Onni Rintala

Strategic operations management in modern industrial business systems

School of Technology and Innovations
Bachelor's Thesis
Industrial Engineering and Management

Vaasa 2024

UNIVERSITY OF VAASA
School of Technology and Innovations
Author: Onni Rintala
Title of the Thesis: Strategic operations management in modern industrial business systems
Degree: Bachelor of Science in Technology
Programme: Industrial Engineering and Management
Supervisor: Daniel Sahebi
Year: 2024 **Pages:** 70

ABSTRACT:
Strategic operations management is considered as the integration of strategic and operational decision-making aiming to maximize value generation capabilities, operational excellence and business competitiveness with the available resources and competencies. The role of strategic operations management, along with the utilization of data-driven decision-making through information technologies, has increased its importance in the modern, complex and dynamic business environment. The role of strategic operations management is crucial in value chain performance as an effective demand chain creates value from which the company extracts its profits through an efficient supply chain. Strategic operations management is about putting strategy into practice by enhancing the fit of operations to competitive priorities determined in competition strategy and strategic alignment among operations to achieve sustainable competitive advantage. As a result of successful strategic operations management is a value chain that integrates and synchronizes supply chain and demand chain operations providing superior business competitiveness.

This thesis work delves into strategic operations management in modern industrial business systems to understand its role and value in the current complex, dynamic and competitive business landscape with unpredictable disruptions and risk factors. The purpose of this thesis is to develop a holistic theoretic understanding of strategic operations management, its role and observe its applications in the form of different operating models. A comprehensive review of strategic management in the context of operations gives insights on how the design of operations system can support and enhance business competitiveness and performance. The thesis is conducted as a literature review in which 112 pieces of business literature work have been reviewed. The thesis focuses on strategic level decisions and aspects of competitiveness, sustainability and technology. The thesis includes a number of reasons why strategic operations management has a high importance in the field of modern manufacturing industries and why it should be considered with care in order to achieve sustainable competitive advantage. The thesis highlights the effects of successful strategic operations management on the quest for business competitiveness through a combination of effectiveness and efficiency. This thesis focuses on industrial manufacturing business perspective with a strategic scope and concentrates on modern business systems from an internal company perspective rather than further analyzing the external business environment.

KEYWORDS: strategic management, operations, competitiveness, value chain, modularization, lean, agile

Contents

1 Introduction 5

1.1 Research background 6

1.1.1 Strategic operations management 6

1.1.2 Top-down strategic approach 8

1.2 Research objectives 10

1.3 Research methodology and scope of the research 11

2 Operations in industrial business systems 12

2.1 Operations management 13

2.2 Value chain approach 14

2.3 Technology in operations 16

3 Strategic management of operations 20

3.1 Decision-making in strategic operations management 20

3.1.1 Decision-making areas 21

3.1.2 Data-driven decision-making 23

3.1.3 Decision-making processes 24

3.2 Objectives of strategic operations management 28

3.2.1 Strategic objectives 30

3.2.2 Operational objectives 33

3.3 Challenges in strategic operations management 37

3.3.1 Supply chain challenges 38

3.3.2 Technology challenges 40

3.3.3 Trade-offs 42

4 Operating models in modern business systems 45

4.1 Modularization 45

4.2 Lean management 48

4.3 Agile methodology 51

5 Conclusion 56

References 58

Figures

Figure 1. Strategic operations management framework for e-government service delivery (Affisco & Soliman, 2006) 8

Figure 2. Position of strategic operations management in strategic structure 10

Figure 3. Value chain model 15

Figure 4. Supply chain network design framework (Chopra, 2019) 25

Abbreviations

ERP = Enterprise Resource Planning

JIT = Just In Time

AI = Artificial Intelligence

MBNQA = Malcolm Baldrige National Quality Award

VRIO = Valuable, Rare, Inimitable, Organizational support

RBV = Resource-based view

S&OP = Sales and Operations Planning

TOC = Theory of Constraints

MBV = Market-based view

1 Introduction

This thesis work is conducted as a literature review for a bachelor's thesis of a Bachelor of Science in Technology programme of Industrial Engineering and Management in the University of Vaasa. Thesis considers topics related to strategic operations management focusing on theoretical framework, strategic management aspects and operating models. Thesis begins with a background for strategic operations management, strategy and operations. The second part concerns decision-making, objectives and challenges in strategic operations management. The third section considers applications of strategic operations management as operating models from different approaches. To finalize the thesis, the topics of the thesis are concluded at the end of this paper.

The thesis considers strategic operations management from an overview perspective providing a holistic picture of the concept. To understand how to practice strategic operations management, one has to first understand thoroughly what it means. Therefore, after an introduction to what strategic operations management is, operations in industrial business systems are defined before delving into decision-making and objectives. The company's corporate and business strategies determine how the operations will be configured as they lay down the strategic objectives of the overall scope of the company and how it competes. Thus, the challenges of strategic operations management consider strategic trade-offs in addition to challenges of modern business environment in terms of supply chain and technology. Technology provides possibilities and tools to be exploited and considered in strategic operations management. The topics regarding technology consider modern technologies such as ERPs, Industry 4.0 and artificial intelligence and their role in operations and strategic operations management. The operating models this thesis considers are modularization, Lean management and Agile methodology.

This thesis explores two separate research questions in the conducted literature review on strategic operations management. The research questions are the following:

1. What is the theoretical framework of strategic operations management as a management science in the context of modern industrial business systems?

2. How can strategic operations management be applied and has been applied as operating models to enhance business competitiveness and performance?

1.1 Research background

Strategic operations management is a rather new field of study in terms of management sciences. The majority of academic work around the topics of strategic operations management, operations strategy and operations management has been taking place during the past 20-30 years. There lies a couple of foundational works, while most of the academic research is still on the empirical level rather than theoretical level in the field of strategic operations management.

1.1.1 Strategic operations management

Brown et. al. (2018) stated that in order for any organisation to achieve success, it is mandatory to have world-class operations, and in addition to that there has to be an ability to manage them also on strategic level. According to Brown et. al., strategic operations management considers organizational objectives and customer values such as flexibility, quality, speed, cost and constant innovation. To achieve the ability to provide requirement-exceeding goods and services to customers, the organization's strategic operations capabilities have to be efficiently and effectively managed (Brown et. al., 2018).

Strategic operations management is about the integration of supply chain and demand chain and managing that integration (Walters & Rainbird, 2017). Referencing Walters and Rainbird, this integration combines the aspects of strategic objectives in terms of being effective and operational aspects in terms of being efficient. As Walters and Rainbird

stated, strategic operations management takes into account simultaneously long-term capabilities and immediate resource constraints in order to deliver and create value as efficiently as possible for the customers, organization and other stakeholders.

Robert Lowson (2002) describes the issues of strategic operations management with the words of complexity, contingency, dynamism and competitive markets. Referencing Lowson, the issues of strategic operations management are constantly gaining importance in commercial sectors, which enhances the importance of its consideration and potential to provide new competitive advantage. Lowson stated that strategic operations management provides foundations for all business success with its ability to supply desired value for the demand generated by the customer markets. He even goes as far as describing consumer demand as “chaotic” due to markets requiring constantly more and more diverse and individualized goods and services. This sort of development in addition to the transition from push business to pull business in terms of the balance of supply and demand pushes organizations to become more and more flexible and responsive (Lowson, 2002). According to Lowson, with successful decision-making in strategic operations management, a significant competitive advantage can be achieved through felicitous implementation and development. As a reference to Lowson, strategic operations management has begun to gain recognition as a substantial contributor to effectiveness of strategy in all types of organizations regardless their size, level of internationality and profit-making objectives.

Affisco and Soliman (2006) introduced a strategic operations management framework which they created for electronic service delivery to provide a more strategic perspective. The service delivery model integrates strategy elements and operational elements (see Figure 1) and leverages value with e-solutions in information dissemination and management of supply and demand (Affisco & Soliman, 2006). According to Affisco and Soliman, forming a successful operations strategy requires focus on design, development and execution of operations so that the operations respond to elements which possess a level of strategic importance. The strategic operations management model should be

designed with a focus on perceived customer value of the service (Affisco & Soliman, 2006). Their observations are in line with Walters and Rainbird who highlighted the significance of value and nature of integration in strategic operations management.

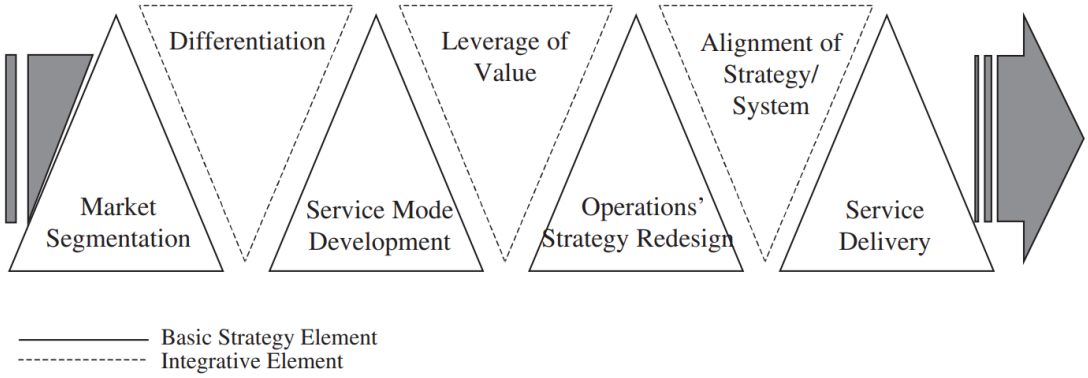

Figure 1. Strategic operations management framework for e-government service delivery (Affisco & Soliman, 2006)

1.1.2 Top-down strategic approach

In order to have a better understanding of the role of strategic operations management within an organization, it should be understood on what level it is positioned within an organization. A top-down perspective provides a comprehensive picture of the strategic structure of an organization. This way it is possible to divide the strategic structure into corporate strategy, business strategy, functional strategy and operative management levels from top to bottom. This is illustrated in Figure 2.

Whittington et. al. (2020) stated that corporate strategy considers the overall scope of a corporation and concerns issues such as geographics, business portfolio and resource allocation. According to Volberda et. al. (2011), other decisions corporate strategy concerns are strategic positions and specified actions that are to be taken in order to gain competitive advantage and increase corporation's value as a whole. Referencing Bowman and Faulkner (1997), corporate strategy considers a multi-product case in terms of selecting markets, resourcing business units and controlling the corporate structure.

Business strategy, often referred to as competition strategy, considers the questions of how the individual business units compete in their particular markets, for example in terms of innovations, scale and responses to the markets and competitors (Whittington et. al., 2020). Volberda et. al. (2011) argue that business strategy is about the intentions and actions the business unit takes in terms of core competencies and the targets, means and contents of the value delivery in order to gain competitive advantage against their competitors. Referencing Bowman and Faulkner (1997), business strategy concerns single-product case in terms of value definition and delivery and resource allocation.

Functional level strategies are developed and defined in order to support the actual business strategy in their particular functional areas. The most common and generally accepted distribution of functional strategies is dividing them into finance, marketing and operations strategies which concern how the functions deliver the upper level strategy with the highest efficiency and accuracy (Whittington et. al., 2020). According to Whittington et. al., successful strategy implementation depends vitally on the extensive amount of decisions and actions occurring at the functional level.

Operations strategy refers to a set of operational decisions taken with the aim of achieving a long-term competitive advantage (Slack & Lewis, 2020). Maylor et. al. (2015) consider operations strategy as the linkages created or planned to be created between organizational strategy and the actual operations of the organization. According to Kim et. al. (2014), the vast number of complex processes that take place at multiple organizational levels and in multiple directions are formed with operations strategy.

Strategic operations management can be positioned in between operations strategy and operations management in strategic structure (see Figure 2). As seen in the chart, strategic operations management integrates the short-term and long-term planning and actions of operations in order to ensure fluency throughout the organization from high-level strategy to operational implementation. The management level of the strategic

structure chart, operations management, will be covered in the next section along with a thorough consideration of industrial operations.

Figure 2. Position of strategic operations management in strategic structure

1.2 Research objectives

The primary objective of this thesis is to develop a comprehensive theoretic understanding of strategic operations management and its role and importance in modern industrial companies and business systems. The thesis aims to provide support for decision-making guidelines in the context of strategic operations management and finding development targets in the design of operations system by giving insights on its characteristics and effects on business performance and competitiveness. The objective is to first provide the reader with a clear overview of operations and their system design, strategic management and effect on competitive advantage. Secondly, thesis provides information on applicable operating models from various approaches to improve the business competitiveness and performance of a modern industrial company.

1.3 Research methodology and scope of the research

The thesis is primarily a literary review by its nature. The thesis is conducted by familiarizing oneself with relevant literature, articles and scientific research, as well as following discussions, news, and overall development related to the thesis topics. Some references are drawn from course lectures arranged in the University of Vaasa.

Research scope is considered to focus primarily on manufacturing industries and technology-oriented companies. The research concerns operations from comprehensive and strategic perspective and less operational perspective. The thesis does not delve into great details in day-to-day operational management practices, but it focuses more on the design of operations system and operations and their strategic meaning. The time-scope is on modern companies and management methods taking into account recent events and trends in modern business-making such as sustainability and geopolitics while some fundamental academic works from further back in time have been referenced due to their timeless applicability.

2 Operations in industrial business systems

Operations are the core of an industrial corporation which, simply defined, form together a process of three stages: acquisition of raw materials, transformation of raw materials into products and distribution of products to customers. Referencing Demir (2019), the steps of transforming inputs into outputs are the responsibility of operations. Barringer and Ireland (2016) comprehensively define operations to include manufacturing process and location, networks and partners, quality management and outsourcing among many other functions. Brown et. al. (2018) stated that world-class operations are one of the rare keys to achieving sustainable competitive advantage in modern business environment with the condition of them being inimitable. Referencing Walker et. al. (2015), alternative operations frameworks have experienced growing interest due to recognition of the benefit that they can provide. According to Järvenpää et. al. (2017), operations can be observed by their ability to create value and by their potential of development for the purposes of operations management to help in their development and management work. On the contrary, Porter (1996) argued that decoupling individual operational activities from their strategic activity system regarding the competitive value cannot be done without misleading their individual significance for the success of the company.

Operations in industrial manufacturing companies can be argued to be easier to grasp than in service companies since they are in touch with more tangible inputs and outputs. In this sense, operations can be divided into different functions including supply chain, procurement, logistics, production and sales and distribution channels. As Haverila et. al. (2009) stated, operations include, in addition to functions in order-delivery chain, also functions in sales, distribution, product design and procurement.

Haverila et. al. (2009) separate the development of operations into five phases. According to their book on industrial economy, the longest and the first phase, handcraft, lasted up until the first industrial revolution took place in 18th and 19th centuries during which mass production and standardization came into existence. Haverila et. al. stated

that after the second world war during 1950s and 1960s, Just In Time (JIT) production model started to take place and shape industrial systems. Referencing Haverila et. al., this JIT production model has been followed with Lean operating model and with the latest development phase, network operations. Even though the book of Haverila et. al. was published back in 2009, Lean management principles and network-oriented operations planning are still considered among the most modern perspectives in operations management along with Six Sigma and Agile operating models. The same type of development was recognized by Brown et. al. (2018). By observing this development arch, it is notable that the development of operations has accelerated over time and a new stage of development could be expected in short time with the aid of artificial intelligence and other major improvements in modern information technologies.

2.1 Operations management

Since operations management has been in the role of problem solver in practical issues and applications, it has lacked actual theoretical foundations (Walker et. al., 2015). Maylor et. al. (2015) stated that operations management focuses on transformation processes. This view could be argued to be quite simplifying as operations management is a lot more than just the transformation process of inputs which would refer to the process of production by itself. Referencing Slack and Lewis (2020) and their comprehensive definitions, operations management is about designing, organizing and improving the configuration of systems which forms a value-creating process to transform inputs into products, goods and services. Brown et. al. (2018) expand the definition of operations management as they include the aspect of the best and most efficient use of finite resources during the actual transformation process. Haverila et. al. (2009) stated that operations management is about the management of different functions of order-delivery chain and covers the process of transforming an input from production factor markets into an output to the output markets.

As an enabler for success and source for sustainable competitive advantage, operations management should be integrated into the strategic processes (Demir, 2019). Operations management can be divided into three different levels: strategic decisions, systems and operational control (Haverila et. al., 2009). Referencing Haverila et. al., strategic decisions concern objectives, production facility locations, technology decisions, capacity and defining roles of stakeholders involved with the operations. Systems are about network co-operation, information and quality systems and procedures and procurement which in long-term develop the competencies of the corporation (Haverila et. al., 2009). According to Haverila et. al., operational control refers to day-to-day and short-term execution and implementation of operational activities with the aim to achieve desired results as efficiently as possible.

2.2 Value chain approach

The value chain approach suggests that an alternative term for strategic operations management could be value chain management. Walters and Rainbird (2017) define value chain as an integration of efficiency driven supply chain and effectiveness driven demand chain resulting in a complex web of business processes. This definition combines the strategic and operational objectives, effectiveness and efficiency, and the nature of integration of strategic operations management. Demand chain refers to understanding customer expectations and market characteristics and meeting them through operational processes in sales and marketing etc. (Walters & Rainbird, 2017) which are then matched with the capabilities and outputs provided by the supply chain.

One famous and foundational approach towards operations is the value chain model (see Figure 3) introduced in 1985 by Michael Porter who is one of the most renown strategy gurus of the modern era. Value chain approach is based on the organizational activities that form a process which creates value for the customers in the form of goods, products or services (Whittington et. al., 2020). According to Whittington et. al., value chain model helps analyzing resources and understanding the strategic position of the

organization. Porter (1985) stated that competitive advantage can be observed by comparing the value chains of competitors and exposing the differences between them. In Porter's original version of value chain model, production is referred to as operations but as discussed, the field of operations in its current form cover more than just the production functions.

In his value chain model, Porter has divided the operations into value activities that are technologically and physically distinct. Each of the value activities employes human resources, technology and purchased inputs in addition to creating and using information and performance parameters (Porter, 1985). Referencing Porter, value activities consist of primary activities which are directly involved in the physical creation, sales and transfer of the product to customer and support activities which provide the human resources, technology, purchased inputs and other functions needed to perform the primary activities. Porter also introduced a more extensive value model, value system, which included supplier, channel and buyer value chains in addition to the corporation's own value chain. Whittington et. al. (2020) added the consideration of business ecosystem into Porter's value system in order to have more comprehensiveness.

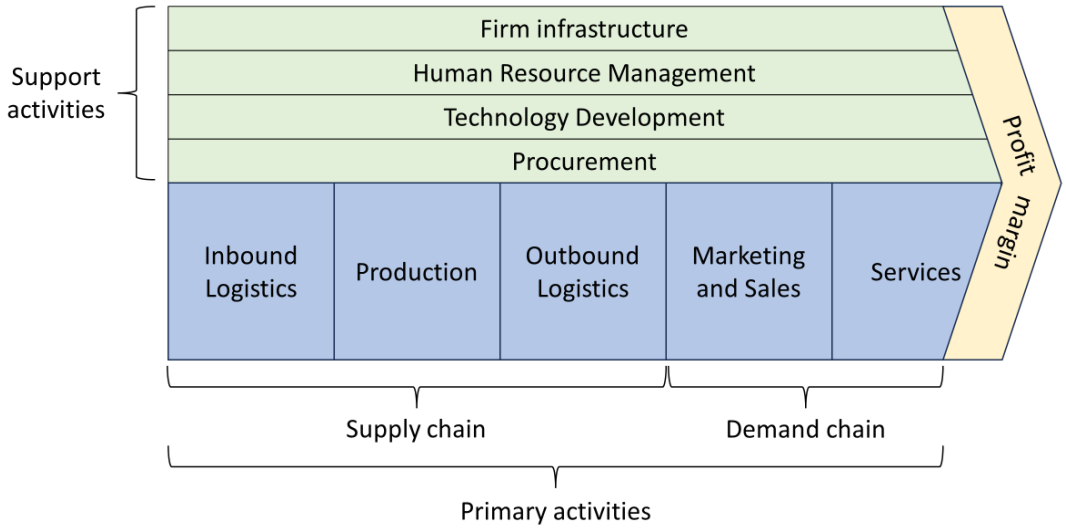

Figure 3. Value chain model

The value chain model can be criticized for its applicability in modern business as it is a simplification and considers business from push rather than pull perspective and positions marketing to be implemented only after production (Korkeamäki, 2023). As Lowson (2002) mentioned, the modern business environment has transitioned towards pull business where marketing can actually be the first thing in line to be started. Referencing Korkeamäki (2023), since value chain model was created in 1980s for manufacturing companies, its applicability in modern business systems could be argued. Other criticism towards the value chain model can be drawn from the fact that many modern companies now focus just on some specific parts of the value chain and don't possess the whole value chain as the model would suggest. Companies often seek to outsource the functions that they don't see as their core business or competence which then again makes other companies focus on just excelling in some particular functions such as manufacturing, logistics or service. Therefore, the value chain model could be expanded into a value network model which takes into account external stakeholders and partners in addition to the core company itself (Whittington et. al., 2020). Also, the change from a more stable business environment to a more dynamic one has emphasized the development towards value network from value chain approach.

2.3 Technology in operations

Operations is a chain of processes in which technology acts as an enabler, contributor, platform and also often as a product. Operations can play a role of an initiator or an applicator for new technologies and technological innovations. Skinner (1984) stated that operations technology innovations can be a strategic competitive advantage providing major improvements in quality, lead time, capital utilization and many other aspects. According to Kuruppuarachchi and Perera (2010), the performance of an organization tends to increase when a higher level of technology is exploited. Technological development has had a major impact in operations and their development from handcraft to modern mass customization (Haverila et. al., 2009; Brown et. al., 2018).

Technological development increases efficiency in terms of resources and time and enables more production volume and more complex processes to be executed.

The fourth industrial revolution, referred to as Industry 4.0, has emerged as the development of intelligent, autonomous, network connected, self-regulating and vertically and horizontally integrated production systems have taken major steps forward with the development of information technologies (Dzhulii et. al. 2020). According to Dzhulii et. al., Industry 4.0 is about cyber-physical systems that act in production processes, supply chain and data management enhancing efficiency with a large span of technologies such as Internet of Things (IoT), robotics, 3D printing, cloud computing, blockchain, artificial intelligence and digital twin. Industry 4.0 technologies can help companies to achieve higher profitability, increased differentiation and optimize risk management (Mithas et. al., 2022). Ghobakhloo and Iranmanesh (2021) stated that strategic guidelines are vital when implementing complex and resource-intensive digital transformation of Industry 4.0. According to them, change management and strategic planning capabilities are required when pursuing successful digital transformation of operations.

As the environment of strategic operations management is increasingly complex, dynamic and competitive, industrial corporations have increased their investments in advanced manufacturing technologies and flexible manufacturing competence (Zhang et. al., 2006). Referencing Zhang et. al., advanced manufacturing technologies automate and integrate design, manufacturing and control of the products and production. According to Zhang et. al. advanced manufacturing technologies offset uncertainty and enable smoother flow through production resulting in increased responsiveness and performance with the manufacturing process. Different kinds of advanced manufacturing technologies are for example robotics, programmable automation systems and integrated systems (Zhang et. al., 2006).

Bhandal et. al. (2021) refer to the dynamism of the markets as they underline the importance of supply chain in terms of value creation and competition and present digital twin as one of the most recent technologies that pushes this trend even further. They introduce a term of digital supply chain that reflects the transformation initiated by digital technologies and enables extracting real-time intelligence to generate business value and new leverage for optimal decisions. Dutta et. al. (2020) consider blockchain technology as a revolutionizer for supply chain management as it has potential to transform the processes of supply chain in terms of security, velocity and transparency.

The complexity of the business environment arises in the article of Feng and Ye (2021) in which they stated that smart logistics provides an efficient and promising solution for operations in terms of logistics. According to Feng and Ye, logistics is a function of operations in which many emerging intelligent information technologies have been applied despite several barriers of development such as high implementation costs and unstandardized function modules. Intelligence, flexibility, integration and self-organization are combined in smart logistics implementation to enhance efficiency and avoid disruptions in logistics processes (Feng & Ye, 2021).

Enterprise resource planning (ERP) systems are key corporate information systems used to enhance sharing of real-time data and to provide information availability, transparency and analyses for strategic level management (Klochkova & Orlova, 2021). According to Klochkova & Orlova, ERP systems automate core business processes and support resource management activities. ERP systems have been developed to manage the flow of resources, materials and components between different parties and processes (Zhang et. al. 2006), and since then they have been expanded to cover all types of transactions and data around the organization. In an empirical investigation, McAfee (2002) discovered that lead times and on-time deliveries improved significantly when enterprise level information technologies were adopted. McAfee recognized a causal link between overtime improvements in operational performance and information technology adaptation resulting in increased operational effectiveness after ERP was

implemented. ERP systems integration highlight the importance of technology structure and systems thinking when establishing strategic networks with the corporate's internal stakeholders, suppliers and partners (Ash & Burn, 2003).

Information technology and digitalization are major driving factors in modern business systems and modern technologies in operations. Referencing Donchak et. al. (2022), hybrid B2B selling is expected to dominate sales strategies as majority of buyers prefer digital channels affecting the structure of demand chain. According to S. Jorfi and H. Jorfi (2011), IT capabilities can be a factor of competitiveness, especially in the current business environment and therefore IT systems and IT infrastructure should be designed to contribute to and scale with company growth. Haverila et. al. (2009) stated that the integration of information technology requires digital modelling, but it provides increased productivity and flexibility and shorter throughput times in manufacturing.

Artificial intelligence (AI) is a growing trend in the business world due to its capabilities to revolutionize, boost and transform how business and companies operate. AI has been used mainly as a data analysis technology in descriptive, predictive, prescriptive and cognitive analytics (Mithas et. al., 2022), but with the introduction of generative AI, its utilization opportunities can be expanded to support for example innovation and service processes. The field of AI consists of a number of technologies and algorithmic tools such as machine learning, deep learning, neural networks and large language models. Akter et. al. (2022) mention that several large corporations are already planning to integrate AI in operations to enhance automation. They stated that the implementation of a comprehensive AI transformation requires sophisticated and advanced data ecosystem and governance. According to Cannas et. al. (2023), AI methods are capable of improving competitiveness by improving operational efficiency and sustainability and responding to challenges of dynamic business environment. Referencing Cannas et. al. (2023), AI applications can be applied in various operational processes such as transportation and customer interfaces to support certain purposes such as demand forecasting and risk management.

3 Strategic management of operations

Strategic management sets the guidelines and designs the structure of a company and its operations. In this section, strategic operations management is considered from three separate approaches: decision-making, objectives and challenges. These are topics to be considered when starting to configure the operations system and networks around it. Understanding decision-making, objectives and challenges around strategic operations management supports the company's successful performance and competitiveness.

3.1 Decision-making in strategic operations management

Corporate and business strategies along with the business model give the guidelines and goals that decisions of strategic operations management should follow. Corporate strategy provides the business area and context the decisions are to be taken whilst business strategy sets the competitive priorities to thrive for. When those are set, it is the task of strategic operations management to decide on the plans and actions how the organization configures itself, its business and its operations in order to achieve those priorities. As Slack and Lewis (2020) stated, the decisions of strategic operations management concern the complete transformation and business process, the current and future changes and challenges in competition and business environment and the development of operations as a whole in order to provide sustainable competitive advantage. Referencing Laukkanen (2007), one of the core decisions in international business is the actual operating model involving decisions on exporting, contractual co-operation modes and direct international investments.

Strategic alignment throughout the whole organization is vital for achieving desired results and competitive advantages. Referencing S. Jorfi and H. Jorfi (2011), strategic alignment illustrates the degree to which business, operations and technology support each other in terms of mission, objectives and plans. The importance of strategic alignment derives from its impact on business performance, responsiveness to new

opportunities and gaining the desired competitive advantages in diverse, dynamic and competitive markets (Jorfi, S. & Jorfi, H., 2011). The effectiveness of changing and turbulent competitive markets is underlined by S. Jorfi and H. Jorfi when considering the level and importance of strategic alignment. They propose to put emphasis on flexibility, capability and communications effectiveness of information technology systems in order to improve the strategic alignment throughout the organization. Barnes et. al. (2007) stated that progress in a number of e-business based companies had been obstructed by poor strategic alignment.

3.1.1 Decision-making areas

Demir (2019) provides a list of 10 different decision-making areas regarding strategic operations management including topics such as product and service design, capacity, location, outsourcing, quality, resources, supply chain and other operational activities that are required to perform management processes. In his article, Demir presents an idea of Robert Hayes and Steven Wheelwright from 1984 that the decision-making of strategic operations management could be divided into two areas, structural and infrastructural decisions. According to Demir, structural decisions are about the allocation of tangible and physical resources that contribute to optimal convenience in operations and often require long-term decisions. Infrastructural decisions on the other hand consider intangible matters such as organization, quality and human resources which might not require as substantial capital investments as the structural decisions (Demir, 2019).

The strategic decision-making areas that are considered in strategic operations management regarding operations resources are capacity, supply network, process technology and development and organization which can be illustrated in operations strategy matrix (Slack & Lewis, 2020). Referencing Slack and Lewis, the other axis of operations strategy matrix considers market requirements and competition point of view with aspects of quality, speed, dependability, flexibility and cost. According to Slack

and Lewis, exploitation of the operations strategy matrix provides a possibility to find and understand the relationships and interrelationships of each decision-making area and their performance objectives. The matrix model provides a comprehensive overview of operations from strategic point of view as it provides information on how each of the market requirements are taken into account in operations resources and how each operations resource considers market requirements (Slack & Lewis, 2020). The relational importance of each intersection is affected by the decisions on competitive priorities at the business strategy level.

S. Jorfi and H. Jorfi (2011) consider strategic operations management from IT business point of view and bring up decision-making areas such as flexibility, capability, systems and communication. They consider these as key factors for operations to properly be aligned and support the planned strategy. Some other factors contributing to strategic alignment S. Jorfi and H. Jorfi found in their study were decisions to improve compatibility, connectivity and modularity.

Najdawi et. al. (2008) divide strategic executive decisions related to operations into four topics considering forecasting, logistics management, capacity planning and facility locations. In various industries, especially in manufacturing industries under significant demand fluctuation, companies often are obligated to make forecasts and decisions on their pricing and production before the high-demand season is on-going (Ramachandran et. al., 2018). According to Ramachandran et. al., this kind of decisions can achieve higher performance if the decision-making subjects gain awareness of the interdependencies and in effect uncertainty is reduced. Hansen and Ahmed-Kristensen (2012) point out that when making decisions on facility locations and offshoring, it is important to connect operations to strategic management to avoid decoupling within the organisation.

3.1.2 Data-driven decision-making

An emerging topic in decision-making methodologies is data-driven decision-making which aims to base decisions on analyses of historical trends and current data (Lu et. al., 2019). Data-driven decision-making is a new approach to decision-making in which decisions are based on data rather than experience decreasing the level of disruptiveness and increasing performance with analytical capabilities (Kunttu, 2023). According to Kunttu, data can be utilized to answer various business questions, but this requires understanding the applicability of different analytical methods in case-specific purposes and characteristics. According to Mithas et. al. (2022), data-driven decisions are considered for example in product and customer strategies. Data analytics acts as the basis for various operations related activities such as demand forecasting, constraint identification and optimization tasks such as supply chain network modeling.

Referencing Kesavan and Kushwaha (2020), data-driven decision-making transforms modern operations and arguably significantly increases profitability in comparison to intuitive decision-making. Analytics capabilities and utilization associate positively with the quality of decisions (Awan et. al., 2021) which provides business value and solves business problems (Fosso Wamba et. al., 2019). Referencing Fosso Wamba et. al., data-driven decision-making can be characterized as a new management revolution as it provides higher productivity and better understanding of the market, positively increasing business performance.

According to Rejikumar et. al. (2020), data-driven decision-making contributes to the development of competitive strategies by helping in recognizing trends in the market and overall business environment. A strategic level data-driven approach is capable of enhancing the effectiveness of technology tools and business processes (Troisi et. al., 2020). Referencing Troisi et. al., data-driven strategies integrate factors such as technological infrastructure, proactive management, analysis skills and circular knowledge management processes. According to Troisi et. al., data could be perceived as a strategic resource in today’s business environment as it can be used to prescribe

actions and predict complexity which has been observed as one of the key characteristics of strategic operations management. This observation would propose active use of data tools in decision-making processes regarding strategic operations management.

3.1.3 Decision-making processes

Observing strategic planning processes in operations management help grasping how the strategic and operational aspects are integrated in decision-making and in practice. This section considers three strategic planning processes which concern different aspects of operations management. Supply chain network design practice is used to optimize the structure of supply chain. Sales and operations planning (S&OP) considers the integration and synchronization of strategic and operational management in market demand and resource supply planning and processes capacity- and variety-wise. Theory of constraints (TOC) is a management method that has applications in constraint and bottleneck identification to improve flow through operational processes.

The core objective of supply chain networks design is to enhance customer satisfaction by addressing supply chain responsiveness, demand, and profitability simultaneously which involves considerations of facility roles, locations, and the allocation of capacity, market, and supply (Chopra, 2019). A foundational 4-phase framework for global supply chain network design by Chopra, detailed in Figure 4, prioritizes maximizing overall profits while concerning expected margin and forecasted demand in each market, logistics and facility costs, as well as taxes and tariffs at each location. Chopra highlights the vitality of supply chain network design on business performance and supply flexibility, influencing the configuration, constraints, and competitiveness of the supply chain. According to Chopra, supply chain drivers influence the responsiveness and costs within the designed network, emphasizing the importance of strategic choices in the process.

In the first phase of supply chain network design process, the aim is to form a supply chain strategy aligned with competitive strategies, global competition, and internal

constraints to establish the priorities and objectives guiding the supply chain network (Chopra, 2019). Referencing Chopra, this phase involves formulating a comprehensive understanding of current and future competitive landscapes, market saturation, and potential transitions in the market needs and values to support competitiveness. According to Chopra, identifying internal constraints such as capital, policy and resource constraints is crucial for scaling and scoping the network to gain insight for strategic decisions regarding partnerships and outsourcing.

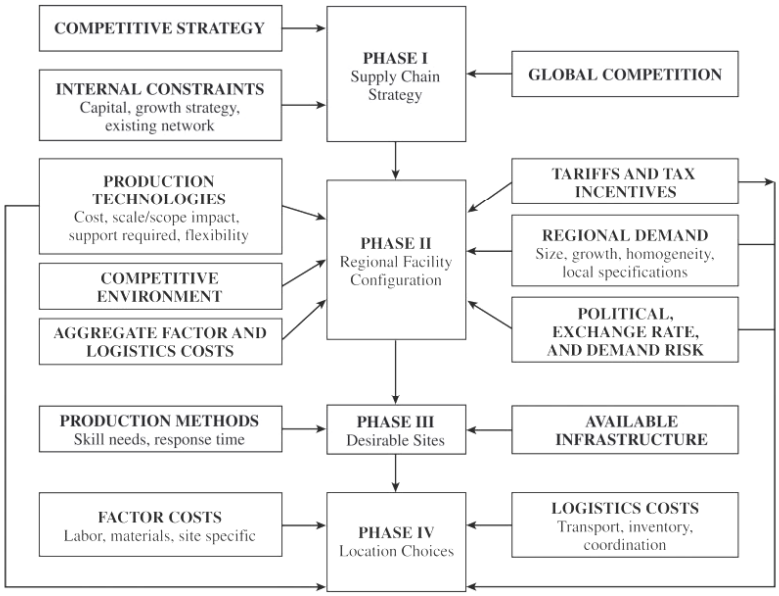

Figure 4. Supply chain network design framework (Chopra, 2019)

In the second phase, the focus is on regional facility configuration as in identifying regions and their corresponding facilities with the consideration of factors such as quantity, locations, supply chain and market roles, product responsibilities, and capacities (Chopra, 2019). According to Chopra, this phase consists of analysis of the size and homogeneity of demand aiming for understanding the opportunities for economies of scale with the available production technologies and evaluation of aggregate factor and logistics costs. Chopra stated that risk management considerations regarding political, legislative, exchange rate, and demand-related risks should be involved at this phase. Referencing Chopra, the regional competition should also be considered in terms of facility locations, response times, and logistics costs. The third and fourth stages of

the framework are about compiling viable site options, selecting those for implementation, and defining their locations and capacities (Chopra, 2019). According to Chopra, the decision-making is based on the information from the second phase of the framework and an analysis on available infrastructure supporting the determined production methods. The infrastructure assessment considers hard factors such as suppliers, utilities and transportation services and soft factors such as community receptivity and workforce availability (Chopra, 2019).

Sales and operations planning (S&OP) process is about the integration and alignment of strategic and operational activities (Tchokogué et. al., 2022) which aims to balance the future demand and supply capacities in a time-phased plan with multiple time periods from short-term to long-term to achieve higher operational efficiency and successful resource management (Krajewski, 2022). Referencing Tchokogué et. al (2022), the cross-functional business process of S&OP is supported by performance reviews and promotion of continuous improvement to synchronize and coordinate between the supply and demand. According to Krajewski (2022), S&OP is often based on factors of product families, workforce and time and related plans such as operations strategy, forecasts, business plan and constraints management. Referencing Krajewski, S&OP is often constructed as a long-term aggregate plan for organizational operations and short-term plan for resource planning, prioritization and scheduling. According to Wallace (2008), the S&OP process is based on four fundamental concepts of demand, supply, volume and mix to avoid imbalances. Wallace described that there lies several sub-processes in demand plan such as brand, marketing and sales plans and in supply plan such as resource, production and logistics plans. Data quality is crucial in S&OP as it affects the forecasting accuracy, which is a necessity for a successful S&O plan.

The S&OP process has in principle four phases: demand planning with the aid of sales and demand forecasts, supply planning for production, inventory, resource and supply chain management, managerial and executive review rounds for adjustments, consensus and approval and finally the actual implementation of strategic planning to operational

activities. According to Tchokogué et. al. (2022), implementation of a S&OP process increases supply chain coordination performance and decreases the risk of the bullwhip effect in supply chain variability. Tchokogué et. al. state that the S&OP process has a great capability to improve competitiveness as it increases the level of alignment, integration and synchronization and performance in individual operational functions. Referencing Wallace (2008), once the S&OP process has been completed five major plans are configured: demand forecast and production, inventory, resources and distribution plans.

Theory of constraints (TOC) is a systematic management philosophy which aims to optimize the operating system flow by finding out the performance-limiting constraint factors in the subsystems and eventually developing and allocating resources to the emerging bottlenecks of the system. According to Ikeziri et. al. (2019), the origin of TOC is from production optimization software that started the consideration of capacity constraints and bottlenecks in factory-level activities which then evolved through scheduling, planning and controlling techniques into an operational and competitive performance driven management philosophy. Modi et. al. (2019) argued that by the logic of TOC eventually every real-life system are not complex but on the contrary simple by nature and therefore even seemingly complex issues have simple solutions when the right root causes are identified. According to Modi et. al., complex supply chains can be effectively integrated, coordinated and optimized with TOC principles. Krajewski (2022) proposed that all capital investments should be considered from the TOC aspect and assess their impacts on operating expenses, throughput and inventories. According to Krajewski, only in front of the assembly stage, shipping points and bottlenecks inventories are needed to ensure the flow through operations. The implementation of TOC is a virtuous cycle between identifying and exploiting the bottlenecks, allocating resources and increasing the capacity of bottlenecks (Krajewski, 2022).

Pacheco et. al. (2021) mention that there are various TOC management tools and principles such as Critical Chain Project Management, VATI Layout Analysis and Drum-Buffer-Rope. The core principle of TOC is that in every system there lays at least one

performance-limiting constraint (Pacheco et. al., 2021), which is in line with the observations on the strategic fit of operations. According to Pacheco et. al., TOC principles contribute primarily competitive features of on-time delivery, short lead time, high flexibility and lower cost. These are the result of better coordination, optimized production capacity and set-ups and lower inventory levels. Through the better and quicker flow in supply chain and production and smaller inventories, the working capital in the pipeline decreases which releases that capital to more efficient use which in return increases overall performance and capital-reliant possibilities. Pacheco et. al. stated that systems applying TOC principles are able to target their improvements more accurately which is followed by improved performance, effectiveness and competitiveness.

3.2 Objectives of strategic operations management

The objectives of strategic operations management are the integration of operational and strategic objectives. Strategic effectiveness and operational excellence are the core objectives within the realm of strategic operations management. From a market perspective, these contribute to achieving desired competitive advantages and excelling in the market with superior profitability. On the other hand, from a resource point of view, efficient use of strategic, operational, intraorganizational and external resources are a key objective.

Haverila et. al. (2009) stated that the most essential objectives in the field of strategic operations management are execution of corporate and business strategies, development of new capabilities and competencies and efficient implementation of everyday operations. According to Haverila et. al., two types of objectives can be set for operations: competition-based and society-based. Competition-based objectives, including cost, quality, time and flexibility, derive from competitive factors ruling in the markets and which are considered to include features such as price, quality, operations velocity, reliability of delivery, characteristics and customization (Haverila et. al., 2009). Referencing Haverila et. al., society-based objectives include objectives such as

environmental well-being, safety and social responsibility. They define operational objectives to include topics such as high productivity, minimizing current assets and short lead time (Haverila et. al., 2009).

Porter (1996) defines two objectives for an enterprise to reach its primary goal, superior performance. He stated that these two objectives are strategic positioning or often referred to as differentiation or competitive prioritization and operational effectiveness. Porter argues that competitive advantage arises from the strategic positioning and superior profitability from operational effectiveness. According to Porter, strategic positioning defines the choices of activities, how they are performed, and how they relate to each other while operational effectiveness refers to excelling in individual activities. Sustainable competitive advantage grows out of this system of activities when they complement each other (Porter, 1996). In the context of this thesis, these activities could be referred to as operations. Referring to Porter, systems, processes and organizational structure should be strategy-specific instead of generic in order to form an activity system that provides definite competitive advantage.

Porter (1996) stated that strategic fit of the operations is vital for the emergence and sustainability of competitive advantage, but its achievement requires integration of actions and decisions across the organization. Here the nature of integration and the importance of strategic operations management is yet again recognizable and the place of strategic operations management in achieving proper strategic fit is underlined. Referencing Porter, the strategic fit of operations can be considered to have three aspects: consistency, reinforcement and optimization. According to Porter, weaknesses in the system of operations are prone to get attention while their poor performance degrades the performance of the whole system exposing bottlenecks and performance constraints. On the contrary, if the company is not able to identify weaknesses in its system of operations, this could imply poor strategic fit when the system of operations should be reconfigured to better execute the intended competition strategy.

3.2.1 Strategic objectives

The generic objectives of strategic operations management derive from operations strategy among which trade-offs are required. Referencing Slack and Lewis, objectives are prioritized to support the strategic market positioning and customer satisfaction as they derive from selected market segment and industry's competitor analysis. The main strategic performance objectives are time, dependability, flexibility, quality and cost (Slack & Lewis, 2020).

Slack and Lewis (2020) stated that on the most basic level, time objective is considered as the time spent from the beginning to the end of operations process. Time-related objectives can be measured with delivery time, often referred to as lead time, and on-time delivery. On-time delivery is a delivery performance related to dependability which is about keeping the promises given to the customers (Slack & Lewis, 2020). Another delivery performance meters related to dependability would be delivering the right quantity and the right quality of products ordered. Zhang et. al. (2006) define flexibility as an organizational ability to respond quickly to changes and meet varying customer requirements without excessive encumbrance. Slack and Lewis (2020) define flexibility as the ability to adopt different states, positions and things in higher numbers. They consider flexibility from four different aspects including aspects of product/service, production mix, volume and delivery. According to Slack and Lewis, quality can be defined in many ways in different occasions and operations but most often it is referenced with concepts such as fit-to-purpose, reliability, consistency, number of features, conformance to specifications or standards and level of performance. As a reference to Slack and Lewis, cost is a universally attractive performance objective which consists of the financial inputs put into the operations to enable production. Costs are often measured with three different metrics: operational expenditure, capital expenditure and working capital (Slack & Lewis, 2020).

The essential aim of strategic effectiveness is to create competitive advantage to achieve superior performance, increase market share within the target market and provide a possibility for premium pricing. Porter (1985) stated that competitive advantage describes the overwhelming value a company is able to create and deliver for its customers in comparison to its competitors. Referencing Porter, competitive advantage is the one characteristic that provides profitability and sustainability for the business in coping with the industry's competitive forces. The two basic types of competitive advantage are cost leadership, meaning that the company is able to operate with the lowest costs and therefore provide the lowest price for the customers, and differentiation (Porter, 1985) which can be achieved for example through a market segment focus, customer value prioritization (time, dependability, accessibility, flexibility, quality etc.) or providing a unique product-service system.

Yasin et. al. (1999) consider strategic effectiveness as an external objective. They stated that customer satisfaction is essential for strategic effectiveness in terms of achieving optimal quality from a customer perspective. Yasin et. al. propose that the systems perspective presented in MBNQA criteria provides essential factors of strategic effectiveness. These strategic effectiveness contributing factors include leadership, market focus, human resource management, strategic planning, information, analysis and process management (Yasin et. al., 1999). Liu (2013) argues that proactive operations, transformation leadership and integration of manufacturing and technology strategies are also contributing factors for strategic effectiveness and business success.

Thompson (1996) proposes that strategic effectiveness and success are dependent on strategic competencies to learn and change in addition to the actual content of the strategy. Through these, a company is able to create value, gain benefit and achieve competitive advantage along with the technological competencies, capabilities and processes it possesses (Thompson, 1996). According to Thompson, the ability to identify and create opportunities is a must, and strategic effectiveness describes the ability to capitalize those opportunities. He stated that succeeding in strategic effectiveness is

affected by the business environment, company resources, values, organizational culture and the ability to change. Referencing Thompson, strategic effectiveness derives from a company-specific and unique mix of strategic competencies which underlines the importance of strategic fit of operations system and competition strategy.

The increasing importance of sustainability in terms of environmental and societal aspects is a driving factor in modern companies and their strategies. Sustainability goals push companies to adopt “more with less” thinking now also in terms of natural resources rather than just financial resources. The scarcity of natural resources affects production capabilities and financial feasibility which on the other hand are compensated for by the growth in knowledge resources and servitization of manufacturing based businesses. Brown et. al. (2018) stated that sustainability has taken its place as a core business requirement in modern business environment. Slack and Lewis (2020) introduced three perspectives for sustainable operations: people, profit and planet. Their approach combines the three aspects of sustainability (societal, economic and environmental) which should be taken into account in strategic operations management in order to simultaneously act responsibly and achieve business objectives .

In the context of business, sustainability has been fundamentally attached to the survival of the company by creating sustainable competitive advantages. Referencing Takala et. al. (2013a), sustainable competitive advantage is about a unique value creation strategy which is not imitable for current or future competitors. Dynamic markets and modern disruptive technologies call in the question of sustainable competitive advantage which rarely can be achieved merely through operational improvements (Porter, 1996). Porter stated that sustainable competitive advantage arises from the fit across activity system and not just the individual parts in it. Malek et. al. (2015) highlight the importance of resource allocation and manufacturing strategies as capabilities to achieve sustainable competitive advantages which arises the significance of operations in modern business environment. According to Malek et. al. (2015), sustainable competitive advantage

arises from core competencies, knowledge management, innovation, resource management capabilities and positive psychological capital.

Sustainable operations refers to business activity systems which thrive for sustainability in the environmental and social fields in addition to economic objectives (Jaehn, 2016). According to Jeffers (2010), modern companies have understood that sustainability could also translate to economic advantages rather than translating just into burden of complying with environmental regulations. One efficient way to economically benefit from sustainability while simultaneously aligning with other sustainability goals is to exploit circular economy into business and operations. Referencing Jeffers, corporate sustainability is a concept describing the understanding that businesses can achieve economic objectives simultaneously with improving quality of life and protecting environmental systems. The three sustainability perspectives are presented in the concept of corporate sustainability which is considered to focus on customer centricity and Lean production principles (Jeffers, 2010).

3.2.2 Operational objectives

Reviewing the literature related to strategic operations management, three different terms for operational success emerge. The terms of operational excellence, operational efficiency and operational effectiveness are used as overlapping concepts by different authors. Gólcher-Barguil et. al. (2019) define operational excellence as effective and efficient management of operations and processes to create and extract maximum amount of value. According to Mangla et. al. (2020), operational excellence is related to dynamism, innovation, relational capabilities, collaboration and flexibility. Referencing Carvalho et. al. (2019), operational excellence is a result of market orientation, process optimization, high efficiency, leadership, organisation and teamwork. In a more recent article, Carvalho et. al. (2023) stated that operational excellence is linked with organizational culture and agility which translates to capability of reacting quickly to changing markets while making continuous, long-term and sustainable improvements in

operations performance. Operational excellence is a great foundation for sustainable competitive advantage (Malek et. al., 2015; Liu, 2013). Tariq et. al. (2021) define operational excellency as organizational competitiveness involving effectiveness, efficiency, correct timing and resource planning. They stated that operational excellency can be achieved through four drivers: organizational vision, strategy implementation with engaged people, proper metrics for process performance and technologies supporting the processes.

The comprehensive end goal is to achieve a high level of operational efficiency which is often evaluated on the basis of productivity and cost-efficiency but should also be evaluated on the criteria of the company's strategic objectives. This is implicitly stated in a famous quote from Michael Porter: "More important is to do right things than doing things right". Even if operating would be efficient, the company won't survive if it fails to deliver desired customer value. Referencing Feng and Ye (2021), operational efficiency enhances the development of industrial and commercial satisfaction.

According to Prahalad and Ramaswamy (2004), operational efficiency is one of the initiatives that are considered to increase profits. Järvenpää et. al. (2017) stated that profitability is the basis of survival and growth for any business. Lahti (1987) considered that operational efficiency is an efficiency metric based on company's real currents of logistical activities and investments in these translate to higher profitability. Yasin et. al. (1999) pointed out that operational efficiency is an internal objective which is also demonstrated in balanced scorecard as it is listed in the objectives and measurements of efficiency in internal processes. Referencing Lahti (1987), operational efficiency can be measured with efficiencies in material, labor and capital and rates of utilization.

Kortmann et. al. (2014) stated that a complex but important relationship exists between operational efficiency and strategic flexibility as it is commonly considered that there is a trade-off between flexibility and efficiency when companies try to optimize business processes. Achieving a well-balanced stated between these long- and short-term

objectives supports competitive advantage but is not solely sufficient to gain one. (Kortmann et. al., 2014). According to Kortmann et. al., operational efficiency is a two-dimensional concept considering time and cost. Referencing Kortmann, time-efficiency concerns manufacturing lead time, delivery speed and inventory turnover whereas cost-efficiency concerns manufacturing, engineering and quality costs.

Resource efficiency is one metric for operational efficiency (Korkeamäki, 2023) and along with it comes the objective of resource optimization. Resource optimization has gained attention due to its effect on profitability and more recently due to the topics of sustainability. Resource optimization can be approached from two perspectives. The first one is to try achieving a certain amount of outputs with the least amount of resources. The second one perspective is to gain the most output from a certain amount of resources. According to Prahalad and Ramaswamy (2004), resource allocation and opportunity recognition are the basic-level strategic tasks. Referencing Järvenpää et. al. (2017), business is guided by an economic principle which stated that resources should be used in a way that would lead to the greatest possible output. Brown et. al. (2018) stated that globalization and complex operations networks with it underline the need of best possible use of resources. The availability of resources is one of the foundational conditions of business growth (Laukkanen, 2007), which in return underlines the best possible use of available resources. Referencing S. Aithal and P. Aithal (2023), with the increasing importance and focus on sustainable development, circular economy principles gain attention in contributing to resource optimization since they provide solutions without endangering business value-creation.

In literature, several categorizations for resources exists depending on the perspective. Whittington et. al. (2020) consider two types of resources: threshold resources that are a necessity to compete in a market in the first place and distinctive resources that can provide competitive advantage. They also divided resources into human, financial and physical resources. Referencing Haverila et. al. (2009), factor of production, that could

be referred to as resources, are labor, capital and materials. Knowledge has been added to this list recently (Haverila et. al., 2009) and also time can be considered as a resource.

Alavi and Leidner (2001) stated that resources are either based on property or knowledge. Knowledge has gained a role as a critical organizational resource that could generate sustainable competitive advantage (Alavi & Leidner, 2001) and applying knowledge resources and knowledge management in operations has a positive impact on performance (Senaji & Nyaboga, 2011). Knowledge is an intangible asset, which has potential to provide long-term success (Hellman & Värilä, 2009). Knowledge management supports resources to achieve higher performance, enhance organizational operations and generate more innovation (Tuomi, 2023).

Referencing Whittington et. al. (2020), the distinctiveness of resources is a contributor for competitive advantage. In order resources to be contributors, they have to be valuable, rare, inimitable and have organizational support (Alavi & Leidner, 2001; Whittington et. al., 2020). This evaluation model is referred to as VRIO model. VRIO model stems from Jay Barney who stated that in order to generate competitive advantage, resources need to have value creation ability, be rare and not easily imitated by competitors in addition to being well-organized (Whittington et. al., 2020).

Resource-based view (RBV) is an operations strategy framework and resource management strategy which focuses on the analysis of intangible and tangible resources that have an effect on competitive advantage (Zahra, 2021). According to Zahra, RBV has been utilized especially in resource selection and valuation as it explains use of organizational resources in the venture of achieving competitive advantage. Zahra stated that technology-based joint ventures such as collaborative partnerships can provide access to valuable strategic resources such as business intelligence and knowledge resources. Referencing Zahra, this is often possible just for established companies while smaller companies and start-ups are constrained in resource accessibility and resource management capabilities. RBV utilizes the VRIO resource management model

framework in investment decisions as in if the criteria of VRIO model are met and the evaluated resources provide valuable and profitable competitive advantages, it would indicate feasible investment activities in those particular resources (Hinterhuber, 2013).

Through partnerships and networking, companies can supplement their resources by taking leverage and benefits from vertical and horizontal integration (Whittington et. al., 2020). Effective network management can significantly expand the amount of available resources and be a source for a competitive advantage as ownership and extensive capital investments are not required (Prahalad & Ramaswamy, 2004). Haverila et. al. (2009) noted that the number of partners within a network can be hundreds which puts high emphasis on communication and collaboration with common objectives. An example of utilizing network management in accessing additional knowledge resources are R&D and innovation projects with collaborating companies and universities (Haverila et. al., 2009). Networks are in nature more dynamic and flexible in resource management sense than internal resources as external resources can be tendered continuously, and they can be dropped or accessed with less commitment.

3.3 Challenges in strategic operations management

Complex and dynamic business environment sets challenges for strategic operations management in forming effective and efficient operations systems (Pinheiro de Lima et. al., 2009) which are strategically aligned and then put them into practice. Rapidly changing market dynamics creates challenges in sustainably providing value propositions to match the demand. Integrating sustainability targets and sustainability regulation compliance into strategy and operations while sustaining competitiveness set challenges. Companies face challenges in the modern operating environment in terms of supply chain and technology. On strategic level, companies need to do challenging decisions on trade-offs that affect their operations systems at the very fundamental level.

Contingency theory challenges the idea of universal methods and practices that could be applied as such leading to the absolute best results (Moniz Jr., 2010). According to Moniz Jr., contingency theory suggests that successful management differs depending on situational variables which can be categorized as environmental and internal contingencies. Referencing Moniz Jr., environmental contingencies refer to the level of instability and uncertainty in the operating environment emphasizing flexibility whereas internal contingencies refer to organizational structure and the ability to utilize resources. According to Donaldson (2001), the highest performance can be achieved through fitting the structure of the organization with the contingencies. Contingency theory emphasizes the importance of building a unique and company specific operations system.

3.3.1 Supply chain challenges

Challenges in supply chain cause oversupply and excessive working capital or disruptions within the supply chain process flow which results in production downtime due to lack of materials and components, inability to provide customers with products due to stock-out and disrupted deliveries due to challenges in outbound logistics. A common framework of supply chain priorities illustrates the characteristics of supply chain as a balance between responsiveness and efficiency (Chopra, 2019). Over-the-top focus on responsiveness can cause oversupply while excessive prioritization of efficiency can result in having moments of stock-out (Chopra, 2019). The decision on which to focus on more should derive from the competitive priorities that set the focus points for supply chain performance so that it contributes to the strategy and ensures strategic fit and alignment for its part within the operations.

The discussion of the balance between responsiveness and efficiency has got new angles during the past few years due to the latest and current global events of CoVid-19 pandemic and power politics. During pre-CoVid, the focus in supply chains was on efficiency trends such as outsourcing, supplier base and buffer reductions and globalization (Trkman & McCormack 2009), which escalated in the beginning of CoVid

pandemic as numerous stock-outs and major supply chain challenges. This forced companies to consider having bigger stocks and prefer local suppliers in order to avoid the risks with a global supply network. Another contributing factor to decrease the level of globalization has been the increasing geopolitical risks and tensions due to increasing practice of power politics, especially between USA, EU, Russia and China. Global supply chain networks have also suffered from uncertainties with their maritime logistics in Middle-East around the Suez canal due to terrorism and criminal activities. These events and trends can have a major impact on strategic operations management leading up to even changes in decision-making of competitive priorities.

An emerging major challenge for supply chains is the likelihood of supply disruptions which is the reason why identifying suppliers' disruption risk is an important management step (Trkman & McCormack, 2009). According to Trkman and McCormack, supplier evaluation can be based on supplier environment, performance and supply chain characteristics. They stated that in risk management processes the focus is often on predicting disruptive events and not on the root causes of supply uncertainties and continuous changes in terms of technologies and customer preferences in turbulent environment. Trkman and McCormac mention that the same supplier strategy is likely result in different outcomes in turbulent and non-turbulent environments and therefore the supply chain should be designed company-specifically instead of merely following universal guidelines. This statement is also backed by Christopher and Holweg (2011) that stated that many supply chain practices were developed during the era with less dynamic and turbulent environment. According to Christoper and Holweg, structural flexibility should be designed into supply chains to embrace volatility as an opportunity and stay competitive through adaptiveness.

Bressanelli et. al. (2019) identified 24 challenges regarding circular economy integration in supply chain designs. Several authorities including academics and the business sector have increasingly taken circular economy into consideration as it could help companies simultaneously achieve sustainability targets while sustaining their competitiveness

(Bressanelli et. al., 2019). According to Bressanelli et. al., business model transformation aimed at sustainable development can be based on a circular economy based framework that consists of four factors: circular product design policies, business model servitization, reverse logistics and enablers such as digitalization and customer collaboration.

3.3.2 Technology challenges

As technology provides a vast number of opportunities, it also sets certain challenges for companies in terms of integration, training and utilization. Production processes and knowledge processes have undergone major digital transformations as information technologies have evolved but in most cases, implementing changes also comes with emerging challenges. Process technology plays a crucial role in product quality, production flexibility, manufacturing cost and lead time, which is why challenges in manufacturing processes, material transformation and scale-up are on top priority.

Shortening product lifecycles and uncertainty of rapidly changing market needs create pressure to shorten innovation and development lead-times while also requiring highly flexible production systems to adapt to continuously changing manufacturing needs (Zheng et. al., 2019). According to Zheng et. al., design flexibility and customization intensiveness are the main challenges opposed by manufacturers which translates to the fact that many small and medium-sized enterprises have yet to abandon handwork in their manufacturing processes as they are required to deliver small batches of diverse product selection. Variability and flexibility are among the main aspects of improvements that smart manufacturing systems try to tackle as traditional mechanisms lack the ability of dynamic adaptation (Yan et. al., 2017). Referencing Yan et. al., industrial robots have faced challenges in insufficient computational capacity and often a significant waste of resources occur.

Kuhn et. al. (2011) argued that process variation is a critical challenge and solving it requires a combination and cycle of continual improvement and new innovations.

According to Kuhn et. al., long-term systematic approach to process variation in each process stage drives profitability and competitiveness. Knocke and Vogt (2009) stated that process development requires experimenting in vast numbers so they proposed as a solution a small, scalable and precise system for controlled experiments which could then be scaled up to production plant level. They noted that when aiming for improved process variation, process development should also take into account the optimization of cost, productivity and time in all production conditions.

Sustainable process and product technologies are being developed and adopted to answer to challenges opposed by sustainability targets by introducing features to reduce emissions, substitute materials to more sustainable ones, increase energy efficiency and improve recycling possibilities (Fu et. al., 2018). While the adoption of sustainable technologies is challenging and often externally initiated, it can generate new business opportunities and improve profitability. According to Fu et. al., important factors for sustainable technology adoption are pressure from markets, technology capabilities and experience in previous technology adoptions and systems. Adoption of sustainable technologies is often done as co-operative act in supply network since independently developing and adopting sustainable process technologies requires such capacity of resources that merely larger corporations would possess as individuals (Fu, et. al. 2018). Knowledge-intensive processes such as knowledge management, market research and data analysis have gained massive possibilities for boosting their performance and accuracy with the adoption of new information technologies. Although, integrating them efficiently in day-to-day processes and extracting the benefits from them to the full extent is still challenging. According to Fosso Wamba et. al. (2019), many organizations face challenges in leveraging big data analytics to business value generation. Challenges in data and cyber security in addition to verification of data relevancy, reliability and accuracy are hampering the deployment of information technologies.

3.3.3 Trade-offs

As competition has increased and blue oceans in markets have been explored, the significance and challenge of trade-offs regarding competitive priorities has increased. If the companies are not willing to make any trade-offs, they may not be able to provide any distinctive or differentiating value which can result in cost competition and decreasing profitability for the whole industry. According to Porter (1996), trade-offs are essential in strategic management, and they arise from inflexible and incompatible activities and limited internal coordination and control. Porter argued that without trade-offs achieving sustainable competitive advantages will never be reached. On the other hand, Mithas et. al. (2022) argued that the introduction of new technologies of Industry 4.0 can influence trade-offs by providing new capabilities improving flexibility while not compromising other competitive priorities and understanding when certain trade-offs are needed or can be avoided.

One fundamental strategic decision-making challenge is the decision between resource and market based view when configuring the company's operation strategy. Resource-based view (RBV) focuses on company's internal strengths while market-based view (MBV) focuses on environmental opportunities when companies try to form their own sustainable competitive advantages (Slack & Lewis, 2020). According to Slack and Lewis, MBV was dominating view in the 1900s, while RBV started to take place in executives strategic considerations more in the 2000s. In MBV school of thought, the first and most important strategic task is strategic positioning and analyzing competitive forces of the industry which then determine the way strategy and operations are designed (Slack & Lewis, 2020). Referencing Slack & Lewis, when considering RBV in strategic management the role of internal resources, capabilities and operations arise as the explanation for company's outperformance. Put in short, in RBV strategic decisions and positioning are based on understanding company's resources while in MBV strategic decisions and design of operations system arise from market opportunities and their satisfaction. It can be argued that RBV is also more applicable in sustainability-based strategies since they have the same objective of efficient resource management and getting the most from

existing resources while MBV aims for gaining maximal financial benefit from market opportunities which can result in unsustainable use of natural resources.

A big decision-making challenge regarding operations and trade-offs is the decision between and the degree of localization and globalization. Globalized operations can provide higher degree of cost-efficiency, more availability for resources and larger partnership networks while localized operations can provide more responsiveness, less supply chain risks in numbers and magnitude and better overall control over simpler networks. According to Bohnenkamp et. al. (2020), while globalization has been the current trend to compete against global and local rivals, some companies have adopted deep localization strategy and established their sourcing and supply chain operations as entirely localized. While global value chains and supply chains have strengthened with the aid technological advancements and gained importance in the realm of operations, they have become complex and more crucial (Orlanyuk-Malitskaya et. al., 2024). According to Orlanyuk-Malitskaya et. al., localized operations with close distance to the place of consumption have influenced current value chain formation principles when aiming for secured local and global competitive leadership. In effect of globalization, corporations have offshored their production facilities to low-cost countries and simultaneously broadened their global market coverage which on the other hand has made supply chains more complex and vulnerable to disruptions (Kazancoglu et. al., 2023). According to Dekkers (2010), the traditional and dominant cost-driven view on outsourcing and offshoring may serve short-term profitability interests but it conflicts with organisational health, hampers the ability to manage outsourced operations and ignores contemporary challenges. Dekkers states that as the strategic decision to proceed with outsourcing is often irreversible, especially make-to-order and engineer-to-order based businesses should take the outsourcing decisions with thorough and integral consideration to avoid adverse effects of loss of control and responsiveness.

Product level decisions have major level effects on how the operations system is designed and operations are configured. Challenging strategic decision is between

standardization and customization which depends on the nature of industry, value proposition and competitive priorities thrived for. The dominant market trend is that customers ask for more and more customized solutions but with shorter lead time and lower costs. Shortened product lifecycles and dynamic market requirements also set challenges for standardizing products and operations. Standardized products are generally more cost-efficient to produce with less lead time as production variance is lower and established supply chains are applied in addition to the notion that from reliability point of view standardized products have higher quality as standard components and proven processes are used with higher numbers of testing hours. On the other hand, customized products provide higher flexibility in product mix, product portfolio's value proposition extends, and customers get more tailored solutions with higher perceived value. The questions are about if the company seeks to appeal to similar market segments and extract less value but from larger global markets with standard products or if it wants to focus on smaller number of customers but extract more value from each individual customer with customized products and if the market is expecting low-value or high-value products. A mode of design and operation developed to tackle this dilemma is mass customization. According to Liu et. al. (2020), new automation and analytics technologies providing flexible models and adaptive supply chains are enabling mass customization to a higher degree than before. Referencing Liu et. al., determining factors for mass customization applicability are the level of opportunities to exploit customization, customer requirement variability and readiness to adopt customization practices.

4 Operating models in modern business systems

As discussed previously in this text, operations system should be configured company-specifically to align with the individually determined business strategy and competitive priorities. This means that companies' operating models might be extensively unique and customized to serve their exact needs. Some common factors and universal management principles for operating models identified and applied with company-specific adjustments and strategic focus points. Different operating models can be identified in multiple aspects of companies. Next, three different operating models are considered from the aspects of products, processes and operations which all shape the operations system. They concentrate on different aspects but can be applied at the same time. Modular operating model focuses on utilizing mass customization by embracing certain principles in product design, Lean management on operational efficiency through process development and Agile methodology on change responsiveness and flexibility in operations.

4.1 Modularization

Modularization is a form of implementation of mass customization in product design which provides an opportunity to enhance operational efficiency significantly. The very essence of modularization tackles the trade-off between cost and differentiation in flexibility (Persson & Lantz, 2022) since it is based on combining the benefits of mass production and flexibility in product offering. As operations are derivatives from products, modularization in product design can improve efficient use of capabilities in design and resources in operations. Modularization is based on product architecture design in which the product is configured from independent and interchangeable modules that each represent some customer value, feature or functionality on their own. Each module has multiple of its own variants, module variants, which have standardized interfaces with other modules. Standard interfaces enables the possibility of configuring vast number of different product variations with smaller number of building blocks.

According to Barbosa et. al. (2017), modularization strategy is adopted in order to increase competitiveness of the organization. Barbosa et. al. stated that competitiveness of supply chain can be improved through synergies that modularization strategy provides. Persson and Lantz (2022) recommended modularization strategy to be adopted by companies that are active in markets that have high customization requirements. Referencing Halstenberg et. al. (2015), modularization strategy in its core aims to organize complex processes and products efficiently into simpler ones as the product architecture significantly affects the processes of product development. Modularization has an effect on the product lifecycle which enables its exploitation also in recycling considerations and sustainable development (Halstenberg et. al., 2015). Challenges with modularization strategy emerge for instance from interfaces as a constraining factor in design and finding the optimal number of the modules and module variants to balance the trade-off between cost-efficiency and flexibility.

The benefits of modularization can be measured in all competitive priority aspects as cost-factor benefits come from economies of scale and standardization, flexibility-factor advancements are clear in providing more variety in product offering, quality-factor increases through standardized mass production of module variants and higher number of testing hours, and time-factor improvements are achieved in terms of introducing new innovations to markets as there is no need to redesign the whole product but just the module variant, through learning curve in manufacturing and assembly work and parallel manufacturing of the modules (Persson & Lantz, 2022; Barbosa et. al., 2017). From a supply chain operations point of view, modularization has several benefits such as decreased complexity in supply chain and manufacturing and reducing inventory levels and costs (Persson & Lantz, 2022) as well as higher negotiation power over suppliers due to higher volumes. From a demand chain perspective, more flexible product offering can provide advantage in sales operations and standardized modules improve the ease of service operations.

The argumentation behind efficiencies of modularization can be based on combinatorics. For example, if there are 4 modules and each module has 4 module variants, in total there are 4 x 4 = 16 module variants but in total there are 4^4 = 256 product configuration combinations. This means that instead of managing and manufacturing 256 individual product designs, only management and manufacturing of 16 module variants are needed which results in significantly decreased complexity and increased efficiency and flexibility in product and operation management. Modularization also provides a notable efficiency advantage in product development as, if the same numbers from aforementioned example are applied, improving just one module variant in the end improves in total 1 x 4^3 = 64 product configuration combinations instead of improving just one product configuration.

Persson and Lantz (2022) stated that as the demand for customized products has increased, the complexity of supply and manufacturing operations has led to adoption of modularization strategy in numerous manufacturing companies. Referencing Persson and Lantz, modularization contributes to gaining competitive advantage followed by higher prices as with modularized products, the company is able to achieve higher customer satisfaction in an effective way. Modularization strategy contributes also to the company's financial performance as it improves the ability to deliver customized products in a cost-efficient way (Persson & Lantz, 2022). According to Persson and Lantz, by adopting the modularization strategy companies tend to achieve higher profit margins, return on assets and return on equity as well as lower capital investment costs as manufacturing, engineering, product development, quality and inventory costs are reduced. Following the findings of Persson and Lantz, it can be concluded that product modularization strategy contributes to both strategic effectiveness in value creation and operational efficiency by streamlining complex operations and should be considered especially in manufacturing companies competing in markets with high valuation of customization.

4.2 Lean management

Lean is a value- and efficiency-focused management principle which aims to create value in each process stage by simplifying and removing waste from processes resulting in shortened throughput time, reduced working capital, improved manufacturing productivity, better resource utilization and higher operational efficiency. Sinha and Matharu (2019) noted that Lean management origins from Toyota, a Japanese automotive manufacturer, and is one of the most significant paradigms in the field of operations management as organizations aim to simultaneously optimize operations and reduce costs while providing satisfying customer experiences and improving competitiveness. Krajewski (2022) defined Lean systems as value-maximizing operations systems focused on removing delays and waste such as overproduction, waiting, inventories, underutilization and inappropriate processing from the system by emphasizing simplicity and consistency while keeping strict cost control and producing outputs only when needed providing competitiveness and high value-for-money from customer point of view. According to Krajewski, Lean management methods are about systematically identifying bottlenecks and improving efficiency by consistently decreasing the levels of inventories and capacities to find the next problem. Referencing Krajewski, common ways to practice Lean are by 5S method, Kaizen, Kanban, Lean house model, automation, flexible workforce, standardization, pull method and close supplier relationships to achieve lower costs, more flexibility, less complexity, just-in-time operations and smaller inventories. Piercy and Rich (2015) stated that Lean management is applicable in achieving sustainable operations as the principle of resource optimization unites them. They noted that Lean management affects at operational and strategic levels from which supply chain development in terms of more focused and localized supplier base and long-term collaborative supplier relationships acts as a fine example.

Singh et. al. (2020) noted that Lean management can realize cost saving breakthroughs in manufacturing companies while providing quality and customer satisfaction with the least amount of non-value-adding activities and process waste. Value stream mapping is a Lean management tool that has established itself in the field of industrial operations

management, especially in Lean waste reduction, by visually and comprehensively mapping the complete process flow of a product from raw materials and production to final product and distribution as a current state version and as a future desired version of the system (Singh et. al., 2020). Referencing Singh et. al., value stream mapping has proven results as reductions in lead time, production cost, working capital and levels of inventories and workforce. Kumar and Shankar (2022) stated that value stream mapping is a renowned tool for streamlining and creating more value-adding processes by minimizing non-value-adding activities. They noted that in value stream mapping, processes can be evaluated by their potential of reducing waste and simplifying to the minimum when the process speed increases resulting in shorter lead time following one of the main principles of Lean to minimize throughput time. Ferreira et. al. (2022) stated that combining value stream mapping with simulation tools supports Industry 4.0 technology roadmapping by helping to understand transitions regarding materials, processes and information flows with the application of Industry 4.0. According to Ferreira et. al. (2022), as value stream mapping systematically identifies waste, supports prioritization decisions and coordinates development initiatives it has gained attention as a Lean practice in modern complex industrial systems. The combination of Industry 4.0 technologies and Lean management practices such as value stream mapping grow in interest among companies as they have mutual objectives and can be implemented as complementary initiatives (Ferreira et. al., 2020). Lean thinking could also be considered from the contrary standpoint. In contrast to removing non-value-adding activities, the activities could be developed and designed in such a way that they would start to generate value. This perspective would be especially practical in cases where the non-value-adding activities are essential for the process and can’t be removed.

Lean management principles can be integrated and complemented by and to other process development theories such as theory of constraints (TOC) and Six Sigma. TOC focuses on identifying and exploiting bottlenecks and constraints within the process to improve the process performance while Six Sigma quality management methods are applied into processes in order to reduce variations and defects. The combination of

Lean and Six Sigma is a renown process development framework in modern industrial companies known as Lean Six Sigma. Gupta et. al. (2022) presented an integrated framework in which they included TOC into this already proven management method of Lean Six Sigma as TOC focuses on throughput of the system while Lean and Six Sigma focus on inventory levels and operating expenses providing a more holistic process development framework. They noted that the integration of these three operational excellence theories takes into account different perspectives of the process and provides improvements to the process in terms of flow, capability and waste minimization strengthening the ultimate financial performance. Duhem et. al. (2023) noted that as the dynamism and complexity of the modern industrial business systems increase with low customer tolerance and high product variety, even the Lean operating model approach may not be efficient enough. They stated that a demand-driven operating model based on real demand and strategic buffers is needed to address the unpredictable demand fluctuations smoothly. A notable mention here is that Lean operating model is also a demand-driven approach exploiting a pull business mechanism. Duhem et. al. noted that a demand-driven operating model combines the principles of Lean, TOC and Six Sigma in order to reduce inventories and lead time while supporting independence within the system with strategically positioned variability-preventing buffers that can be adjusted dynamically according to the demand planning and order execution.

According to Duhem et. al. (2023), the use of artificial intelligence and machine learning in particular can be used as an effective tool in challenging planning of dynamic demand in order to efficiently adjust the inventory levels to address demand spikes. Haddud and Khare (2020) identified that the use of Industry 4.0 technologies such as Internet of Things and cloud computing in supply chain digitalization improve the impact of Lean practices in the context of operations development resulting in enhanced business performance. According to Haddud and Khare, the implementation of Lean operation practices with the support of Industry 4.0 technologies results in better change responsiveness, inventory management and supplier and customer participation in addition to more accurate processes with improved overall business effectiveness.

Haddad and Khare found that digitalization helps Lean practices most in supply chain visualization, demand forecasting and market change responsiveness.

Garcia- Buendia et. al. (2023) stated that Lean supply chain strategy should be considered especially in manufacturing companies which markets are characterized by technologic uncertainty, rapid changes, dynamism and unpredictability. They noted that Lean supply chain strategies have emerged to address the quest for competitiveness and the effects of uncertainties while minimizing inventories and increasing stock turnover rate by resource integration, information sharing, coordination and collaboration with supply chain partners. According to Garcia Buendia et. al., Lean management can be implemented both up- and downstream in supply chain to enhance the performance in all the competitive priority aspects. Ahmed and Huma (2021) identified in their study that Lean strategy has a significant positive impact on the robustness of a supply chain and can provide competitive advantage by improving operational performance. They noted that a Lean supply chain strategy is best applicable in a stable demand environment and with the support of a strong internal quality management system. According to Ahmed and Huma, the Lean strategy hardly has a direct impact on the supply chain resilience, but the increased robustness supports the resilience providing better risk management from up- and downstream supply chain risks.

4.3 Agile methodology

Agile methodology originates from software development as being a business-driven operation strategy that embraces flexibility, transparency, and collaboration in development phase translating into quick versioning, constant interaction and meeting dynamic market demands. Agile operating model emphasizes responsiveness and resilience to changes in modern dynamic business environment, for example in terms of demand fluctuations, emerging risks and supply chain. Shaughnessy and Goulding (2021) stated that the concept of Agile is about customer-centric rapid change techniques and delivering value at every step of business processes. Agility can be defined as a

digitalization-based knowledge management competency of an organization to rapidly transform its core business and way of operating in response to changes in dynamic markets and business environment by utilizing market intelligence. Sreenivasan and Suresh (2024) identified agility as an ability to rapidly recognize and sustainably react to external challenges such as demand fluctuation and changes in business environment and market preferences in terms of volume and variety by resource reorganization and transformation of processes and strategies to provide adaptivity for operations and diversity for product offering.

According to Screenivasan and Suresh (2024), Agile operations improve competitiveness and reduce risk of failure when confronting new technologies, tightening competition and changes in market demand as Agile businesses have better probability to realize their efforts to benefits and profits. They mention that being able to adapt to complexity and provide a variety of suitable products and services quickly after environmental changes while prioritizing attention in value is characteristical for an Agile business. Jaggars and Jones (2018) noted that Agile planning is about an architecture of iterative strategic thinking which when implemented as Agile operations is effective and sensitive and open for new opportunities. Referencing Armanious and Padgett (2021), agility is vital for businesses to survive and sustain their competitive advantage in the midst of unexpected crises and rapid technological development. They stated that organizational Agile competencies that provide competitive advantage emerge from employees who are capable of quickly identifying and interpreting environmental changes and knowledge-based capabilities of digital economy. Innovations through continuous learning and Agile competencies are in the core of competitive sustainability in the realm of digitalization (Armanious and Padgett, 2021). Carvalho et. al. (2019) presented that agility and operational excellence have a solid relationship as Agile capabilities support operational excellence by rapid and effective response to unexpected market changes in complex business environment. According to Kadenic and Tambo (2023), improved strategic dimension of resilience of operating model is one of the potentials of Agile methodology as it ensures greater responsiveness to contingencies and changes which

translated well during CoVid-19 period when agility was one common factor in well-survived and well-recovered businesses. They noted that as resilience is a capability to manage change and a system's ability to sustain its configuration and reorganize itself in need, the concepts of system resilience and Agile responsiveness have a synergic relationship. Kadenic and Tambo stated that Agile business processes integrated in strategy and operating model are in the core of building effective and efficient operational resilience to respond to operational disruptions

Agile manufacturing has emerged from the need to respond to dynamics of modern markets and environmental disruptions while maintaining global competitiveness (Sreenivasan & Suresh, 2024). Alzoubi et. al. (2023) stated that Agile operations provide a solution for managing operations during unpredictable demand and reaching for new business opportunities while increasing quality, flexibility and lead time. Gunasekaran et. al. (2019) noted that Agile manufacturing is a key capability for sustainable competitive advantage in complex and dynamic markets with shortening product lifecycles. They identified five enablers for Agile manufacturing: Agile supply chains, total employee empowerment, transparent customization, technology integration and intelligent automation. Nabass and Abdallah (2019) found that Agile manufacturing improves business competitiveness and organizational performance by having a positive effect on quality, delivery and flexibility through utilization of market knowledge. They noted that Agile manufacturing is a practice of Agile operations together with modularization, manufacturing paradigms and efficient information systems as Agile operating model is demand-driven instead of being forecast-driven. According to Nabass and Abdallah, as Agile manufacturing enables more extensive and differentiated product offering it has the potential to increase profits and market share in addition to operational improvements. Although, increasing responsiveness and flexibility in operations and manufacturing may increase costs even if Agile methods are adopted which calls for cost saving initiatives such as Lean, modularization and supply chain integration. Yayla-Küllü et. al. (2021) presented that postponement in pricing decisions, product quantity and product mix with rapid, precise and effective resource re-allocation support Agile

ambitions and competitive advantage in markets with high level of customer behavior uncertainty and heterogeneity. They underlined the importance of Agile competencies and strategic alignment in modern business where companies encounter short-term uncertainties in demand changes and long-term uncertainties in customer behavior. On the other hand, postponement in pricing decisions obstructs the opportunity to invoice in advance and delays money transaction from customer to the company, which means that the company has to use its own capital instead of the sales revenue to run its operations until the payment has been completed. This can be considered as a trade-off between efficiency in terms of working capital and capital leverage and effectiveness in terms of flexibility and risk management of procurement cost fluctuation.

Chopra (2019) defined agility in supply chain as an ability to enhance strategic fit when shifting supply chain partnerships to support changing supply chain requirements in terms of responsiveness and efficiency. Tarafdar and Qrunfleh (2017) noted that Agile supply chain strategy is critical for the capability of responding to shortening product lifecycles and volatile demand fluctuations and introducing new products quickly. They found that postponement, customer relationship management and strategic supplier partnerships with information system and knowledge management capabilities have a significant effect on the agility and performance of the supply chain. Ahmed and Huma (2021) noted that Agile strategy improves supply chain resilience and is an excellent approach in dynamic demand conditions with the rapid change responsiveness ability. According to Wong et. al. (2022), the use of artificial intelligence can improve managerial resource use, agility and re-engineering capabilities of supply chain by utilizing AI in risk management and scenario modelling. They stated that as supply chains are a crucial form of competition in modern business, the integration of Agile competencies of flexibility, responsiveness and opportunity exploitation in supply chains is crucial. Wong et. al. noted that Agile supply chain relies on metrics to measure relevant external stimuli, available strategic responses and scalable resources in which AI helps to identify changes that require actions and simulating alternatives to aid strategic decision-making to re-allocate resources, optimize inventories and eventually sustain competitiveness.

Jo et. al. (2014) claimed that developing manufacturing intelligence for quick field responses was the initiator of Agile operation management systems that are able identify and rapidly react to problems with real time data. Referencing Jo et. al., the quick decision-making of Agile operation management systems can reduce waste of resources in terms of work, time and energy in problem-solving. They identified four technology components (data visualization, information mining, alternative finding and alternative verification) and four sub-systems (intelligent dashboard, manufacturing process miner, improvable alternative approach and factory process simulator) to be included in Agile operation management system which aims to possess flexible manufacturing intelligence and automatically extracted manufacturing processes in order to efficiently and effectively form and finalize decision-making alternatives. Ifandoudas and Chapman (2009) explored the combination of TOC and RBV to achieve Agile operations in order to cope with the increasing competition requiring flexibility, innovation and short lead time. They stated that Agile strategy can be practiced through TOC principles in continuous operational improvements and innovations for short-term optimization in flows and processes and RBV principles in strategic prioritization for sustainable competitiveness, resource management and responsiveness. According to Ifandoudas and Chapman, the integration of TOC to RBV not just fixes the bottlenecks but also strengthens the key strategic resources that provide Agile competencies such as responsiveness, adaptability, innovation and speed required from businesses to successfully compete in modern dynamic markets.

5 Conclusion

Strategic operations management is about the integration of strategic and operational decision-making aiming to maximize value generation capabilities, operational excellence and business competitiveness with the available resources and competencies. The role of strategic operations management, along with utilization of information technologies, knowledge management and data-driven decision-making as its tools, has increased its importance in the modern, complex and dynamic business environment. Strategic operations management is about putting strategy into practice by enhancing strategic alignment among operations and the fit of operations to competitive priorities determined in competition strategy to achieve sustainable competitive advantage. As a result of strategic operations management is a design of a value chain that integrates and synchronizes supply chain and demand chain operations providing superior business performance and competitiveness. A meter for the success of the value chain, and thus for strategic operations management, can be used the company's profitability level considering to be determined by two variables: effectiveness that relates more to demand chain operations, value creation and revenue generation, and efficiency that relates more to supply chain, operational performance and cost generation.

Operations as the core of an industrial companies are responsible for the transformation process from inputs to outputs and the flow within the process from the raw material sources to the customer. Operations management is a relatively new management science which focuses on designing and controlling the system of operations to maximize value creation while optimizing resource utilization. Operations can be perceived as a profit-generating value chain consisting of an efficiency-driven supply chain and an effectiveness-driven demand chain. Technology is an essential part of operations with an increasing importance with the introduction of the modern technologies of digitalization, Industry 4.0 and artificial intelligence.

Corporate and business strategies define the strategic positioning and competitive priorities that strategic operations management thrives for by aligning and fitting the

operations system in accordance with the competitive priorities. Decision-making of strategic operations management concerns not just the operations themselves but also a vast number of factors such as operation resources, forecasting, capacity planning and facility locations. In the field of strategic operations management, the modern decision-making processes such as S&OP, TOC and supply chain network design concern the synchronization, capacity, flow and design of the entire value chain and are more and more often data-driven rather than experience-driven. The main strategic objective in strategic operations management is to design and possess a company-specific operations system that supports the competitive prioritization of upper level strategies and provides a sustainable competitive advantage. Operational excellence and resource optimization are the operational level objectives of strategic operations management which can be achieved through practices such as RBV, VRIO, knowledge management and network management. Complex, unpredictable and dynamic business environment sets challenges for all modern industrial companies which increases the importance of adequate strategic operations management to address the supply chain and technology challenges effectively and efficiently while concerning the various trade-offs involved such as decisions on globalization and standardization.

Operating model determines the company's unique way of operating and operations system aiming for sustainable competitive advantage and superior business performance. Operating models are further customized to serve the company's specific needs in their own context but in this thesis three modern approaches to operating models were introduced from the perspectives of products, processes and operations. Modularization is about enhancing operational efficiency and mass customization through certain product design principles. Lean management is considered as a management theory for value-driven process development and way of operating. Agile operating model thrives for change responsiveness in a rapidly changing business environment. Agile is considered to focus more on effectiveness in dynamic markets whereas Lean is considered to aim for efficiency in more stable markets while modularization can be implemented to boost success of both operating model strategies.

References

Affisco, J. & Soliman, K. (2006). *E-government: a strategic operations management framework for service delivery.* Business Process Management Journal, Vol. 12 No. 1, p. 13.21. https://www.emerald.com/insight/content/doi/10.1108/14637150610643724/full/html

Ahmed, W., & Huma, S. (2021). *Impact of Lean and Agile strategies on supply chain risk management.* Total quality management & business excellence, 32(1-2), 33-56. https://doi.org/10.1080/14783363.2018.1529558

Aithal, S. & Aithal P. (2023*). Importance of Circular Economy for Resource Optimization in Various Industry Sectors – A Review-based Opportunity Analysis*. International Journal of Applied Engineering and Management Letters, 7(2), 191-215. Retrieved 10.1.2024 from https://ssrn.com/abstract=4575631

Akter, S., Michael, K., Uddin, M. R., McCarthy, G., & Rahman, M. (2022). *Transforming business using digital innovations: The application of AI, blockchain, cloud and data analytics*. Annals of operations research, 308(1-2), 7-39. https://doi.org/10.1007/s10479-020-03620-w

Alavi, M., & Leidner, D. E. (2001). *Knowledge Management and Knowledge Management Systems: Conceptual Foundations and Research Issues*. MIS Quarterly, 25(1), 107–136. https://doi.org/10.2307/3250961

Alzoubi, H. M., Alshurideh, M. T., Hussein, A. A., Kurdi, B. A., Ahmad, A., & Alhamad, A. (2023). *Rationalizing the cost of quality through Lean and Agile operations practices: Evidence from Aviation industry*. Uncertain supply chain management, 11(1), 319-324. https://doi.org/10.5267/j.uscm.2022.9.011

Armanious, M., & Padgett, J. D. (2021). *Agile learning strategies to compete in an uncertain business environment.* The journal of workplace learning, 33(8), 635-647. https://doi.org/10.1108/JWL-11-2020-0181

Ash, C., & Burn, J. (2003). *A strategic framework for the management of ERP enabled e-business change.* European journal of operational research, 146(2), 374-387. https://doi.org/10.1016/S0377-2217(02)00556-8

Awan, U., Shamim, S., Khan, Z., Zia, N. U., Shariq, S. M., & Khan, M. N. (2021). *Big data analytics capability and decision-making: The role of data-driven insight on circular economy performance.* Technological forecasting & social change, 168, 120766. https://doi.org/10.1016/j.techfore.2021.120766

Barbosa, L. M., Lacerda, D. P., Piran, F. A. S., & Dresch, A. (2017). *Exploratory analysis of the variables prevailing on the effects of product modularization on production volume and efficiency.* International journal of production economics, 193, 677-690. https://doi.org/10.1016/j.ijpe.2017.08.028

Barnes, D., Hinton, M. & Mieckowska, S. (2007). *The strategic management of operations in e-business*. Taylor & Francis. https://doi.org/10.1080/09537280410001714260

Barringer, B. & Ireland, R. (2016). *Entrepreneurship: Successfully Launching New Ventures* (5th edition, Global edition). Pearson Education Limited.

Bressanelli, G., Perona, M., & Saccani, N. (2019). Challenges in supply chain redesign for the Circular Economy: A literature review and a multiple case study. International journal of production research, 57(23), 7395-7422. https://doi.org/10.1080/00207543.2018.1542176

Bhandal, R., Meriton, R., Kavanagh, R. & Brown, A. (2021). *The application of digital twin technology in operations and supply chain management: a bibliometric review*. Supply Chain Management: An International Journal, Vol. 27 No. 2 p. 182-206.

Bohnenkamp, T., Schiele, H., & De Visser, M. (2020). *Replacing global sourcing with deep localisation: The role of social capital in building local supply chains*. International journal of procurement management, 13(1), 83-111. https://doi.org/10.1504/IJPM.2020.105200

Bowman, C. & Faulkner D. (1996). *Competitive and Corporate Strategy.* Irwin Professional Publishing, U.S.

Brown, S., Bessant, J. & Jia, F. (2018). *Strategic Operations Management* (4th edition). Routledge. https://doi.org/10.4324/9781315123370

Cannas, V. G., Ciano, M. P., Saltalamacchia, M., & Secchi, R. (2023). *Artificial intelligence in supply chain and operations management: A multiple case study research*.

International journal of production research, ahead-of-print(ahead-of-print), 1-28. https://doi.org/10.1080/00207543.2023.2232050

Carvalho, A. M., Sampaio, P., Rebentisch, E., Carvalho, J. Á., & Saraiva, P. (2019). *Operational excellence, organisational culture and agility: The missing link?* Total quality management & business excellence, 30(13-14), 1495-1514. https://doi.org/10.1080/14783363.2017.1374833

Carvalho, A. M., Sampaio, P., Rebentisch, E., McManus, H., Carvalho, J. Á., & Saraiva, P. (2023). *Operational excellence, organizational culture, and agility: Bridging the gap between quality and adaptability.* Total quality management & business excellence, 34(11-12), 1598-1628. https://doi.org/10.1080/14783363.2023.2191844

Chopra, S. (2019). *Supply chain management: Strategy, planning, and operation* (Seventh edition. Global edition.). Pearson Education Limited.

Christopher, M., & Holweg, M. (2011). "*Supply Chain 2.0": Managing supply chains in the era of turbulence.* International journal of physical distribution & logistics management, 41(1), 63-82. https://doi.org/10.1108/09600031111101439

Dekkers, R. (2010*). Impact of strategic decision making for outsourcing on managing manufacturing*. International Journal of Operations & Production Management.

Demir, A. (2019). *The Impact Of Strategic Operations Management Decisions On Shoppers' Wellbeing*. Asian Academy of Management Journal, Vol. 24, No. 1, 25–57. https://doi.org/10.21315/aamj2019.24.1.2

Donaldson, L. (2001). *Structural Contingency Theory*. International Encyclopedia of the Social & Behavioral Sciences. https://doi.org/10.1016/B0-08-043076-7/04214-5

Donchak, L., McClatchy, J. & Stanley, J. (2022). *The future of B2B sales is hybrid.* McKinsey. https://www.mckinsey.com/capabilities/growth-marketing-and-sales/our-insights/the-future-of-b2b-sales-is-hybrid

Duhem, L., Benali, M., & Martin, G. (2023). *Parametrization of a demand-driven operating model using reinforcement learning.* Computers in industry, 147, 103874. https://doi.org/10.1016/j.compind.2023.103874

Dutta, P., Choi, T., Somani, S. & Butala, R. (2020). *Blockchain technology in supply chain operations : Applications, challenges and research opportunities*. Elsevier Ltd.

Dzhulii, L., Mironova, N., Stankevych, I., Paunov, M., & Syvak, O. (2020). *Strategic Company Management In The Conditions Of Industry 4.0*. Academy of Strategic Management Journal, 19(5), 1-9.

Feng, B. & Ye, Q. (2021). *Operations management of smart logistics: A literature review and future research*. Frontiers of Engineering Management.

Ferreira, W. d. P., Armellini, F., Santa-Eulalia, L. A. d., & Thomasset-Laperrière, V. (2022). *Extending the Lean value stream mapping to the context of Industry 4.0: An agent-based technology approach*. Journal of manufacturing systems, 63, 1-14. https://doi.org/10.1016/j.jmsy.2022.02.002

Fosso Wamba, S., Akter, S., Trinchera, L., & De Bourmont, M. (2019). *Turning information quality into firm performance in the big data economy*. Management Decision, 57(8), 1756–1783.

Fu, Y., Kok, R. A., Dankbaar, B., Ligthart, P. E., & van Riel, A. C. (2018). *Factors affecting sustainable process technology adoption: A systematic literature review*. Journal of Leaner production, 205, 226-251. https://doi.org/10.1016/j.jclepro.2018.08.268

Garcia-Buendia, N., Moyano-Fuentes, J., Maqueira, J. M., & Avella, L. (2023). *The lean supply chain management response to technology uncertainty: Consequences for operational performance and competitiveness*. Journal of manufacturing technology management, 34(1), 67-86. https://doi.org/10.1108/JMTM-07-2022-0250

Ghobakhloo, M., & Iranmanesh, M. (2021). *Digital transformation success under Industry 4.0: A strategic guideline for manufacturing SMEs*. Journal of manufacturing technology management, 32(8), 1533-1556. https://doi.org/10.1108/JMTM-11-2020-0455

Gólcher-Barguil, L. A., Nadeem, S. P., & Garza-Reyes, J. A. (2019). *Measuring operational excellence: An operational excellence profitability (OEP) approach*. Production

planning & control, 30(8), 682-698. https://doi.org/10.1080/09537287.2019.1580784

Gunasekaran, A., Yusuf, Y. Y., Adeleye, E. O., Papadopoulos, T., Kovvuri, D., & Geyi, D. G. (2019). *Agile manufacturing: An evolutionary review of practices.* International journal of production research, 57(15-16), 5154-5174. https://doi.org/10.1080/00207543.2018.1530478

Gupta, M., Digalwar, A., Gupta, A., & Goyal, A. (2022). *Integrating Theory of Constraints, Lean and Six Sigma: A framework development and its application*. Production planning & control, ahead-of-print(ahead-of-print), 1-24. https://doi.org/10.1080/09537287.2022.2071351

Haddud, A., & Khare, A. (2020). *Digitalizing supply chains potential benefits and impact on Lean operations*. International journal of Lean six sigma, 11(4), 731-765. https://doi.org/10.1108/IJLSS-03-2019-0026

Halstenberg, F. A., Buchert, T., Bonvoisin, J., Lindow, K., & Stark, R. (2015). *Target-oriented Modularization – Addressing Sustainability Design Goals in Product Modularization*. Procedia CIRP, 29, 603-608. https://doi.org/10.1016/j.procir.2015.02.166

Hansen, Z. N. L., & Ahmed-Kristensen, S. (2012). *Connecting engineering operations to strategic management: A framework for decision making in engineering offshoring*. International journal of product development, 17(3-4), 204-227. https://doi.org/10.1504/IJPD.2012.052102

Haverila, Matti J., Erkki Uusi-Rauva, Ilkka Kouri & Asko Miettinen (2009). *Teollisuustalous.* Infacs Oy.

Hellman, K. & Värilä, S. (2009). *Economica: Arvokas asiakas*. Talentum.

Hinterhuber, A. (2013). *Can competitive advantage be predicted?: Towards a predictive definition of competitive advantage in the resource-based view of the firm.* Management decision, 51(4), 795-812. https://doi.org/10.1108/00251741311326572

Ifandoudas, P., & Chapman, R. (2009). *A practical approach to achieving Agility-a theory of constraints perspective.* Production planning & control, 20(8), 691-702. https://doi.org/10.1080/09537280903107473

Ikeziri, L. M., Souza, F. B. d., Gupta, M. C., & de Camargo Fiorini, P. (2019). *Theory of constraints: Review and bibliometric analysis*. International journal of production research, 57(15-16), 5068-5102. https://doi.org/10.1080/00207543.2018.1518602

Jaehn, F. (2016). Sustainable operations. European Journal of Operational Research 253 (2), p. 243-264. https://doi.org/10.1016/j.ejor.2016.02.046

Jaggars, D., & Jones, D. (2018). *An Agile planning and operations framework.* Performance measurement and metrics, 19(2), 121-126. https://doi.org/10.1108/PMM-11-2017-0057

Jeffers, P. I. (2010). *Embracing sustainability: Information technology and the strategic leveraging of operations in third‐party logistics*. International journal of operations & production management, 30(3), 260-287. https://doi.org/10.1108/01443571011024629

Jo, H., Noh, S. D., & Cho, Y. (2014). *An Agile operations management system for green factory*. International Journal Of Precision Engineering And Manufacturing-Green Technology, 1(2), 131-143. https://doi.org/10.1007/s40684-014-0018-z

Jorfi, S. & Jorfi, H. (2011). *Strategic Operations Management: Investigating the Factors Impacting IT-Business Strategic Alignment.* Procedia Social and Behavioral Sciences 24 (2011) 1606–1614.

Järvenpää, M., Länsiluoto, A., Partanen, V. & Pellinen J. (2017). *Talousohjaus ja kustannuslaskenta* (4th edition). Sanoma Pro Oy.

Kadenic, M. D., & Tambo, T. (2023). *Resilience of operating models: Exploring the potential of Agile project management as enabler*. International journal of managing projects in business, 16(3), 521-542. https://doi.org/10.1108/IJMPB-05-2022-0122

Kazancoglu, Y., Lafci, C., Berberoglu, Y., Upadhyay, A., Rocha-Lona, L., & Kumar, V. (2023). *The effects of globalization on supply chain resilience: Outsourcing techniques as*

interventionism, protectionism, and regionalization strategies. Operations management research. https://doi.org/10.1007/s12063-023-00429-1

Kesavan, S., & Kushwaha, T. (2020). *Field Experiment on the Profit Implications of Merchants' Discretionary Power to Override Data-Driven Decision-Making Tools*. Management science, 66(11), 5182-5190. https://doi.org/10.1287/mnsc.2020.3743

Kim, Y. H., Sting, F. J., & Loch, C. H. (2014). *Top-down, bottom-up, or both? Toward an integrative perspective on operations strategy formation*. Journal of operations management, 32(7-8), 462-474. https://doi.org/10.1016/j.jom.2014.09.005

Klochkova, A. & Orlova, O. (2021). *ERP-systems As a Strategic Management Tool*. Economics and Environmental Management. https://doi.org/10.17586/2310-1172-2021-14-2-134-142

Knocke, C., & Vogt, J. (2009). Biofuels - challenges & chances: How biofuel development can benefit from advanced process technology. Engineering in life sciences, 9(2), 96-99. https://doi.org/10.1002/elsc.200700064

Korkeamäki, L. (2023). *Course on Strategic Business Development*. University of Vaasa.

Kortmann, S., Gelhard, C., Zimmermann, C., & Piller, F. T. (2014). *Linking strategic flexibility and operational efficiency: The mediating role of ambidextrous operational capabilities*. Journal of operations management, 32(7-8), 475-490. https://doi.org/10.1016/j.jom.2014.09.007

Krajewski, L. (2022). Operations Management: Processes and Supply Chains. Global Edition. Pearson.

Kuhn, K. J., Giles, M., Becher, D., Kolar, P., Kornfeld, A., Kotlyar, R., Ma, S., Maheshwari, A. & Mudanai, S. (2011). *Process Technology Variation*. IEEE transactions on electron devices, 58(8), 2197-2208. https://doi.org/10.1109/TED.2011.2121913

Kumar, U., & Shankar, R. (2022). *Application of Value Stream Mapping for Lean Operation: An Indian Case Study of a Dairy Firm.* Global business review, 97215092211130. https://doi.org/10.1177/09721509221113002

Kunttu, I. (2023). *Course on Value Creation by Knowledge Management*. University of Vaasa.

Kuruppuarachchi, D. & Perera H. (2010). *Impact of TQM and Technology Management on Operations Performance.* The IUP Journal of Operations Management, Vol. IX, No. 3.

Lahti, A. (1987). *Strateginen yritysanalyysi.* Ekonomia.

Liu, N., Chow, P., & Zhao, H. (2020). *Challenges and critical successful factors for apparel mass customization operations: Recent development and case study*. Annals of operations research, 291(1-2), 531-563. https://doi.org/10.1007/s10479-019-03149-7

Liu, Y. (2013). *Sustainable competitive advantage in turbulent business environments.* International Journal of Production Research, 51:10, p. 2821-2841. https://doi.org/10.1080/00207543.2012.720392

Lowson, R. (2002). *Strategic Operations Management: The New Competitive Advantage.* Routledge. https://web-s-ebscohost-com.proxy.uwasa.fi/ehost/command/detail?vid=0&sid=376fa71c-8b2d-419b-8565-ca5c15bc3163%40redis&bdata=JnNpdGU9ZWhvc3QtbGl2ZQ%3d%3d#jid=13ME&db=bsu

Lu, J., Yan, Z., Han, J., & Zhang, G. (2019). *Data-Driven Decision-Making (D3M): Framework, Methodology, and Directions.* IEEE Transactions on Emerging Topics in Computational Intelligence, 3(4), 286-296. https://doi.org/10.1109/TETCI.2019.2915813

Malek, N., Shahzad, K., Takala, J., Bojnec, S., Papler, D. & Liu, Y. (2015). *Analyzing Sustainable Competitive Advantage: Strategically Managing Resource Allocations To Achieve Operational Competitiveness.* Management and Production Engineering Review, Vol 6 (4), p. 70-86. https://urn.fi/URN:NBN:fi-fe202101272928

Mangla, S. K., Kusi-Sarpong, S., Luthra, S., Bai, C., Jakhar, S. K., & Khan, S. A. (2020). *Operational excellence for improving sustainable supply chain performance*. Resources, conservation and recycling, 162, 105025. https://doi.org/10.1016/j.resconrec.2020.105025

Maylor, H., Turner, N., & Murray-Webster, R. (2015). *"It worked for manufacturing. . .!". Operations strategy in project-based operations.* International journal of project management, 33(1), 103-115. https://doi.org/10.1016/j.ijproman.2014.03.009

McAfee, A. (2002). *The Impact of Enterprise Information Technology Adoption on Operational Performance: An Empirical Investigation*. Production and Operations Management Vol. 11 No. 1

Mithas, S., Chen, Z., Saldanha, T. J., & De Oliveira Silveira, A. (2022). *How will artificial intelligence and Industry 4.0 emerging technologies transform operations management?* Production and operations management, 31(12), 4475-4487. https://doi.org/10.1111/poms.13864

Modi, K., Lowalekar, H., & Bhatta, N. (2019). *Revolutionizing supply chain management the theory of constraints way: A case study*. International journal of production research, 57(11), 3335-3361. https://doi.org/10.1080/00207543.2018.1523579

Moniz Jr., R. (2010). *Practical and effective management of libraries*. Chandos Publishing. https://www.sciencedirect.com/topics/economics-econometrics-and-finance/contingency-theory

Nabass, E. H., & Abdallah, A. B. (2019). *Agile manufacturing and business performance: The indirect effects of operational performance dimensions*. Business process management journal, 25(4), 647-666. https://doi.org/10.1108/BPMJ-07-2017-0202

Najdawi, M. K., Chung, Q., & Salaheldin, I. (2008). *Expert systems for strategic planning in operations management: A framework for executive decisions*. International journal of management and decision making, 9(3), 310-327. https://doi.org/10.1504/IJMDM.2008.017412

Orlanyuk-Malitskaya, L., Plakhova, T., Sakulyeva, T., & Glazkova, I. (2024). *The impact of globalisation processes on supply chain management*. Innovative infrastructure solutions : the official journal of the Soil-Structure Interaction Group in Egypt (SSIGE), 9(2), . https://doi.org/10.1007/s41062-023-01331-2

Pacheco, D. A. d. J., Antunes Junior, J. A. V., & de Matos, C. A. (2021). *The constraints of theory: What is the impact of the Theory of Constraints on Operations Strategy?*

International journal of production economics, 235, 107955. https://doi.org/10.1016/j.ijpe.2020.107955

Persson, M., & Lantz, B. (2022). *Effects of customization and product modularization on financial performance.* Journal of engineering and technology management, 65, 101704. https://doi.org/10.1016/j.jengtecman.2022.101704

Pinheiro de Lima, E., Eduardo Gouvêa da Costa, S., & Reis de Faria, A. (2009). *Taking operations strategy into practice: Developing a process for defining priorities and performance measures.* International journal of production economics. https://doi.org/10.1016/j.ijpe.2009.06.022

Porter, M. (1985). *Competitive Advantage: Creating and Sustaining Superior Performance.* NY Free Press.

Porter, M. (1996). *What Is Strategy?.* Harvard Business Review. https://hbr.org/1996/11/what-is-strategy

Prahalad, C.K. & Ramaswamy, V. (2004). *The Future of Competition: Co-Creating Unique Value with Customers.* Harvard Business School Press.

Ramachandran, K., Tereyagoglu, N., & Xia, Y. (2018). *Multidimensional Decision Making in Operations: An Experimental Investigation of Joint Pricing and Quantity Decisions*. Management science, 64(12), 5544-5558. https://doi.org/10.1287/mnsc.2017.2919

Rejikumar, G., Aswathy Asokan, A., & Sreedharan, V. R. (2020). *Impact of data-driven decision-making in Lean Six Sigma: An empirical analysis*. Total quality management & business excellence, 31(3-4), 279-296. https://doi.org/10.1080/14783363.2018.1426452

Sreenivasan, A., & Suresh, M. (2024). *Agile readiness for sustainable operations in start-ups.* International journal of innovation science, 16(1), 166-192. https://doi.org/10.1108/IJIS-08-2022-0164

Senaji, T. & Nyaboga, A. (2011). *Knowledge Management Process Capability: Operations strategy perspective.* International Journal of Management & Information Systems. https://doi.org/10.19030/ijmis.v15i3.4651

Shaughnessy, H., & Goulding, F. (2021). *Sprinting to digital transformation: A time boxed, Agile approach.* Strategy & leadership, 49(1), 18-24. https://doi.org/10.1108/SL-12-2020-0157

Singh, J., Singh, H., Singh, A., & Singh, J. (2020). *Managing industrial operations by Lean thinking using value stream mapping and six sigma in manufacturing unit: Case studies*. Management decision, 58(6), 1118-1148. https://doi.org/10.1108/MD-04-2017-0332

Sinha, N., & Matharu, M. (2019). *A comprehensive insight into Lean management: Literature review and trends.* Journal of industrial engineering and management, 12(2), 302-317. https://doi.org/10.3926/jiem.2885

Skinner, W. (1984). *Operations Technology: Blind Spot in Strategic Management*. The Institute of Management Sciences, Harvard University.

Slack, N. & Lewis, M. (2020). *Operations Strategy* (6th edition). Pearson Education.

Takala, J., Koskinen, J., Liu, Y., Serif Tas, M. & Muhos, M. (2013). *Validating Knowledge and Technology Effects to Operative Sustainable Competitive Advantage.* Management and Production Engineering Review, Vol 4 (3), p. 45-54. https://doi.org/10.2478/mper-2013-0028

Tarafdar, M. and Qrunfleh, S. (2017*). Agile supply chain strategy and supply chain performance: complementary roles of supply chain practices and information systems capability for agility.* International Journal of Production Research, Vol. 55 No. 4, pp. 925-938, https://doi.org/10.1080/00207543.2016.1203079

Tariq, M. U., Poulin, M., & Abonamah, A. A. (2021). *Achieving Operational Excellence Through Artificial Intelligence: Driving Forces and Barriers*. Frontiers in psychology, 12, 686624. https://doi.org/10.3389/fpsyg.2021.686624

Tchokogué, A., Ngniatedema, T., & Pache, G. (2022). *Learning from sales and operations planning process implementation at ASTRO Inc*. Business process management journal, 28(2), 481-507. https://doi.org/10.1108/BPMJ-10-2020-0459

Thompson, J.L. (1996). *Strategic effectiveness and success: the learning challenge*. Management Decision, Vol. 34 No. 7, pp. 14-22. Retrieved 7.1.2024 from https://doi.org/10.1108/00251749610124864

Troisi, O., Maione, G., Grimaldi, M., & Loia, F. (2020). *Growth hacking: Insights on data-driven decision-making from three firms*. Industrial Marketing Management, 90, 538–557.

Trkman, P., & McCormack, K. (2009). *Supply chain risk in turbulent environments—A conceptual model for managing supply chain network risk*. International journal of production economics, 119(2), 247-258. https://doi.org/10.1016/j.ijpe.2009.03.002

Tuomi, V. (2023). *Course on Value Creation by Knowledge Management*. University of Vaasa.

Volberda, H., Morgan, R., Reinmoeller, P., Hitt, M., Ireland, R. & Hoskisson, R. (2011). *Strategic management: Competitiveness and Globalization: Concepts and Cases.* Cengage Learning Business Press.

Wallace, T. F. (2008). *Sales & operations planning: The "how-to" handbook : how it works, how to implement it with low risk and low cost, how to make it better and better* (3rd ed.). T. F. Wallace & Company.

Walters, D. & Rainbird, M. (2017). *Strategic Operations Management: A Value Chain Approach*. Bloomsbury. https://books.google.fi/books?hl=fi&lr=&id=w5pGEAAAQBAJ&oi=fnd&pg=PR2&dq=%22strategic+operations+management%22&ots=eyT6u0-gqv&sig=0B-MHviZYw_BH53vDiR3kZ7ErVc&redir_esc=y#v=onepage&q=strategic%20operations%20management&f=false

Walker, H., Chicksand, D., Radnor, Z. & Watson, G. (2015). *Theoretical perspectives in operations management: an analysis of the literature*. International Journal of Operations & Production Management, 35(8), 1182-1206. https://doi.org/10.1108/IJOPM-02-2014-0089

Whittington, R., Regnér, P., Angwin, D., Johnson, G., & Scholes, K. (2020). *Exploring strategy: Text and cases* (12th edition.). Pearson Education Limited. https://bookshelf.vitalsource.com/books/9781292282503

Wong, Lai-Wan, Garry Wei-Han Tan, Keng-Boon Ooi, Binshan Lin, and Yogesh K. Dwivedi. 2022. *Artificial Intelligence-Driven Risk Management for Enhancing Supply Chain*

Agility: A Deep-Learning-Based Dual-Stage PLS-SEM-ANN Analysis. International Journal of Production Research, 1–21. https://doi.org/10.1080/00207543.2022.2063089.

Yayla-Küllü, H. M., Ryan, J. K., & Swaminathan, J. M. (2021). *Product Line Flexibility for Agile and Adaptable Operations.* Production and operations management, 30(3), 725-737. https://doi.org/10.1111/poms.13313

Yan, H., Hua, Q., Wang, Y., Wei, W., & Imran, M. (2017). *Cloud robotics in Smart Manufacturing Environments: Challenges and countermeasures*. Computers & electrical engineering, 63, 56-65. https://doi.org/10.1016/j.compeleceng.2017.05.024

Yasin, M., Czuchry, A., Dorsch, J. & Small, M. (1999). In search of an optimal cost of quality: an integrated framework of operational efficiency and strategic effectiveness. Journal of Engineering and Technology Management, Vol 16 (2), p. 171-189. Retrieved 7.1.2024 from https://doi.org/10.1016/S0923-4748(99)00004-1

Zahra, S. A. (2021). *The Resource-Based View, Resourcefulness, and Resource Management in Startup Firms: A Proposed Research Agenda*. Journal of management, 47(7), 1841-1860. https://doi.org/10.1177/01492063211018505

Zhang, Q., Vonderembse, M. & Cao, M. (2006). *Achieving flexible manufacturing competence: The roles of advanced manufacturing technology and operations improvement practices*. International Journal of Operations & Production Management Vol. 26 No. 6 p. 580-599

Zheng, C., Qin, X., Eynard, B., Bai, J., Li, J., & Zhang, Y. (2019). *SME-oriented flexible design approach for robotic manufacturing systems*. Journal of manufacturing systems, 53, 62-74. https://doi.org/10.1016/j.jmsy.2019.09.010