competitive, the company works in providing new products, technologies and services in the future.	I3, I6. I10
New market	The company is currently working in identifying new market opportunities.	I3
Environmental friendly products and processes	The company is actively working in reducing the energy consumption in the process, but also offers environmental friendly products to satisfy the customers' requests.	I10

5. Concluding remarks

In this study, the data analysed through a cross-case analysis was linked to the framework of operations capabilities presented in the literature. The findings are summarized in Table 5. From an overall level, all the dimensions and operations capabilities included in the existing framework are considered critical by the case companies involved in this study. The findings revealed that an additional operations capability was identified in all the case companies, employee flexibility.

Table 5. Analysis of the empirical findings in relation to the literature.

Dimensions	Capabilities	Definitions	Gamma	Delta	Epsilon	Literature
Cost	Total cost	Ability to reduce production and distribution costs.	✔	✔	✔	✔
	Productivity	Ability to optimize the utilization of manufacturing resources (machines, equipment, labours) and increase their output.	✔	✔	✔	✔
Quality	Performance	Ability to provide products and processes at a desired high level of performance.	✔	✔	✔	✔
	Conformance	Ability to offer products and manufacturing processes that correspond to the specifications, which help to ensure defects free products.	✔	✔	✔	✔
	Durability	Ability to offer durable 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 change.	✔	✔	✔	✔
	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.	✔	✔	✔	✔

This study contributes in building a complete framework of operations capabilities within the specific context of a high cost environment; this framework will benefit both researchers and practitioners in a better understanding of operations capabilities' development and formulation of winning operations strategies. However, the research findings were only based on three case companies in the manufacturing sector in a high cost environment, future research can focus in investigating the topic of operations capabilities by taking into consideration different industries or contexts.

6. Reference

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