Aalborg University Copenhagen

Operations & Management Engineering

Master Thesis Report

# Operating cost, business continuity and sustainability should be considered when determining a production location

May 26, 2021

AALBORG UNIVERSITY
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**Faculty of Engineering and Science**
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Operating cost, business continuity and sustainability should be considered when determining a production location

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# 1 Preface

This master thesis is written as the finalisation of the master's program Operations and Management Engineering at Aalborg University, Copenhagen. The thesis aims to support Danish production companies selling tangible products make a decision related to production location. More specifically, it helps them determine whether they should back, reshore or keep their production offshored. The thesis is written under the supervision of David Hansen from Aalborg University.

The research has given the researchers insight into current offshoring trends and what influences decision-making when evaluating a production location. Additionally, it has provided increased knowledge of the current challenges for Danish production companies selling tangible products.

The target audience of the research is people in academia or practitioners working in companies with offshored production. The audience can get a better understanding of the current challenges and trends within offshoring production. Finally, the audience should be able to evaluate companies' current production location situation and help them identify whether the company should backshore, reshore or keep production offshored.

Extending appreciation to David Hansen for his support and constructive feedback throughout the entire process. Additionally, a big thank you is given to all companies who contributed and provided the insights needed to answer the primary research question.

# 2 Abstract

The research presented within this report addresses the phenomenon of back and reshoring. More specifically, it investigates how Danish production companies can decide if they should bring their production back to Denmark or relocate currently offshored production. The three main elements investigated relating to production location are cost, business continuity and sustainability.

Offshoring is common practice among many global production companies looking to realise the benefits of lower labour cost and access to skilled labour in developing countries. In the more recent years the previously defined benefits are being questioned. This is due to increasing labour cost globally and a shift in focus from cost to other factors such as sustainability and exploiting advancements in technology. The shift in focus has sparked interest in the phenomenon of back and reshoring among companies with offshored production. Additionally, the COVID-19 pandemic has shown companies need a sustainable and resilient supply chain to ensure business continuity.

Through a systematic literature review and conducted interviews with Danish production companies the researchers have developed a conceptual framework. The framework aims to assist production companies in the process of deciding on a production location. The matrix-like model makes a quantitative evaluation and recommendation as to whether a company should backshore, reshore or keep their business offshored. The framework provides adequate flexibility to accommodate different product types or industries and is rigid enough to be effective.

The research concludes Danish production companies need to keep three main factors in mind when determining whether to back or reshore. These are operating cost, social and environmental sustainability, and business continuity which is evaluated through automation, infrastructure, supply chain resilience and political factors. The framework can be used to structure the evaluation process, where companies should assess for each determinant if they will benefit from either backshoring, reshoring or keeping the production offshored. Besides the implications for practitioners, this research fills a gap in current academic literature as current frameworks are either missing the sustainability element, lack the decision-making function or based solely on the literature.

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# 3 Glossary

**Offshoring:** The practice of moving production overseas. Offshoring is defined as the process of obtaining products and services from operations based outside the home country, but with the company still owning the assets.

**Reshoring:** The practice of relocating an overseas production to another overseas location.

**Backshoring:** The practice of moving an overseas production back to the companies country of origin.

**Small and medium-sized enterprises (SMEs):** Companies with less than 250 employees and less than 375mDKK annual turnover (€50m, converted the 26 of May 2021) (European Commission, 2021).

**Large enterprises:** Companies with over than 250 employees and over than 375mDKK annual turnover (€50m, converted the 26 of May 2021).

**Infrastructure:** The access to skilled labour, necessary technologies to drive a specific process and elements required to facilitate transportation of goods, communication and other business matters.

**Environmental sustainability:** Relates to making responsible decisions which will reduce your business' negative impact on the environment. Initiatives try to solve local and global environmental issues such as climate change, use of renewable energy, soil erosion, soil quality, water management and air and water pollution. (Ghosh & Debnath, 2019)

**Social sustainability:** A measure of the wellbeing of humans. It includes all elements with a direct impact on human wellbeing, such as standards of living, working conditions, population growth, human health (Mohamed & Paleologos, 2021).

**Operating cost:** All costs related to producing a company's goods or services, including elements such as rent of production facilities, cost of labour, maintenance expenses, raw materials, freight and additional overhead costs (Murphy, 2021; Dictionary, n.d).

**Political stability:** A stable society with limited interruption of a company's business by the government or other institutions.

**Protectionism:** Economic policy restricting imports from other countries through e.g. import tariffs and import quotas.

**Policy incentives:** Introduction of policies that help attract or retain business, e.g. tax benefits, financial support.

**Business Continuity:** The process of creating systems of prevention and recovery to deal with potential threats to a company (Tsiolias, Keramydas, Vlachos, & Iakovou, 2016).

**Supply Chain Resilience:** The ability to return to operations as soon as possible after a disruption (Anukoonwattaka & Mikic, 2020).

# 4 Introduction

Offshoring is defined as the process of obtaining products and services from operations based outside the home country, but with the company still owning the assets. Slack, Brandon-Jones, and Johnston (2016) present the term offshoring and how it is different from outsourcing, based on ownership and location of the production. In *Figure 1*, offshoring is presented as offshore operations.

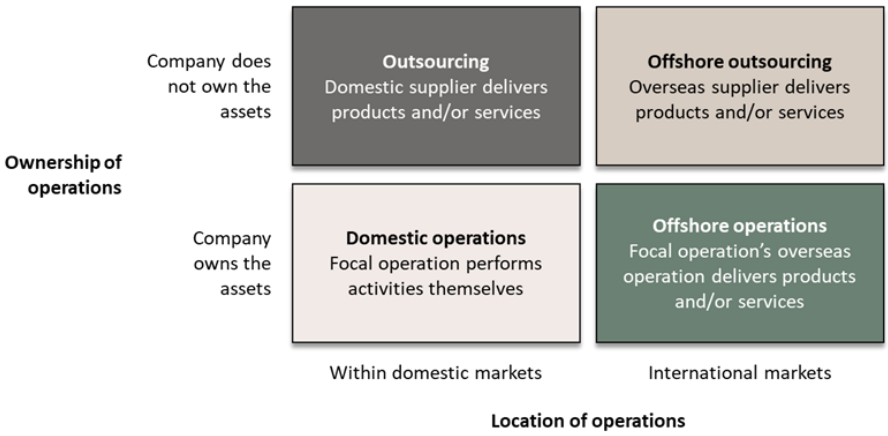


*Figure 1: Offshoring and outsourcing matrix, inspired by Slack et al. (2016, p.164)*

Offshoring has for the last decades been common practice among many global production companies looking to realise the benefits of lower labour cost and access to skilled manual labour in developing countries (Whitaker, Fornell, & Krishnan, 2006). The offshoring structure has typically been part of cost-cutting strategies of moving production from high to low-cost economies. The main purpose of this was to gather the production in one place to utilise economies of scale and stay competitive. During these times companies focused mainly on cost optimisation to ensure business continuity through low labour cost and low inventory levels (Lewin & Peeters, 2006; Farrell, 2005).

In the last decade, the macro environment has changed, with the introduction of the 4th industrial revolution, also known as Industry 4.0, and the establishment of the United Nation's (UN) sustainable development goals. Industry 4.0 moves towards digitisation through the use of big data and analytical platforms. Industry 4.0 also introduced smart factories, which utilise information and communication technology to generate more transparent supply chains, along with increasing the automation level of production lines through the use of robotics. (Moore, Mike, 2019)

The establishment of the UN's sustainability goals increased the awareness and focus of sustainability both among politicians and customers. Sustainability is getting more attention every year but according to Orzes and Sarkis (2019) research addressing the link between sustainability, supply chain reconfiguration and reshoring is still rather scarce in current academic literature. Di Stefano and Fratocchi (2019) claims a lack of attention is given to the research of the possible impact sustainability has on the production location decision-making.

Labour cost globally has increased significantly, and researchers claim offshoring carries greater hidden costs than previously anticipated, making it increasingly unattractive (Dachs, Kinkel, Jager, & Palcic, 2019). Simultaneously, production companies see a shift in focus from cost saving to other factors such as sustainability and exploiting advancements in technology when deciding on a production location. The cost of technology has previously limited the possibilities of full exploitation for production companies. With the cost decreasing rapidly, it is possible to automate production for a more reasonable price, bringing new opportunities not seen in developing countries with limited access to the same automation opportunities. (Dachs, Kinkel, & Jäger, 2019)

In the more recent years, changes in companies' focus beyond cost saving have created a phenomenon of bringing production activities from countries abroad back domestically or to another country. This is called backshoring and reshoring respectively. The terms gained attention in policy discussions and academic research in recent years (Bals, Daum, & Tate, 2015). Research by Lampón and González-Benito (2020) showed a company backshoring to their home country could realise benefits such as greater optimisation opportunities in terms of operational efficiency. Johansson and Olhager (2018b) states companies primarily reshore their production with hopes of achieving higher quality, flexibility and access to innovation opportunities, skills and knowledge.

During the COVID-19 pandemic and the subsequent lockdowns due to reliance on offshored production, many companies experienced dramatic exposure to supply chain disruptions (Strange, 2020). Supply chain management literature addresses the risk of global supply chains, and the pandemic has exemplified how important it is to have a resilient supply chain mitigating this risk. According to The Economist Intelligence Unit (2020), supply chain professionals need to emphasise risk-related practices and the increasing pressure for more sustainable and resilient business models. However, it is difficult to believe these professionals could simply stop focusing solely on efficiency and growth (The Economist Intelligence Unit, 2020). On a political level, the pandemic has also unveiled the lack of self-sufficiency for needed products, e.g. personal protective equipment for hospital personnel in many countries (Barbieri et al., 2020). The identified benefits of reshoring have led to a discussion among companies who adopted a cost-cutting strategy and offshored their production regarding the previously defined benefits. These benefits are now, to some degree being questioned (Bals et al., 2015). However, despite reshoring and backshoring being a trending topic and benefits being demonstrated, it is still to this day rather uncommon to relocate ones production (Dachs, Kinkel, & Jäger, 2019).

## 4.1 Problem statement

The preliminary findings show back and reshoring of production can bring many benefits to companies with production currently located in developing countries. However, it is rather uncommon to relocate offshored production raises questions as to why companies are deciding to keep their production setup as is. The purpose of this research is to get an understanding of how companies evaluate the attractiveness of a location and support them in the decision-making process. It is desirable to discover what is currently causing companies to stay offshored, how production companies evaluate the different location opportunities and ease this decision-making process. It will also be investigated whether the factors identified in the preliminary research affect the decision-making process as significantly as indicated. The research is aimed at Danish production companies selling a tangible product and will take the elements of cost, business continuity and sustainability into consideration.

### Primary research question

Based on the findings from preliminary research, the primary research question to answer is presented:

*How can Danish production companies selling tangible products determine whether they should back or reshore their production, based on cost, sustainability and business continuity?*

### Sub questions

In addition to the primary research question presented, three sub questions are defined to support the research:

**Q1:** What are the current back and reshoring practices of Danish production companies selling tangible products?

**Q2:** What are common back and reshoring trends and challenges for Danish production companies selling tangible products?

**Q3:** What should Danish production companies selling tangible products keep in mind when setting up their back and/or reshoring practices in the future?

## 4.2 Structure of the report

The report will follow the structure illustrated in *Figure 2*.

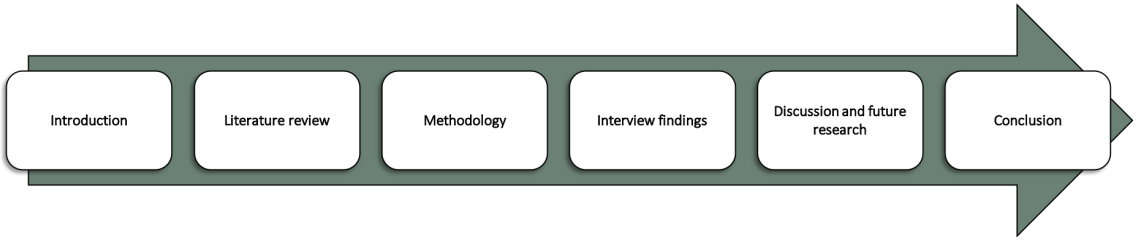


*Figure 2: Structure of the report*

After having introduced the current situation and topic for the research in this Chapter, the next Chapter presents results from an extensive, systematic literature review on the main topic of the report, considering a total of 79 papers. The results create the theoretical foundation for the research and identify gaps within previous and current academic literature. The findings also support the development of three hypotheses to be accepted or rejected through further investigation.

In *Chapter 6, Methodology*, will cover the methodological approach and strategic choices made. Additionally, it introduces the tools and data collection methods used throughout the research. The results from the conducted interviews are then presented in *Chapter 7, Interview findings*, and used to accept or reject the previously developed hypotheses.

*Chapter 8, Discussion,* will consolidate the findings and evaluate them concerning each other to enable the development of a conceptual framework. Additionally, future research opportunities are discussed. Finally, *Chapter 9, Conclusion*, presents the final conclusion and answer to the primary research question.

# 5 Literature review

The following chapter will present the findings from a systematic literature review carried out by the researchers. During the literature selection process illustrated in *Figure 3*, 42 out of 79 considered papers were deemed relevant, and the findings were split into the three areas to investigate further; cost, business continuity and sustainability. The areas were selected with the main topic and problem statement in mind, and to deep-dive into the factors and uncover details as to how they may affect offshoring decisions in companies today. As part of the review, the selected areas were also broken down into additional sub-topics discovered to have an impact on the decision-making, including supply chain disruptions, political factors and technological advancement. Lastly, at the end of the review, common trends of back and reshoring are presented, as well as an evaluation of existing frameworks where their strengths, weaknesses and potential gaps to fill during the research are identified. The findings will eventually be used to support the researchers in the development of a conceptual framework easing the decision-making process according to the papers and findings from the conducted interviews.

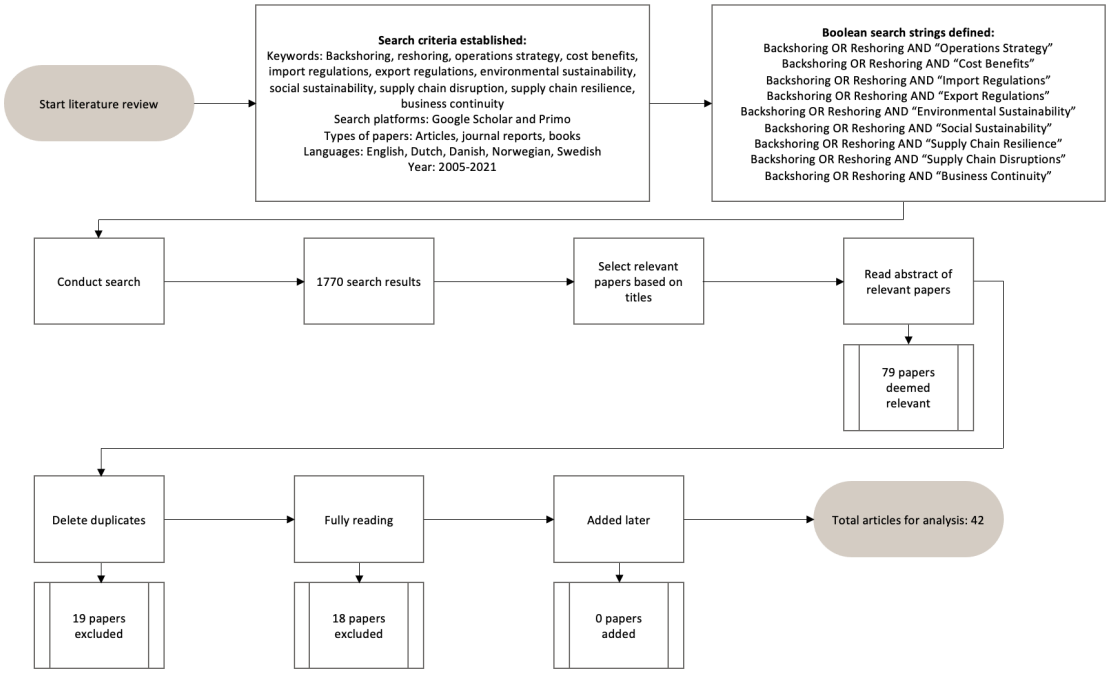


*Figure 3: Literature selection process*

*Table 1* displays a general overview of the factors and related keywords. The column "Papers", exhibits the number of times a factor has been mentioned among the total reviewed papers, thereby indirectly indicating topics of importance. The papers may be repeatedly counted should they cover more than one of the topics, and the total number may thereby exceed the total number of papers reviewed.

*Table 1: Key findings from the literature review*

| Factor | Papers | Keywords |
|---|---|---|
| **Cost** | 13 | Developed vs developing countries, deprioritisation of cost, total cost, low-cost and skilled labour, technology, misjudged offshoring-decision, hidden costs |
| **Business continuity** | 22 | COVID-19, political factors, technological advancement, supply chain resilience (see factors mentioned below) |
| COVID-19 | 5 | Longer lead times, increase trade cost, trade restrictions |
| Political factors | 5 | Protectionism, policy incentives |
| Technological advancement | 5 | Industry 4.0, e.g. artificial intelligence, robotics, big data |
| Supply chain resilience | 7 | Supplier network, long-term relationships, supply chain visibility, market proximity |
| **Sustainability** | 6 | Environmental and social sustainability, UN's sustainable development goals, triple bottom line, complexity, footprint |
| **Common reshoring and backshoring trends** | 14 | The "made in" effect, large versus small enterprises |
| **Existing frameworks** | 4 | Sustainability factor and decision-making elements missing |

## 5.1 Cost

Cost concerning back and/or reshoring of production relates to a variety of elements, including total cost, costs of reconstruction, transportation, management, exchange rates and wages in the respective production country (Soroka, 2016; Srai & Ané, 2016; Stentoft, Mikkelsen, Jensen, & Rajkumar, 2018). It is evident when looking into the reviewed papers cost is the one of the factors with the largest impact on the decision-making process related to offshoring and reshoring, mentioned by 13 of the total 42 reviewed papers (Zhai, Sun, & Zhang, 2016; Soroka, 2016).

### 5.1.1 Rising labour cost is leading to reconsidering production location

It is found most companies have up until now offshored their production to developing countries mainly to gain access to the combination of low-cost yet skilled labour which is tough to find in the home country (Falkenstrand & Lundström, 2017; Rashid & Barnes, 2017; Gurtu, Saxena, & Sah, 2019; Zhai et al., 2016). As part of research conducted by Falkenstrand and Lundström (2017), it was found in developing countries, labour cost made up 14 per cent of the total production cost, whereas in developed countries could make up as much as 50 per cent. This proves the major cost-saving possibilities of moving the production abroad.

In recent time, labour cost has been seen to increase rapidly in developing countries, and as it is expected to keep rising in the coming years, it might no longer bring the same benefits to organisations it did previously (Cohen et al., 2016; Falkenstrand & Lundström, 2017). The rapid increase in labour cost is leading companies to reconsider their current production location, which a study by Presley, Meade, and Sarkis (2016) showed as the primary driver for relocation for about

60 per cent of companies in the Eurozone. Although cost seems to be seen as the main driver of the decision-making process related to production location by most companies, some researchers also see different reshoring benefits surpassing the previously realised cost savings. Cohen et al. (2016)'s research shows some companies rather prioritise proximity to the market and suppliers, innovation opportunities through the development of technologies, and avoiding detrimental governmental policies by being located in countries with low risk.

### 5.1.2 Labour cost is not the cost in focus anymore

Among the rising drivers for reshoring, the decrease in the cost of technologies seems to repeat itself in the literature. It was found companies reshoring with this in mind can realise major cost savings linked to the production by making use of the recently emerging technologies and decreasing the cost of automation in more developed countries (Enderwick & Buckley, 2020; Falkenstrand & Lundström, 2017; Gurtu et al., 2019; Presley et al., 2016). Other researchers, including Bauman (2020), Piatanesi and Arauzo-Carod (2019) and Rasaei and Manoharan (2020) reported reshoring is often a result of previously having misjudged the offshoring decision, i.e., having miscalculated the total cost, including the cost of production and labour, when it was offshored.

Regardless of any organisation's cost-related reason to reshore production, many factors must be considered. The total cost of the activity is one of these things, where all underlying costs must be kept in mind, and not only labour cost (Stentoft et al., 2018). Moving the production between countries is also a costly process, and the bigger the company, the higher the cost will be. It entails a shift of the entire supply chain, which can be disturbing for the company and lead to higher costs than first estimated. The moving period may additionally cause uncertainties for the production itself, which is likely to add to the total cost of the relocation. (Falkenstrand & Lundström, 2017)

**Operating cost is the most important factor**

The above sections identified although there is a shift in priority for some production companies, the cost is still the most important factor for deciding on the production location for the majority of companies. However, companies should not only focus on labour cost but the total operating cost of producing a product must be considered.

## 5.2 Business continuity

Slack et al. (2016) define business continuity as "the procedures adopted by businesses to mitigate and recover from the effects of major failures". In other words, it is the advanced planning and preparation conducted to ensure an organisation can operate its business during emergency events. Examples of these events are pandemics, business crises, natural disasters, terrorism, or any event resulting in disruption of current business operations (Ellram, Tate, & Petersen, 2013). During the literature review, three potential macro factors impacting business continuity were identified: the COVID-19 pandemic, political factors, and technological advancement. These factors will in the following sections be broken down and investigated further to get an understanding of related trends and arguments used to reconsider the location of production.

### 5.2.1 COVID-19 resulted in a major supply chain disruption

After the pandemic hit the world in 2019, various links of companies' supply chains were affected. The main supply chain impacts due to COVID-19 are illustrated in *Figure 4*. Firstly, companies experienced longer lead times due to the supply of parts and components being cut off (Anukoonwattaka & Mikic, 2020; Magableh, 2021; Cai & Luo, 2020). Secondly, the researchers have seen an increase in trade cost due to the introduction of measurements limiting the domestic and international shipments, resulting in prolonged delays at borders and ports (Anukoonwattaka & Mikic, 2020; Magableh, 2021; Bacchetta et al., 2021). Lastly, companies experienced a continuous increase in trade restrictions as more than 21 countries introduced export restrictions of necessary goods such as medical supplies, equipment and food products (Anukoonwattaka & Mikic, 2020; Magableh, 2021; Bauman, 2020).

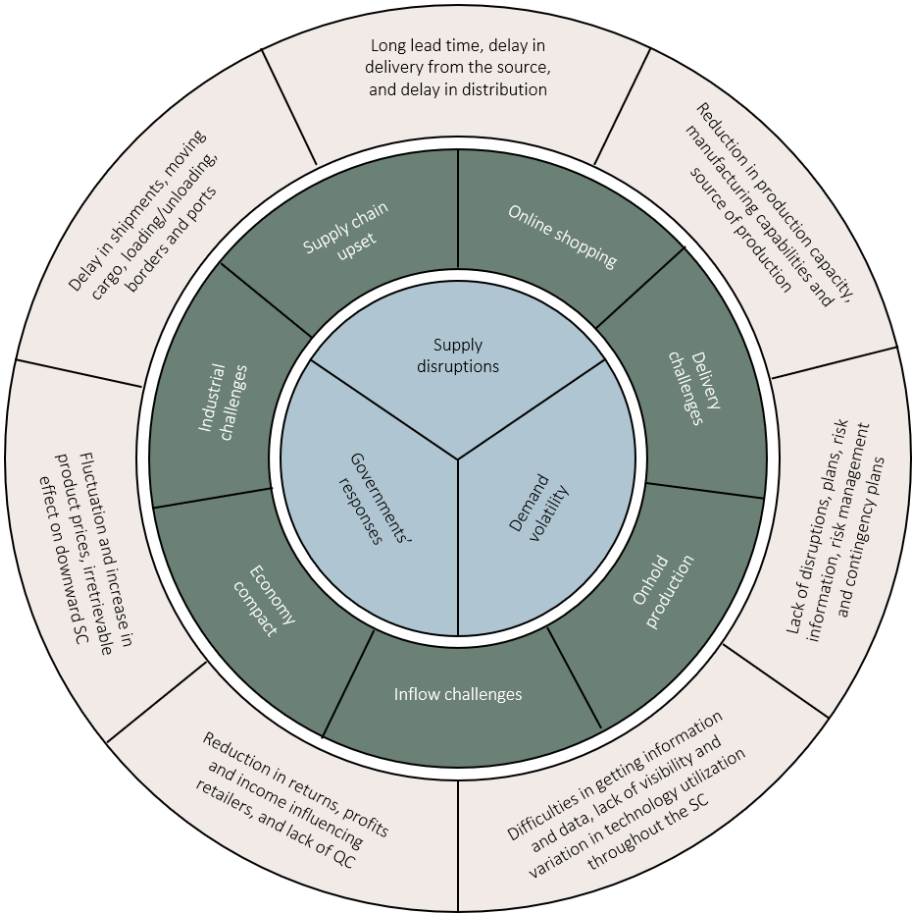


*Figure 4: Supply chain impacts due to COVID-19, inspired by Magableh (2021)*

Most companies realised a contingency plan was non-existing when the pandemic impacted the global supply chain. The strategy at the time focused on cost optimisation, which includes low inventory levels, single sourcing supplier strategy and no diversification of production sites. This made supply chains more vulnerable in a situation with high uncertainty, such as the pandemic. The result of the pandemic increased companies' understanding of the importance of contingency planning to have a more resilient supply chain. (Magableh, 2021)

### 5.2.2 Political factors are influencing the production location

Changes in political factors can impact a company's decision-making process related to production location in numerous ways. Cai and Luo (2020) argue when there is a rise in protectionism, combined with an increase in cost in less developed countries, reshoring activities will increase. This can be seen in recent policy changes, where the increased attractiveness of reshoring has led to a trend of protectionism among developed countries (Kalaitzi et al., 2020; Enderwick & Buckley, 2020; Anukoonwattaka & Mikic, 2020). Some examples highlighted in literature are the European Union's duty on import cars from the United States (US), US import tariffs of steel and aluminium and the US introducing tariffs on goods coming from China (Enderwick & Buckley, 2020; Kalaitzi et al., 2020).

The literature also identifies an increasing number of countries introducing policy incentives for companies to relocate production to their home countries, i.e. backshore the production (Enderwick & Buckley, 2020; Piatanesi & Arauzo-Carod, 2019; Anukoonwattaka & Mikic, 2020). Both Japan and the US introduced incentives to make companies backshore their production to bring back jobs

domestically. These incentives decrease unemployment and can drive economic growth nationally. Japan announced they had set aside more than two billion US dollars to assist firms in shifting out of China and Larry Kudlow. Similarly, the National Economic Council Director from the US' White House called for authorities to pay the costs for American firms to move operations home from China (Enderwick & Buckley, 2020).

### 5.2.3 Technological advancement is impacting production location

Technologies are constantly developing, but since the introduction of industry 4.0 in 2011, most of the technologies have been matured and are beginning to be more widely used across different industries. The main technologies contributing to the restructuring of supply chains are additive manufacturing, robotics, big data, digital twins and artificial intelligence (AI) (Chowdhury, Paul, Kaisar, & Moktadir, 2021). Introducing industry 4.0 technologies contribute to ensuring higher quality standards, ability to produce customer-specific products and compensate for high or rising labour costs in the production (Hilletofth, Eriksson, Tate, & Kinkel, 2019). Technology is becoming one of the main drivers of reshoring since the cost is decreasing concurrently with new advanced technologies being developed, replacing and automating manual labour. (Falkenstrand & Lundström, 2017; Kalaitzi et al., 2020; Rasaei & Manoharan, 2020).

The literature also argues by introducing more advanced technology to manufacturing, access to skilled labour and new technology will be required, which can be found in more developed countries (Rasaei & Manoharan, 2020). Thus, it will be more attractive to reshore the production to more developed countries. Adidas Sportswear is a great example of an industry leader which has started this, by bringing parts of their shoe manufacturing back to Germany from China, through the introduction of "intelligent robotic technology" (Kalaitzi et al., 2020).

### 5.2.4 Mitigating risk through supply chain resilience

The literature identified different initiatives companies can use to decrease the risk of future supply chain disruption. One example of supply chain disruption is what companies experienced during the COVID-19 pandemic.

A recommendation is made to avoid a single sourcing strategy, as this makes a supply chain more vulnerable to disruption events. Anukoonwattaka and Mikic (2020) and Tsiolias et al. (2016) recommend creating a supplier network with multiple suppliers, thus avoiding the single-sourcing strategy. Anukoonwattaka and Mikic (2020) and Tsiolias et al. (2016) also highlight the importance of building long-term and stable relationships with the suppliers in the supplier network, as this secures the supplies of the necessary materials even in disruption events. Creating visibility through the supplier network can help companies identify the potential risk and weak links within the supply chains, especially under disruption events. The literature recommends the companies utilise technologies such as 5G, big data and artificial intelligence to increase the supply chain visibility and build closer relationships with preferred suppliers (Cai & Luo, 2020; Magableh, 2021).

Chowdhury et al. (2021) and Quak (2020) argue for bringing the production closer to the main customer market will reduce the vulnerability of the supplier network. Additionally, they also identified near or reshoring production closer to the markets as a key element of business continuity in a global supply chain. However, to be able to do that Falkenstrand and Lundström (2017) argues it will require a higher level of automation and innovation within the production facilities.

#### Main challengers of business continuity

The reviewed papers demonstrated drivers and challenges of continuity of a business. Most papers highlight the main elements challenging business continuity to be the resilience of supply chains, complexity of advancements in technology and large, unexpected changes in political factors.

## 5.3 Sustainability

From a sustainability perspective, the reviewed papers bring varying insights. It is found environmental costs are significantly higher in developed countries than developing countries. This is due to stricter environmental laws, and many organisations up until recently have placed their production in developing countries to realise cost savings. The prioritisation has been with cost over the environmental impact, which consequently has led to a negative impact on the environment. (Gurtu et al., 2019; Sequeira & Hilletofth, 2019)

In the more recent years, the global focus on both environmental and social sustainability has increased tremendously, both from a consumer and organisational perspective. The introduction of the UN's sustainable development goals in 2015 brought attention to the rising environmental issues in the world, encouraging organisations to do better, and consumers to make better choices. Related to this, Arrigo (2020) mentions companies continue to see cost as a primary focus when determining their production location, but now also reflect a greater perspective on sustainability when deciding on a location. Multiple papers similarly identified making sustainable choices may add to the total costs and complexity of the decision-making related to production location. However, the increased global sustainability focus has affected organisations worldwide to make more sustainable considerations regarding their production and total environmental footprint, and to focus on the Triple Bottom Line approach, which involves the economical, environmental and social dimensions of sustainability. (Arrigo, 2020; Presley et al., 2016; Falkenstrand & Lundström, 2017)

A point made by Ashby (2016) which should be kept in mind is the risk involved in moving production simply for the sake of sustainability. It is found the reshoring process itself may leave a larger impact on the environment than keeping the business as is. Reshoring from developing countries can largely impact local communities in these countries, something which should be considered. On a similar note, Ashby (2016) also discovered offshoring to developing countries to possibly harm both social and environmental sustainability, due to lack of supply chain visibility and large differences in practices and standards between countries. Off, back and reshoring for the sake of sustainability should therefore always be done with consideration and awareness of the total impact it may have.

**Sustainability increasing in importance**

From the literature, it is identified sustainability is currently not the top priority of organisations relocating their production. However, a shift in its importance is noticed as more companies seem to invest in sustainability efforts particularly after the introduction of the UN's sustainable development goals. Especially sustainability concerning a production location has seen increased awareness.

## 5.4 Common reshoring and backshoring trends

The world investment report from 2020 predicts reshoring, diversification and regionalisation will be the main drivers of restructuring global supply chains in the coming years (Miroudot, 2020). In the cost section above it was identified labour cost is rising in developing countries, which decreases the labour cost gap between the developed and developing world. Zhai et al. (2016) and Bacchetta et al. (2021) identified three main reasons for reshoring production facilities, which are quality, technology and lead time. The attractiveness of bringing production closer to the market is increasing, as this reduces the lead time significantly and improves the business continuity of the companies' production (Johansson, Olhager, Heikkilä, & Stentoft, 2019; Johansson & Olhager, 2018a; Sequeira & Hilletofth, 2019; Cai & Luo, 2020; Zhai et al., 2016). The advancement in technology makes automation of production simpler and less expensive along with increasing the quality standards (Johansson et al., 2019). Engström, Sollander, Hilletofth, and Eriksson (2018) and Rasaei and Manoharan (2020) argue quality issues are one of the challenges with offshoring production to developing countries, and thus by bringing the production back to developed countries, the quality of the product may increase. On another note, Enderwick and Buckley (2020) highlight different factors pro-global production, e.g. free and non-discriminatory trading environment, lower tariffs,

efficient market processes and a relatively stable production environment. Additionally, efficient infrastructure both through logistics, digital accessibility and technologies to coordinate global supply chains are mentioned.

**The "made in" effect motivates back and reshoring**
Another motivation for back and reshoring production is the "made in effect", i.e. the value any product may gain from being produced in a specific country rather than abroad. This driver is believed to positively affect the customers' willingness to purchase a product (Merino, Di Stefano, & Fratocchi, 2021; Rasaei & Manoharan, 2020). However, during an investigation by Rasaei and Manoharan (2020) it was found the made-in effect largely depends on the type of product and industry, as different product groups cause different expectations among consumers (Rasaei & Manoharan, 2020). Additionally, it was identified it enhanced the public opinion on certain products, and some policies have been introduced to increase companies' competitiveness in terms of taxation, innovation and quality certificates (Piatanesi & Arauzo-Carod, 2019).

**No major differences between large and small enterprises**
The literature does not identify any differences between large and small enterprises when companies decide to back or reshore their production. The factors influencing this decision are based on the characteristics of companies. This includes but is not limited to whether they have a niche segment or product, require to be close to the market and produce high quality products. (Cohen et al., 2016; Waehrens, Slepniov, & Johansen, 2015; Merino et al., 2021)

## 5.5 Existing frameworks

With the aim of this research being to develop a conceptual framework to support Danish production companies in the decision-making process related to production location, similar existing frameworks have been analysed. In doing this, the researchers would be able to identify the frameworks' strengths and weaknesses, and thereby learn about possible gaps to be filled by this research.

Research by Presley et al. (2016) presents a case study demonstrating the decision-making process related to reshoring using a multitude of offshoring theories. The framework itself is based on the Strategic Sourcing Evaluation Methodology framework as illustrated in *Figure 5*, and in his research, Presley et al. (2016) aim to support organisations in the strategic decision-making, evaluation and justification of the decisions related to reshoring.

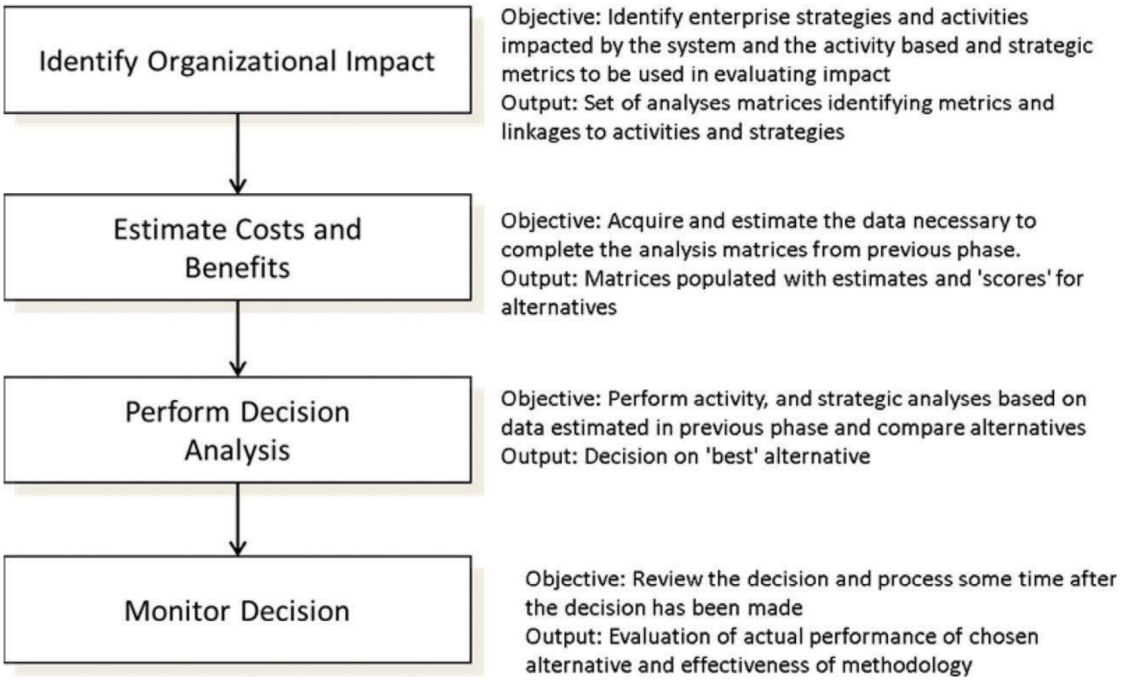


*Figure 5: Strategic Sourcing Evaluation Methodology (Presley et al., 2016)*

The framework guides the user through the steps of (1) Identifying organisational impact, (2) Estimating cost and benefits, (3) Performing a decision analysis and (4) Monitoring the decision made. On a high level, the framework presents the objective and the expected output of each step. However, the exact approach as to how to reach these objectives is not specified, in a way leaving it up to the user to identify the optimal approach. The case study presents the use of a literature review and theories such as Dunning's Eclectic Paradigm (the OLI model) and Research-based view (RBV) to reach the desired output in the different steps. As can be seen, the framework is backed up by many theories. However, gaps are found in how the models and theories inspiring the framework are designed to relate to offshoring specifically rather than back and reshoring. Moreover, Presley et al. (2016) do not investigate organisations' current practices and theories related to reshoring, thereby relying solely on literature being a true representation of a company's practices.

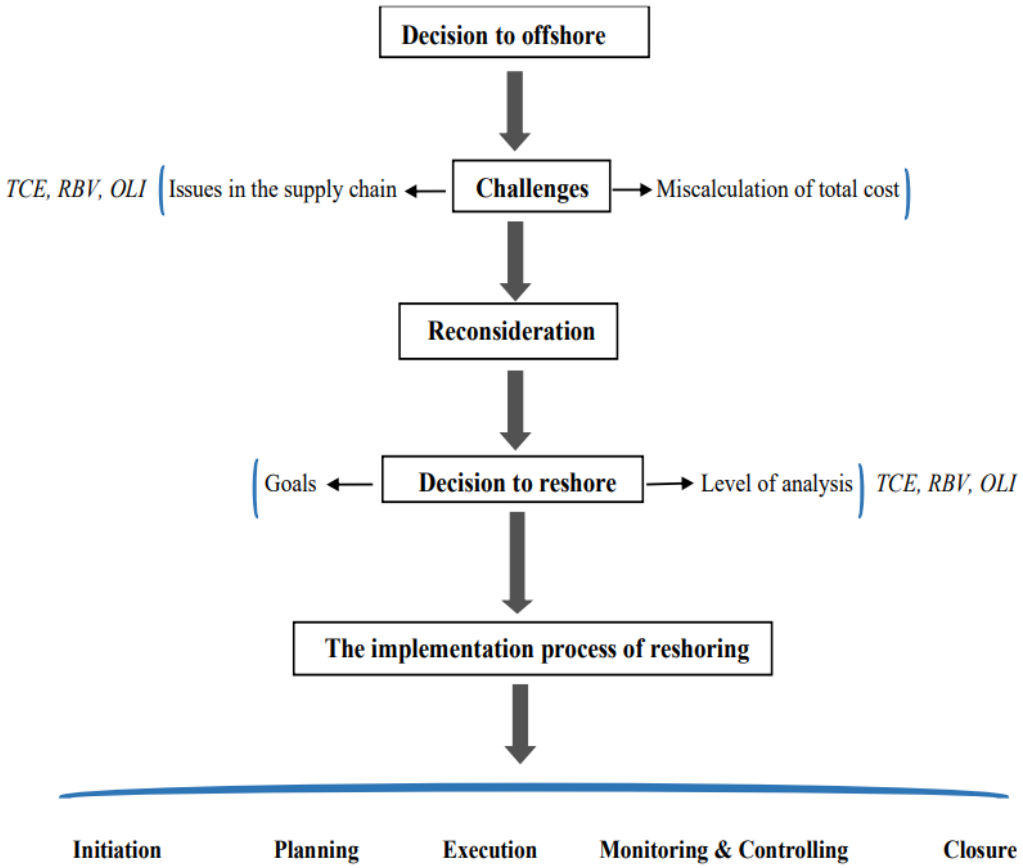


*Figure 6: Framework 1 (Rasaei & Manoharan, 2020)*

Similarly to the previously presented framework, Rasaei and Manoharan (2020) consider some of the same theories and elements in their framework as presented in *Figure 6*. They present a general framework highlighting the steps involved in the process of reshoring. Alike Presley et al. (2016) they do not deep-dive into current events and controversial issues which may or may not affect the decision-making process, apart from mentioning the cost, issue and goals aspects as necessary considerations, as seen in *Figure 5*. This framework is also solely based on literature and theories and assumes reshoring is always done as a correction of a failed offshoring decision made in the past.

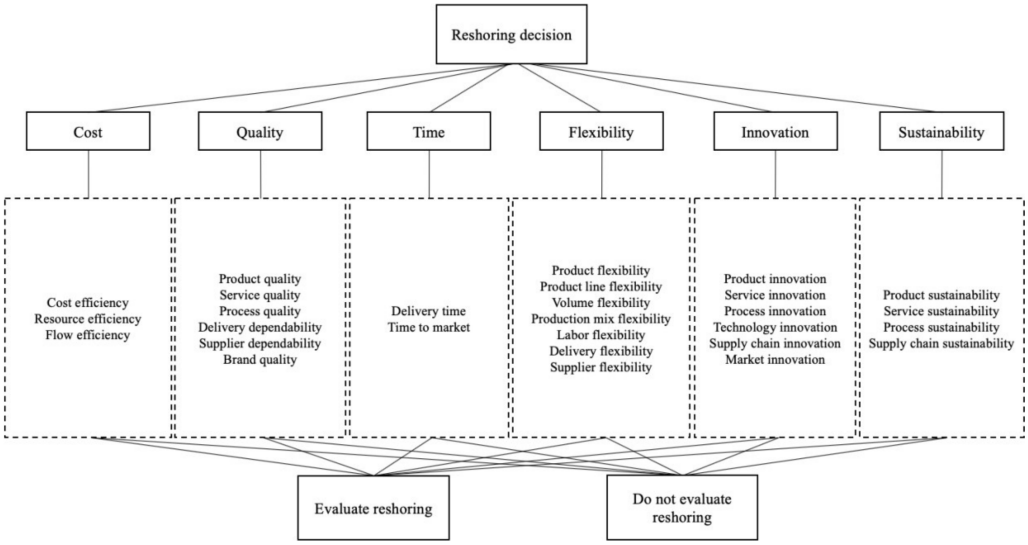


*Figure 7: Framework 2 (Sequeira & Hilletofth, 2019)*

Sequeira and Hilletofth (2019) and McIvor and Bals (2021) present frameworks which come closest to the aim of this report. Sequeira and Hilletofth (2019) present the hierarchy of reshoring decision-making in *Figure 7*, as well as an advanced decision-making matrix. The matrix considers the elements described in the hierarchy which may or may not affect the decision-making process. Sequeira and Hilletofth (2019) seem to consider many important elements while enabling the adoption of a specific company's practices. However, a gap is found in the lack of user-friendliness of the tool and the researchers not evaluating the effect of the sub-elements of the framework. Moreover, like the previously introduced frameworks, its development and selected factors are based solely on information found in theory.

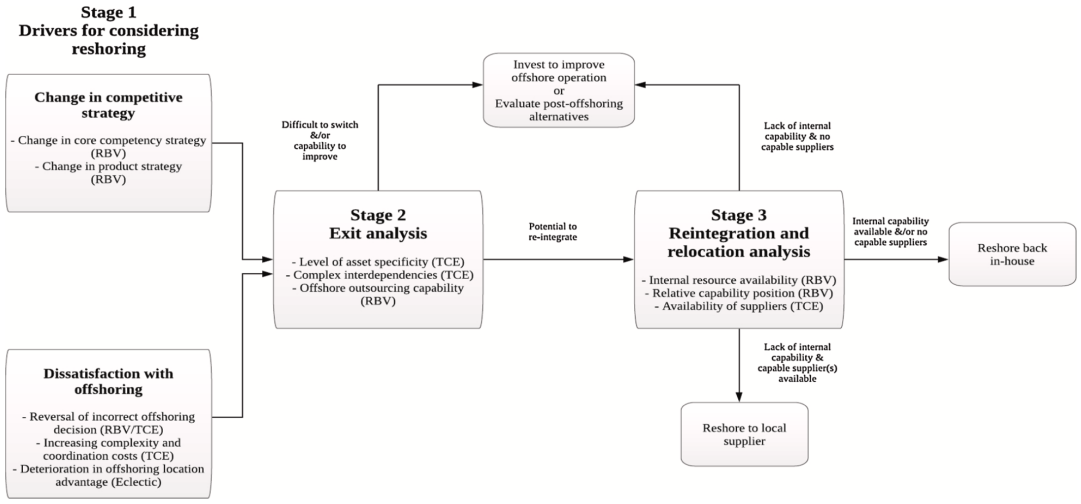


*Figure 8: Framework 3 (McIvor & Bals, 2021)*

The second similar framework by McIvor and Bals (2021), which presents a simple yet specific process, and highlights elements to consider in the process. As can be seen in *Figure 8*, the framework displays a process map involving three stages and mentions the need to consider elements

such as overall strategy, complexity and coordination cost, and supplier and resource availability. It covers a lot of elements as also identified in this literature review, but does however disregard elements such as sustainability, technology and political factors as found to be some of the most important drivers from this review.

## 5.6 Sub conclusion

The reviewed papers show there are many elements which should be considered when making the decision to back or reshore production. It is found relocating an organisations' production facilities is a time-consuming, costly and overall complex process which requires the involvement of many resources both from inside and outside the organisation. It tends to be done as a result of either a previously misjudged strategic decision, changes in the external environment, or changes in the internal needs of the organisation. The decision is either deemed necessary with no alternatives identified, or it is a choice made to enable further growth as better opportunities are seen at other production locations.

The literature highlights in recent time, elements such as social and environmental sustainability, business continuity and emerging political factors affect the decision making more than previously. However, it is also found overall, cost, and operating cost specifically, is the main driver of off-shoring, reshoring and backshoring. The emerging considerations come with the increase in labour cost, political challenges, the decrease in the cost of technology and access to the skilled labour in developed countries. Additionally, an increased global focus on sustainability in recent years brings requirements for organisations to be more environmentally and socially sustainable. This is due to both introductions of UN's sustainable development goals and consumers and clients, in general, being more critical to the quality and footprint of the products purchased.

From the frameworks analysed, it should be highlighted a gap was identified in the non-existence of a framework covering the overall decision-making process related to back and reshoring. Current events and controversial issues which may or may not affect the decision-making process of the present time were also missing. Finally, most existing frameworks are solely based on theory and literature and seem to lack a true representation of companies' practices.

All existing frameworks are not collectively exhaustive or only discuss the important elements to consider regarding a production location but do not help companies make the actual decision. The frameworks either miss to include the sustainability factor or do not consider the business context. These gaps within the literature are addressed within this research. To add to the literature and develop a conceptual framework acknowledging all important elements, the following hypotheses are defined:

**H1:** Operating cost is the most important factor determining the location of a production facility for Danish production companies.

**H2:** Danish production companies see supply chain resilience, political factors and technological advancement as the main challengers for business continuity when having offshored production.

**H3:** Environmental and social sustainability are incentivising Danish production companies to back or reshore their production.

The three hypotheses are used as a starting point for the following chapters. Within the next chapter, the methodology of the overall research is discussed, including a further elaboration on how the literature review is used and why it is conducted.

# 6 Methodology

This chapter will introduce the methodological approach taken by the researchers in the composition of this report. It presents the underlying philosophy, overall approach, methodological choices, and techniques and methods used throughout the report to reach a final recommendation.

## 6.1 Research approach

Within business and management, there are five major philosophies researchers must consider which are positivism, critical realism, interpretivism, postmodernism and pragmatism. The positivism philosophy relates the most to the philosophical assumptions of the researchers throughout this research. Positivism concerns the philosophical stance of the natural scientist and entails working with an observable social reality to produce generalisations (Gill & Johnson, 2010). The conceptual framework developed in this report is a generalisation of how Danish companies should approach back and reshoring. The research bases itself on observable facts through the conduction of interviews and the researchers are independent of the collected data. The former and the latter are both seen as typical positivistic philosophical considerations (Saunders, Lewis, & Thornhill, 2016). The research is deductive of nature as the theory is used as a starting point and determines the direction of the remainder of the research. Additionally, the research seeks to find causal relationships between several concepts which according to Saunders et al. (2016) is an important characteristic of deductive reasoning.

The research follows a qualitative design, in which existing theory is tested using qualitative procedures because of its deductive nature (Yin, 2014). More specifically, it is a mono-method qualitative study, meaning only one primary data collection technique is used (Saunders et al., 2016). Interviews are the primary data collection method within this research which will be elaborated on later in this chapter. Qualitative research is associated with a variety of strategies including single exploratory case study research which is the chosen strategy for this research. The case is the single phenomenon of back and reshoring, and the research seeks to explore and gain insights on this topic. The research questions are explorative as the questions ask about the "what" and "how" of the investigated phenomenon (Saunders et al., 2016).

## 6.2 Literature review framework

A systematic literature review is defined as an attempt to identify, appraise and synthesize all the empirical evidence that meets pre-specified eligibility criteria to answer a given research question (Piper, 2013). A literature review helps build an understanding and provide insight into previous research and emerging trends on a topic. Thereby, it can be used to conclude what is already known and what the current research should aim to cover (Saunders et al., 2016). The literature review is used to develop the theoretical foundation of the phenomenon of back and reshoring. The research gaps within the current academic literature will concurrently be identified. Lastly, reviewing the current academic research on the phenomenon will help structure the interview guide. The pre-structuring of the data collection will bring the risk of confirmation bias. Confirmation bias in this case is the occurrence where researchers try to find evidence to confirm their findings and therefore miss out on other important information. To limit confirmation bias, the literature review covers a broad spectrum of academic papers and other mitigating methods will be discussed later on. The following section will present the framework for the literature review conducted during this research, including the process for developing search strings and evaluating the literature's relevance.

### Literature selection process

The review follows a structured approach and pre-planned strategy for identifying existing, relevant literature as seen in *Figure* 9. As illustrated, the process may take place during the entirety of the research period, unless a saturation point is reached. An introductory search is thereby conducted, but alterations may be made, and additional literature may be added as the research progresses.

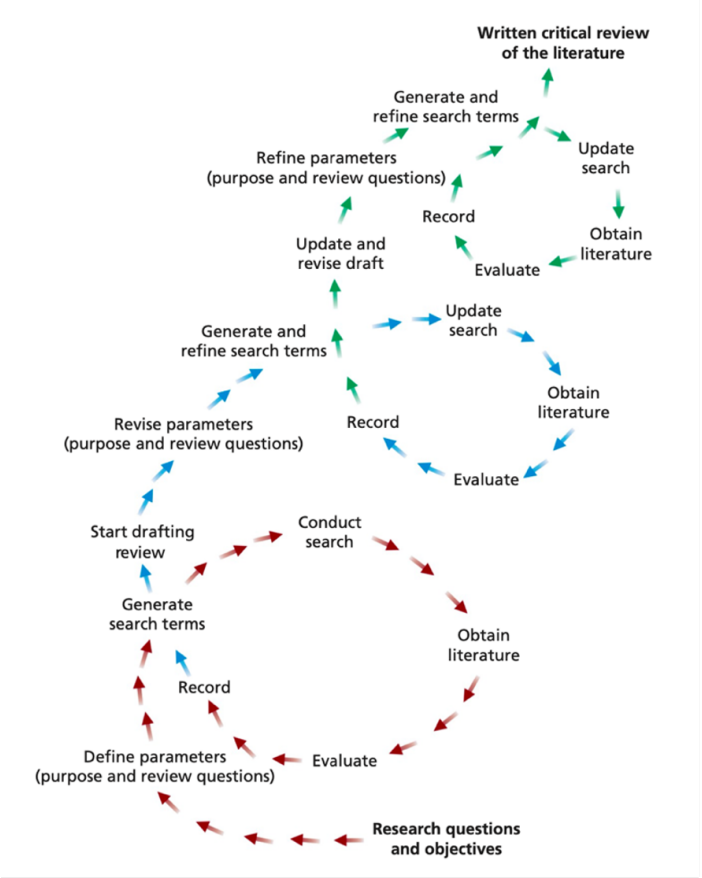


*Figure 9: Literature review selection process (Saunders et al., 2016)*

Before the introductory search for literature, a search strategy is developed. This process includes selecting the parameters of the search, the search terms and phrases to use, the appropriate databases and search engines, and the criteria for evaluating literature as relevant (Saunders et al., 2016). The main search word is set to be back or reshoring as this follows the main topic of the research. Additional search words are determined during a brainstorming session between the researchers based on the knowledge gathered from the preliminary research. The search strings are selected as presented in *Figure* 10 to cover a broad range of sub-topics and go into detail on the selected topic while potentially uncovering additional relevant information. The search engines used to uncover relevant literature are selected as ones where Boolean operators such as AND, OR and NOT are possible. This will allow limitation to the searches and ensure the validity of the findings made. The search engines which are used are Google Scholar and Primo (the Aalborg University library's search engine).

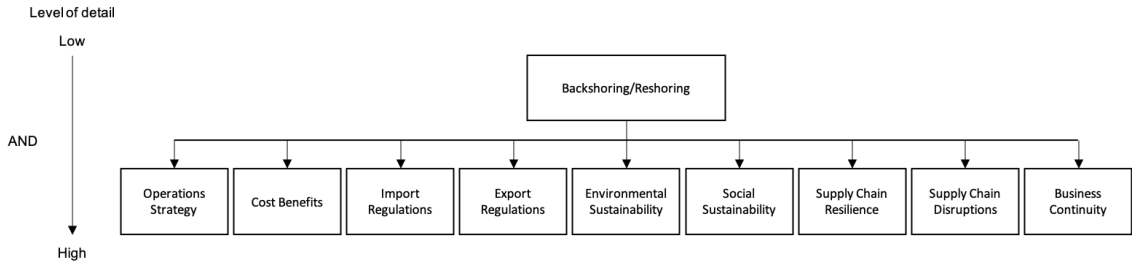


*Figure 10: Literature review search strings*

In addition to limiting the search words and search platforms, the literature itself is limited to literature written in English, Danish, Norwegian, Swedish or Dutch as it covers the spoken or understood languages of the researchers. Additionally, the time interval is set based on the preliminary research, limiting the search to literature published between 2005 and 2021 to uncover the transformation of the research on this topic over time. In terms of citations, no threshold on citations is set as it is desirable to also cover newer insights into the topic, and relatively new literature may not necessarily have a large number of citations. The process of literature selection is presented in *Figure 3* in *Chapter 5, Literature Review.*

Following the review of all papers deemed relevant, commonalities among the reviewed papers are identified. From the findings made, suitable hypotheses are developed, creating a starting point for the next steps of the research, i.e. the interviews and analysis of real-life situations from Danish production companies related to the topics.

## 6.3 Data collection

The primary data used throughout the case study is collected with interviews. To understand the current back and reshoring practices of Danish production companies, semi-structured interviews are conducted. This type of interview gives the interviewee the freedom to speak while ensuring certain topics are discussed. The interviewer has a pre-determined list of questions, known as an interview guide (Bell, Bryman, & Harley, 2019). The interview guide is developed based on the findings of the literature review, hypotheses derived and the research questions, and can be seen in *Appendix A*. The interviews were conducted online and lasted approximately one hour each.

The sample group of the companies interviewed is set to the top 50 largest Danish production companies selling a tangible product with their headquarters located in Denmark. The size of the company is based on annual turnover and a list by Laugesen (2020) is used to identify the top 50. These criteria are set to ensure the companies hold similarities in terms of the type of company and success and increases the likelihood of the data collected being comparable and possible to derive a conclusion from. Additionally, it is decided to aim for the inclusion of companies from different industries to enable a broader comparison and identification of differences across industries as well as the type of product produced.

A decision is made to disregard small to medium-sized enterprises (SMEs). This decision was made as a result of findings from the previously conducted literature review, where it was discovered the size of the company will not have an impact on the decision-making process related to offshoring, backshoring or reshoring. It was found what will impact the decision-making is the type of product the organisation produces (Cohen et al., 2016; Waehrens et al., 2015; Merino et al., 2021).

Following the definition of the sample group, representatives from the sample group were selected using identified criteria. The interviewees were required to work within the supply chain and/or operations area of the business. They would also need to hold knowledge about the production setup and offshoring activities of the company, and represent a senior level of the organisation. This was decided to ensure the interviewee held the necessary knowledge to answer the prepared

questions and give sufficient additional information about common practices within the company as well as the industry where needed. The interviewees were identified using LinkedIn and its people search function, which enabled the researchers to filter on company and title. Out of 72 contacted potential interviewees, 20 reported interest in the research topic, and 9 were interviewed. The information retrieved from the interviews is presented and analysed in *Chapter 7, Interview findings*. To limit bias among the interviewed professionals, an interview guide as presented in *Appendix A* is used during all interviews. The interviews included open-ended questions which allow the interviewees to give their perspectives and limit confirmation bias.

## 6.4 Analysis

To make sense of the rapidly emerging amount and complex data interviews generate, thematic analysis is applied. To determine the themes, a researcher has multiple methods e.g., looking for similarities and differences within or across data sets, find missing data or use theory related concepts (Bell et al., 2019). The conducted interviews are recorded and transcribed, and the transcripts are coded to identify patterns across the interviews. Coding is a mechanism for thinking about the meaning of your data and for reducing the vast amount of data collected (Bell et al., 2019). This technique also brings a quantifiable element into otherwise solely qualitative data (Bell et al., 2019). The transcripts are coded in four themes; operating cost, sustainability, business continuity, and other trends. The first three code themes are deducted from the hypotheses and thereby also the findings from the literature review. The theme of other trends includes topics specifically mentioned by interviewees to have an impact on the production location decision-making process. The other trends enable the researchers to limit a confirmation bias towards only finding information relating to the three hypotheses. As the goal of this research is to identify how companies can determine whether they should back or reshore their operations, the codes are only applied when the theme is discussed concerning production location.

Besides the implications for practitioners, this research aims to fill a gap in current academic literature as current frameworks are either missing the sustainability element, the decision-making function or is based solely on the literature.

# 7 Interview findings

In this chapter, the results of the conducted interviews are presented to identify if the stated hypotheses in *Chapter 5, Literature review* can be accepted or rejected. Nine interviews are conducted with Danish production companies producing a tangible product across different industries.

The coded text from the data collected during the interviews is analysed qualitatively and presented graphically with figures throughout this chapter. As mentioned in the *Chapter 6, Methodology* the transcripts are coded in four themes: operating cost, sustainability, business continuity and other trends. The overview of all codes applied can be found within the codebook placed in *Appendix B*, which provides a brief description of the codes and the number of occurrences.

Within the first section, a dashboard is presented to illustrate initial high-level findings. The next three sections evaluate the hypotheses and discuss the findings of the analysed interviews. The fifth section elaborates on the other trends identified. Finally, a sub-conclusion is given to consolidate the results.

## 7.1 The companies represent a range of industries

The dashboard in *Figure 11* and in an enlarged version in *Appendix C* provides an overview of initial findings from the interviews. The upper part shows which industries and what level of automation is represented, as well as where most interviewed companies have offshored their production to. The lower part specifies what the biggest customer markets are and shows if companies have production close to both their market and suppliers.

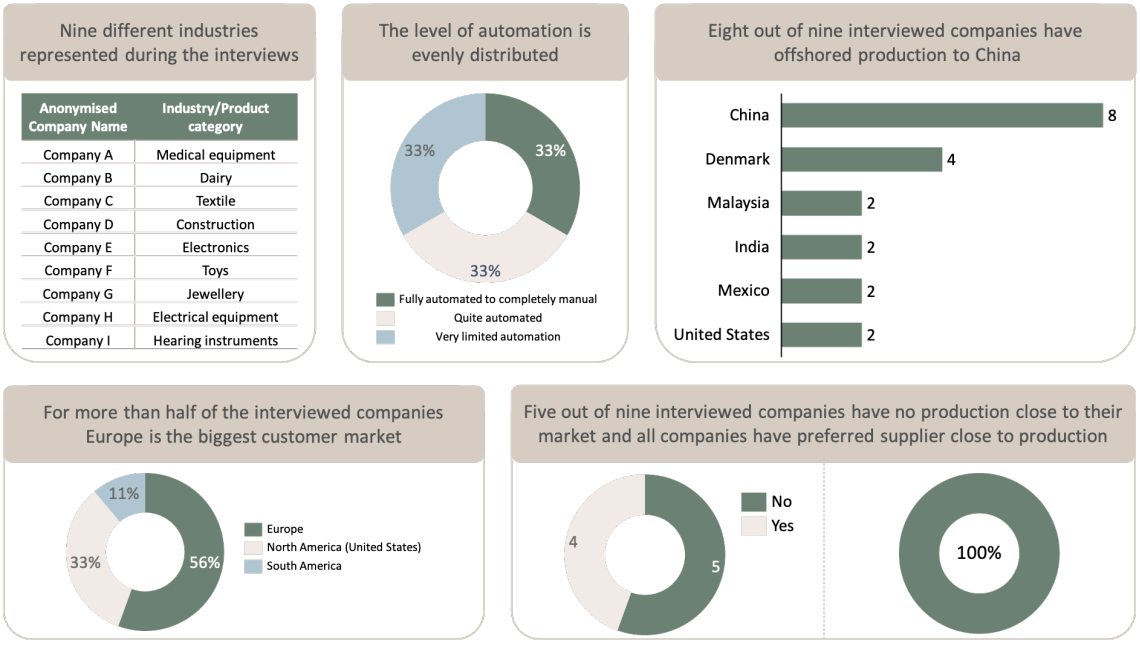


*Figure 11: Interviewed companies dashboard*

The dashboard in *Figure 11* shows the interviewed companies represent multiple different industries and have varied automation levels. All except one company have production in China while for more than half of the companies, Europe is the biggest market. Preferred suppliers close to production is a common trend as all companies have this in place. These initial findings combined with the analyses in the following sections will be used to develop the conceptual framework.

## 7.2 Operating cost is not the main driver of production location

The hypothesis which will be discussed in this section is as follows:

**H1:** *Operating cost is the most important factor determining the location of a production facility for Danish production companies.*

The coding overview in *Figure 12* shows operating cost is the most discussed theme throughout the interviews, coded 33 times out of the total 142 codes. This indicates the theme is of high importance to the interviewed companies. However, these numbers do not reveal exact details regarding what was discussed on the topic, hence it does not imply operating cost is the most important factor.

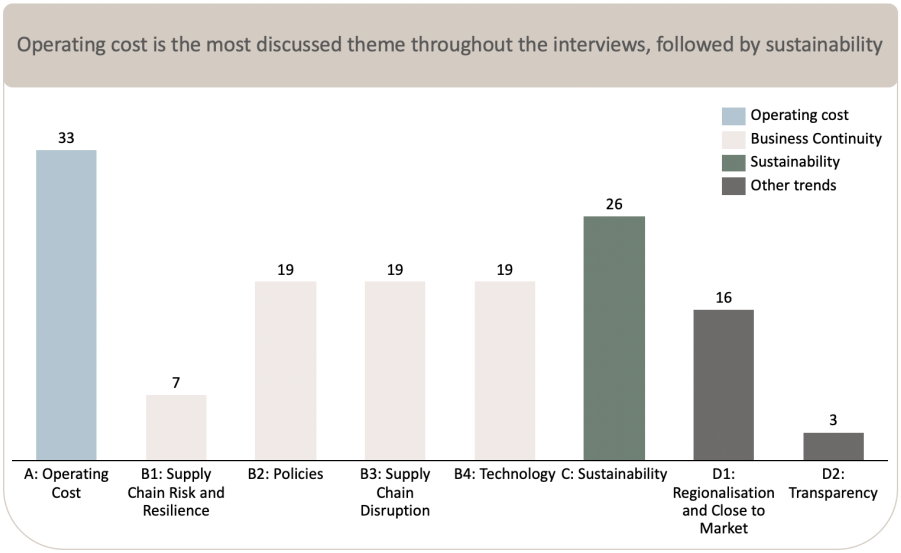


*Figure 12: Code frequency overview*

During the interviews, the companies were asked to rank operating cost, business continuity and sustainability from one to three based on the importance of the factor when deciding on a production location. As can be seen in *Figure 13*, business continuity was rated the most important factor for six out of the nine companies interviewed. This result indicates the operating cost is not the most important factor determining the location of production anymore.

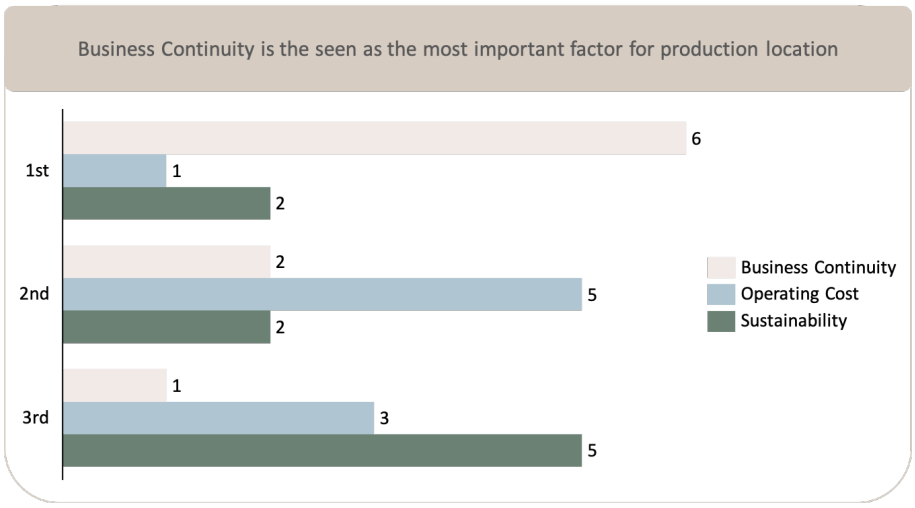


*Figure 13: Business continuity, operating cost and sustainability ranking*

Besides the rank results shown above, multiple companies also provided other insights into the relationship between operating cost and production location. Five companies mentioned labour cost specifically is no longer the driving factor. However, the importance of labour cost also depends on the type of product produced, as labour cost can range from 10 to 60 per cent of the total cost of a product. Countries like China where eight out of nine companies have offshored production, see labour availability decreasing and wages increasing significantly. Instead of labour cost, multiple companies addressed the importance of being close to the market and their suppliers, which only four out of the nine interviewed companies are as of now. Being close to the market and suppliers can reduce lead time, bring down logistical costs and limit CO2 footprint. Even though operating cost is not seen as the primary driver for deciding on a production location, the cost is heavily involved in the back and reshoring discussions. Three companies mentioned costs related to moving production as a significant barrier, e.g. cost of new logistical infrastructure, human resources and loss of expertise. Not only the costs but also the availability of the previously mentioned examples within the country to which you are moving production is a challenge. Lastly, multiple companies pointed out while operating cost is not the most important factor deciding on a production location.

Operating cost will continue to be a crucial element in running a production company, however, based on the conducted analysis, operating cost is no longer seen as the most important factor. Hence, the first hypothesis is thereby rejected.

## 7.3 Business continuity is challenged by political factors, resilience and technology

The second hypothesis which is analysed in this section is defined as follows:

**H2:** *Danish production companies see supply chain resilience, political factors and technological advancement as the main challengers for business continuity when having offshored production.*

As presented before in *Figure 13*, business continuity is seen as the most important factor when deciding on a production location based on the data from the conducted interviews. In *section 5.2, Business Continuity* political factors, supply chain resilience and technological advancement are identified as the main challenges to ensure business continuity for companies with offshored production. To identify if the above hypothesis can be accepted or not, the qualitative data from the interviews are analysed in the following sections.

**Supply chain resilience**
The interviewed companies all see risks with having global supply chains, and in particular, six of them see a risk after the COVID-19 pandemic. However, it is increased awareness rather than the risk itself increasing. Additionally, the pandemic showed the importance of having a resilient supply chain. Some interviewed companies who made investments in the past to ensure a resilient supply chain have seen great benefits during the pandemic, ensuring business continuity. One company did for instance provide the example of having a plan in place to switch to air freight quickly when needed. This is a costly measure but keeps the production going, which is an acceptable return on investment depending on the industry operated in. In general, freight cost increased significantly during the COVID-19 pandemic, however, multiple companies do not see a long term issue resulting from this. One company specifically mentioned seeing the pandemic as the most significant supply chain disruption of the last 30 years. Additionally, three companies mentioned they became aware of the fact they are too reliant on Chinese production facilities. Besides the companies themselves relying too much on China, taken from the broader perspective, entire industries rely on parts being produced in China. As a result of this, some of the interviewed companies mentioned they are investigating or are already in the process of moving production away from China. One of them mentioned in general having too many parts of a business offshored could also create communication challenges. To mitigate these risks and ensure business continuity, seven of the interviewed companies have or seek to have multiple sites producing the same product in the future. Also, two companies mentioned the importance of having a close relationship with the offshored production and suppliers to mitigate global supply chain risk. However, several companies mentioned the optimal solution would be to have production close the headquarters contributing to a resilient supply chain.

**Political factors**
Seven out of the nine interviewed companies see political factors having a significantly higher impact on supply chains today than in the past. COVID-19 accelerated this trend, where countries saw how reliant they are on cross-continent production. Political incentives such as duties and tariffs are making production far outside of the companies' domestic countries increasingly difficult as mentioned by six companies. China is explicitly mentioned as a country with many political challenges, both when operating in and exporting out of China. Six companies mentioned the rising political complications as being unpredictable and challenging business continuity, hence why they seek political stability. Policy incentives also seem to advocate for back and reshoring driven by sustainability through e.g. imposing high freight tariffs as mentioned by two companies. However, there are also examples where a company needs to keep production in a country to obtain market access and be able to sell products.

**Technological advancement**
Two-thirds of the interviewed companies see technology and more specifically a higher level of automation needed to be able to produce outside of low-cost countries. However, four companies pointed out it highly depends on the specific product type if automating is worth it. This can be driven by the lack of technology or because it is too expensive to automate a certain task due to the complexity and/or customisability. Another element is the proportion of labour cost of the total cost, where two companies stated if the labour cost is only a minor portion, it is probably not worth the investment to automate. Automation is not only explored due to its potential cost benefits, but it can also drive a more uniform quality of the products. Additionally, it provides health and safety benefits improving the work environment. Industry 4.0 and digitalisation are seen as the key enablers to get more transparency throughout the supply chain, as mentioned by three companies.

Business continuity is seen as the most important factor when deciding on a production location. Based on the interview findings discussed in this section, the hypothesis is accepted. Political factors, supply chain resilience and technological advancement challenge the interviewed companies the most to keep business continuity of their offshored production.

## 7.4 Sustainability is accelerating the back and reshoring trend

This section discusses the final hypothesis defined as:

**H3:** *Environmental and social sustainability are incentivising Danish production companies to back or reshore their production.*

As can be seen in *Figure 12*, sustainability is the second most discussed element throughout the nine interviews, indicating the theme is of high importance to the interviewed companies. However, as mentioned earlier this only shows the distribution of the codes and not the actual information provided. Therefore, to identify if environmental and social sustainability are truly accelerating the back and reshoring trend, the qualitative data, i.e. the coded interview data is analysed.

Across the interviews, it is clear all companies are focusing more on sustainability than in the past. Multiple companies mentioned this is done through e.g. adjusting their operations or asking suppliers to provide environmental certificates to seek sustainability throughout the supply chain. In general, higher transparency in the supply chain and data being more widely available are seen as enablers of the sustainability agenda of the interviewed companies. Six of the companies also commented environmental sustainability becoming more important specifically for deciding on a production location. Three companies included sustainability as an important parameter in their considerations when choosing a production location. Limiting CO2 emissions from distribution and logistics by being close to the market is mentioned as one way to incorporate environmental sustainability within the production location discussion. However, two companies stated distribution might only be a small portion of a company's CO2 footprint. The production process can be extremely polluting as well, depending on the product produced. Hence, back and reshoring is not the only option to improve sustainability. Reducing emissions at current production locations significantly could be of higher impact.

Besides the potential sustainability benefits back and/or reshoring have, one company provided insight on the potentially detrimental effects it could have on the well-being and socioeconomic status of the workforce. The insight confirms what was previously found in the literature; social sustainability can be affected when multiple large enterprises move their production facilities out of certain developing countries. Lastly, several companies mentioned the consumers are expecting increased transparency on both social and environmental sustainability matters on more products than before. Often, consumers are not willing to pay for more socially and environmentally produced products, which is indicated by three out of the nine interviewed companies to enforce the difficult discussion between sustainability and operating cost.

Based on the analysed interviews, environmental and social sustainability is indeed an element incentivising Danish production companies to back or reshore. Hence, the hypothesis is accepted, and sustainability is seen as a crucial element when developing the conceptual framework.

## 7.5 Other trends of importance are transparency and regionalisation

The semi-structured interview setup with many open-ended questions enabled the interviewees to discuss other decision-making factors or trends within the industry, separate from the established hypotheses and interview guide. The results of these factors are discussed in the following paragraphs, including the two most discussed trends: transparency and regionalisation.

**Transparency**

Transparency can be a driver of bringing production closer to a company's headquarter. As transparency both support the sustainability agenda and is mentioned as an important factor by two companies, it is going to be important for business continuity in the future. Companies try to get higher transparency throughout the tiers of the supply chain, i.e. beyond the first tier of

suppliers. Two interviewed companies indicated this is partly driven by the customers, who are expecting transparency throughout the supply chain. Reducing the number of suppliers is also seen as a strategy to increase transparency, however, a headquarter close to production seems to be the optimal approach.

**Regionalisation and proximity to market**
From the other decision-making factors and trends, regionalisation or proximity to market is discussed the most frequently across eight out of nine interviews. Four companies mentioned regionalisation as being the new globalisation, in the sense that companies are going to focus on a regional instead of global footprint. Two of them stated they are currently investigating what would be needed to move production closer to the market. Being close to the market brings several benefits, such as significantly decreased lead time, lower inventory levels and increased flexibility. Also, one interviewed company mentioned the supply chain risk as being lower in general and therefore business continuity is more achievable when being close to both customers and suppliers. On the contrary, two companies addressed having production in e.g. Europe often means limited supplier proximity i.e. lack of access to raw materials, which in turn increases supply chain risk. Lastly, there are some industries where being close to the market is necessary to be able to operate because the logistical infrastructure would be tremendously difficult to set up, e.g. transporting a large wing from China to Denmark.

## 7.6 Sub conclusion

Two of the three hypotheses formulated are accepted, which in combination with the other findings of the interviews contributed to what must be included in the conceptual framework. Operating cost is an important factor to consider when choosing a production location. However, business continuity and its elements are considered to be the most important. More specifically, the framework shall focus on supply chain resilience, political factors, automation and infrastructure. Automation is considered the most important form of technology involved in the production location decision-making, therefore automation is chosen instead of technological advancement in general. Infrastructure is an element identified throughout the interviews to be of high importance and an additional element to be included for business continuity. If production companies want to cut costs, they need to find alternatives beyond moving production to seek lower labour cost. Due to the increased importance of sustainability in general, and the significant impact a production location has on both social and environmental sustainability, it is a crucial element to include in the conceptual framework. However, it is still less important than operating cost. The importance of the business context is mentioned multiple times throughout the interviews, which confirms the gaps identified in the frameworks available in the current literature. Therefore, business context shall be an important element of the conceptual framework. The framework must have adequate flexibility to accommodate different product types and rigid enough to be effective.

# 8 Discussion

The following section will present a discussion of the findings from the systematic literature review and interviews conducted. The findings will be used in the development of a conceptual framework that may be used to support Danish production companies in making a decision related to whether they should backshore, reshore, or keep their production setup as it currently is. Following the introduction of the framework, the input of a fictive company will be presented to give an example as to how it could look in practice, and limitations and possible future research will be discussed.

## 8.1 Six determinants are identified as the most important

In the past, cost was the most important element to consider for companies deciding on where to place their production. Due to this, many would move their production to less developed countries with low labour cost. However, based on the findings from the interviews and literature, companies are now also considering other elements when deciding where to locate their production. The three main determinants are identified as: operating cost, social and environmental sustainability and business continuity. However, the findings from the literature and interview divide business continuity into four parts: automation, infrastructure, supply chain resilience and political factors. By dividing business continuity into four determinants, it will make it easier for the companies to evaluate business continuity, as it specifies the element to evaluate. The six most important determinants are thereby identified as operating cost, social and environmental sustainability, automation, infrastructure, supply chain resilience and policy incentives. These determinants will be discussed below and arguments for why these determinants, in particular, are evaluated as the most important are presented.

**Operating cost**

The literature review identified different macro factors influencing the operating cost, such as rising labour cost in developing countries, an increase in freight prices and the decrease in the cost of technology. Labour cost still accounts for a significant part of the operating cost, ranging from 10 to 60 per cent. However, labour cost is not the single most important factor when deciding on production location anymore. Therefore, the company must include the total cost of the product when deciding on production location. Based on the findings it is identified operating cost must be included as an element when deciding on a production location.

**Social and environmental sustainability**

Sustainability has previously been disregarded as a factor to consider when offshoring, back and reshoring production. However, findings from both literature and the interviews conducted show it has gained attention and became an element worth considering as part of this decision-making process in the more recent time. During the interviews, sustainability was one of the most frequently discussed topics. It was rated third in regards to importance out of the three factors of operating cost, business continuity and sustainability, but all companies mentioned an increased investment in sustainability matters. The reason as to why this should be included as a determinant in the developed conceptual framework comes from a combination of findings. This includes the introduction of UN's sustainable development goals, and the discovery of big differences in working conditions and environmental cost across countries. Additionally, companies see increased requirements and standards set by consumers.

**Automation**

Automation is becoming more normal in production facilities, as it ensures faster production, increased quality standards and requires less manual labour at the facilities. The technological development within advanced manufacturing makes robots and automation of production lines less costly, as found in *Section 5.2, Business continuity*. This makes it easier for companies to replace and automate existing manual tasks and processes which previously required manual labour. The role of automation in deciding the production location is increasing, which two-thirds of the interviewed companies confirmed. This highlights the importance of including the automation element as one of the deciding factors in the conceptual framework.

**Infrastructure**
Infrastructure, in this case, includes access to labour, technology and logistics. Companies can experience the difficulty of accessing skilled labour and technology in less developed countries, which is needed to increase the technological level of the production. It can potentially slow down the future technological development of companies' production if they are located in less developed countries. The logistical infrastructure varies a lot by country and is one of the elements which must be investigated when moving a production. The importance of production location infrastructure is therefore considered as one of the elements to consider in the conceptual framework.

**Supply chain resilience**
The impact of COVID-19 increased the focus on having a resilient supply chain as companies experienced how vulnerable their supply chains were after a disruption. The result of this increased the focus on creating a more resilient supply chain, which the findings from the interviews and literature confirm. The literature highlights companies need to decrease their supply chain risk, by changing the supplier network, using technology to increase visibility throughout the supply chain and bringing production closer to the market. Therefore, the increased importance of supply chain resilience resulted in including it in the conceptual framework.

**Political factors**
In recent years, companies have seen an increase in the level of protectionism by countries introducing import tariffs on products from certain countries, e.g. the US introducing import tariffs on products that are produced in China. The literature also highlights countries are introducing policy incentives to make it more attractive to move production, which the US and Japan did by subsidising the cost of moving production back domestically. These factors make it more favourable to move production due to the economical benefits, which make the political factors an important element to consider as it influences the total cost of the companies' production. Additionally, the importance of political stability in the production location was highlighted in the interviews. Most of the interviewed companies with production facilities in China explained their experience with the Chinese government influencing their business. Political factors are going through a change, which highlights the importance of including this as an element in the conceptual framework.

## 8.2 Production location decision-making matrix as a tool for Danish production companies

Based on the set criteria and justifications made in the previous section, a conceptual framework as presented in *Figure 14*, and in an enlarged version in *Appendix D* is developed. It presents a matrix-like model making a quantitative evaluation and recommendation as to whether a company should backshore, reshore or keep their production location as is (offshored), based on input from the company and findings from the research. The framework setup is inspired by a standard decision-making matrix, which was found suitable as it can provide flexibility and accommodate different product types or industries.

Cost
Business continuity
Sustainability

| | | Ratings | | | |
|---|---|---|---|---|---|
| Determinant | Weight | Reshore | Backshore | As is | Considerations |
| Operating cost | 30 | | | | Total cost, labour cost, freight cost |
| Automation | 12.5 | | | | Cost of innovation, access to expertise and technologies |
| Infrastructure | 12.5 | | | | Skilled labour, logistical and digital infrastructure |
| Supply chain resilience | 12.5 | | | | Disruptions, transparency, supplier network |
| Political factors | 12.5 | | | | Policy incentives, protectionism, political stability |
| Social and environmental sustainability | 20 | | | | Local community impact, Co2 footprint, local work environment |
| Total | 100 | | | | |

*Figure 14: Production location decision-making matrix*

The recommendation is made based on the company's input, but also considers the weight of the determinant as predefined by the researchers. The weight is established based on an evaluation of the determinants' ability to affect production location, as described in the findings of both the literature review and interview findings, and additionally described in *Section 8, Discussion*. The weight is set to 50 per cent business continuity, 30 per cent operating cost and 20 per cent sustainability. Business continuity is split up equally with 12.5 per cent per factor. The weighting is also in line with the number of times the elements are discussed during the interviews, shown in *Figure 15*. After excluding the other trends, the business continuity elements account for 52 per cent (64 out of 123 codes), operating cost, 27 per cent (33 out of 123 codes) and sustainability, 21 per cent (26 out of 123 codes).

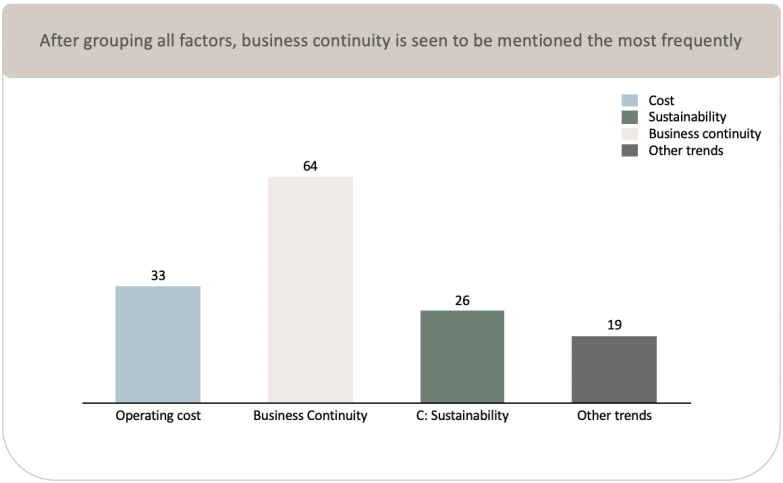


*Figure 15: Code frequency overview, main themes*

Finally, the combined input from both parties will in the bottom row labelled as "Total" be calculated to present the total score of the three possible scenarios; Reshore, Backshore and As is, i.e. keeping production offshored. The highest score will represent the final recommendation for the company. The rating and calculation are done according to the process as presented in the next section.

### 8.2.1 Description of determinants

The determinants presented and described in the following paragraphs as mentioned in previous sections are evaluated as the most important factors to consider when deciding on a production location:

**Operating cost**
Operating cost covers all costs related to producing a company's goods or services, including elements such as rent of production facilities, cost of labour, maintenance expenses, raw materials, freight and additional overhead costs (Murphy, 2021; Dictionary, n.d).

**Social and environmental sustainability**
Environmental sustainability covers both local and global issues, such as climate change, use of renewable energy, soil erosion, soil quality, water management and air and water pollution (Ghosh & Debnath, 2019). Social sustainability, on the other hand, is a measure of the welfare of humans and includes all elements with a direct impact on human well-being, such as standards of living, working conditions, population growth, human health (Mohamed & Paleologos, 2021).

**Automation**
Automation is described by the Cambridge Dictionary as the use of machines and computers that can operate without needing human control Cambridge Dictionary (n.d). In a production location context, this relates to the extent to which it will be feasible to automate production in a given country or area, with e.g. cost of innovation, access to knowledge and resources in mind.

**Infrastructure**
Infrastructure is a underlying foundation or basic framework as of system or organisation (Merriam Webster, n.d). In a production location context, this relates to access to skilled labour, necessary technologies to drive a specific process and elements required to facilitate transportation of goods, communication and other business matters.

**Supply chain resilience**
Anukoonwattaka and Mikic (2020) define supply chain resilience as the ability to return to operations as soon as possible post disruption. In the production location context, companies need to evaluate how resilient the current production setup is based on supplier network or sourcing strategy, visibility in the supply chain and lead time.

**Political factors**
Political factors include how the company is influenced by the political environment surrounding the production location and customer markets. Level of protectionism in the customer markets they are operating, trade restrictions and import quotas are examples of political influences on operations. Additionally, a company can gain value by moving the production to other locations through potential policy incentives. Lastly, evaluating the stability of the political situation at the location of production is a political factor to be considered.

### 8.2.2 Rating and final calculation process

In evaluating the different scenarios, the person rating on behalf of a company, hereafter referred to as the rater, should provide a rating to the following statement: "From a ***determinant*** perspective, it will benefit my company to ***scenario***". The rating should be represented as one number within the range of -2 to +2, where the rating scale is as follows:

**-2:** I strongly disagree

**-1:** I somewhat disagree

**0:** I do not agree nor disagree

**+1:** I somewhat agree

**+2:** I strongly agree

A statement may thereby be "From an ***operating cost*** perspective, it will benefit my company to ***reshore***". The rater inputs the rating most appropriate for their business and production setup, e.g. +2, *I strongly agree*, taking the elements described in the column *considerations* into account.

Having rated all determinants for all three scenarios, the rater will calculate the total by multiplying the weight of each determinant by the rating in its corresponding cell in each scenario and add up the results for each column. The total row will present a score, where the highest score out of the three represents the final recommended scenario for the company, i.e. whether the company is recommended to reshore, backshore, or keep their business as is.

Cost
Business continuity
Sustainability

| | | Ratings | | | |
|---|---|---|---|---|---|
| Determinant | Weight | Reshore | Backshore | As is | Considerations |
| Operating cost | 30 | 1 | 0 | -2 | Total cost, labour cost, freight cost |
| Automation | 12.5 | 0 | 1 | 0 | Cost of innovation, access to expertise and technologies |
| Infrastructure | 12.5 | 2 | 2 | 1 | Skilled labour, logistical and digital infrastructure |
| Supply chain resilience | 12.5 | 2 | -1 | -1 | Disruptions, transparency, supplier network |
| Political factors | 12.5 | 2 | 1 | -2 | Policy incentives, protectionism, political stability |
| Social and environmental sustainability | 20 | -2 | 2 | -2 | Local community impact, Co2 footprint, local work environment |
| Total | 100 | 65 | 77.5 | -125 | |

*Figure 16: Production location decision-making matrix, Defties example*

*Figure 16* presents an example of how a completed framework could look, where ratings have been added on the behalf of a fictive company, *Defties*. Defties is a Danish production company selling sports shoes, with a global presence. The ratings are multiplied with the weight and added up, and the total score in the bottom row presents a score of 65 for scenario 'Reshore', 77.5 for 'Backshore', and -125 for 'Business as is'. In this example with *Defties*, keeping their production as is, will not be beneficial. They are given the final recommendation to backshore, i.e. move their production back to the home country, as this scenario scored the highest and may give them the benefits they are seeking.

### 8.2.3 Considerations

With the introduction of the Production location decision-making matrix, it is important to note this is based on the researchers' investigations and may be subject to biases of the researchers as well as the people interviewed and authors of the literature reviewed. As previously mentioned, these biases are attempted to be reduced by including a broad spectrum of literature from a variety of sources, as well as interviewing companies across different industries.

Besides the implications for practitioners, this research and the framework developed to contribute to the academic literature. The research fills some of the gaps identified by the literature review, as it includes sustainability, the decision-making element and is based on both the literature and field research.

## 8.3 Limitations

- The research is generalises based on nine companies which is a limiting factor. However, through validation of the results from the research with a larger audience this could be solved.
- This research focuses exclusively on production companies and excludes service providers. This has been a deliberate choice, as the focus was on tangible products.
- The research focus is on companies with headquarters in Denmark only, as the focus was on developed countries and Denmark specifically to limit the research to one specific developed country.
- The framework provides an initial recommendation, however, a company must further investigate the recommendation and its feasibility before making an ultimate decision.

## 8.4 Future research

Based on the conducted research multiple future research opportunities are identified, which are as follows:

- Future research shall test the framework with production companies in Denmark to assess its useability.
- Other developed countries must be investigated to evaluate the applicability of the framework in a more generalised matter.
- This research has focused primarily on in-house offshoring, future research can investigate if offshored outsourcing could be approached in a similar fashion.
- This research has focused on the production of products, future research can investigate if service providers could be approached similarly.

# 9 Conclusion

This chapter presents the answer to the primary research question. The primary research question defined in *Chapter 4, Introduction* is "How can Danish production companies selling tangible products determine whether they should back or reshore their production, based on cost, sustainability and business continuity?".

Danish production companies need to keep the following three main determinants in mind when determining whether to back or reshore: operating cost, business continuity and sustainability. Business continuity is operationalised into four determinants: automation, infrastructure, supply chain resilience and political factors. Business continuity is the most important main determinant, in which the four determinants are equally important. Operating cost is the second most important main determinant and sustainability the third. Taking this relative importance in mind, companies must evaluate these elements concerning a production location. More specifically, they should assess for each determinant if the company benefits from either backshoring, reshoring or keeping the production offshored. The framework presented in the previous chapter of this report can be used to structure the evaluation process. The result of the evaluation provides Danish production companies with a recommendation, assisting the production location decision-making process. However, the companies must further investigate the recommendation and its feasibility before making a decision.

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# 10 Appendix

# A Interview guide, offshoring activities

### Introduction

- What are your roles and responsibilities at [Company Name]?

### Company

- What are your roles and responsibilities at [Company Name]?
- Do you have any production outside of Denmark?
- What are the current locations of production?
- What are the biggest customer markets of your company's products?
- Do you think the demand of your products would increase with a "made-in" (e.g. Denmark) branding?
- Where are your preferred (most important suppliers) suppliers primarily based?
- Did you experience any major changes within your supply chain during the COVID19 pandemic?
- Has your company considered bringing production back to Denmark or move it to another country i.e., backshoring or reshoring?
- What do you see as current supply chain/operations trends within your company?
- What do you see as current supply chain/operations challenges within your company?
- How automated is your production?

### General

- What do you see as offshoring/backshoring trends in the industry?
- Do you see an increased risk with global supply chains after the COVID pandemic?
- Do you see any big changes concerning policy incentives having impact on production location?
- If you would need to choose between cost, business continuity and sustainability which one is seen as the most important factor of deciding on a production location?
- How would you rate these elements from 1-3 in terms of importance depending on production location?
- What do you think about cost in relation to production location?
- What do you think about business continuity/supply chain resilience in relation to production location?
- What do you think about sustainability in relation to production location?
- What do you see as drivers or benefits of backshoring/reshoring production?
- What do you see as barriers or disadvantages of backshoring/reshoring of production?

### Dream state

- If anything was possible, what do you see as the optimal state of [Company Name]'s production?

# B Interview codebook

| Code Name | Description | Interviews | References |
|---|---|---|---|
| **Operating Cost** | - Operating cost covers all costs related to producing a company's goods or services.<br>- The code is only applied when mentioned in relation to a production location | 9 | 33 |
| **Business Continuity** | | | |
| Supply Chain Risk and Resilience | - The ability to return to operations as soon as possible post-disruption and the related risks<br>- The code is only applied when mentioned in relation to a production location | 7 | 7 |
| Policies | - Political factors include how the company is influenced by the political environment at the production location and customer markets<br>- The code is only applied when mentioned in relation to a production location | 7 | 19 |
| Supply Chain Disruption | - Any major disruption such as the COVID-19 pandemic impacting the supply chain<br>- The code is only applied when mentioned in relation to a production location | 8 | 19 |
| **Sustainability** | - Both social and environmental sustainability are in scope<br>- The code is only applied when mentioned in relation to a production location | 9 | 26 |
| **Other trends** | | | |
| Regionalisation and Close to Market | - Anything related to discussions on regionalisation and being close to the market<br>- The code is only applied when mentioned in relation to a production location | 8 | 16 |
| Technology | - Technologies such as automation, industry 4.0 discussion, digitalisation<br>- The code is only applied when mentioned in relation to a production location | 8 | 19 |
| Transparency | - Discussions related to transparency throughout the supply chain<br>- The code is only applied when mentioned in relation to a production location | 2 | 3 |

*Figure 17: Interview codebook*

# C Dashboard, interviewed companies

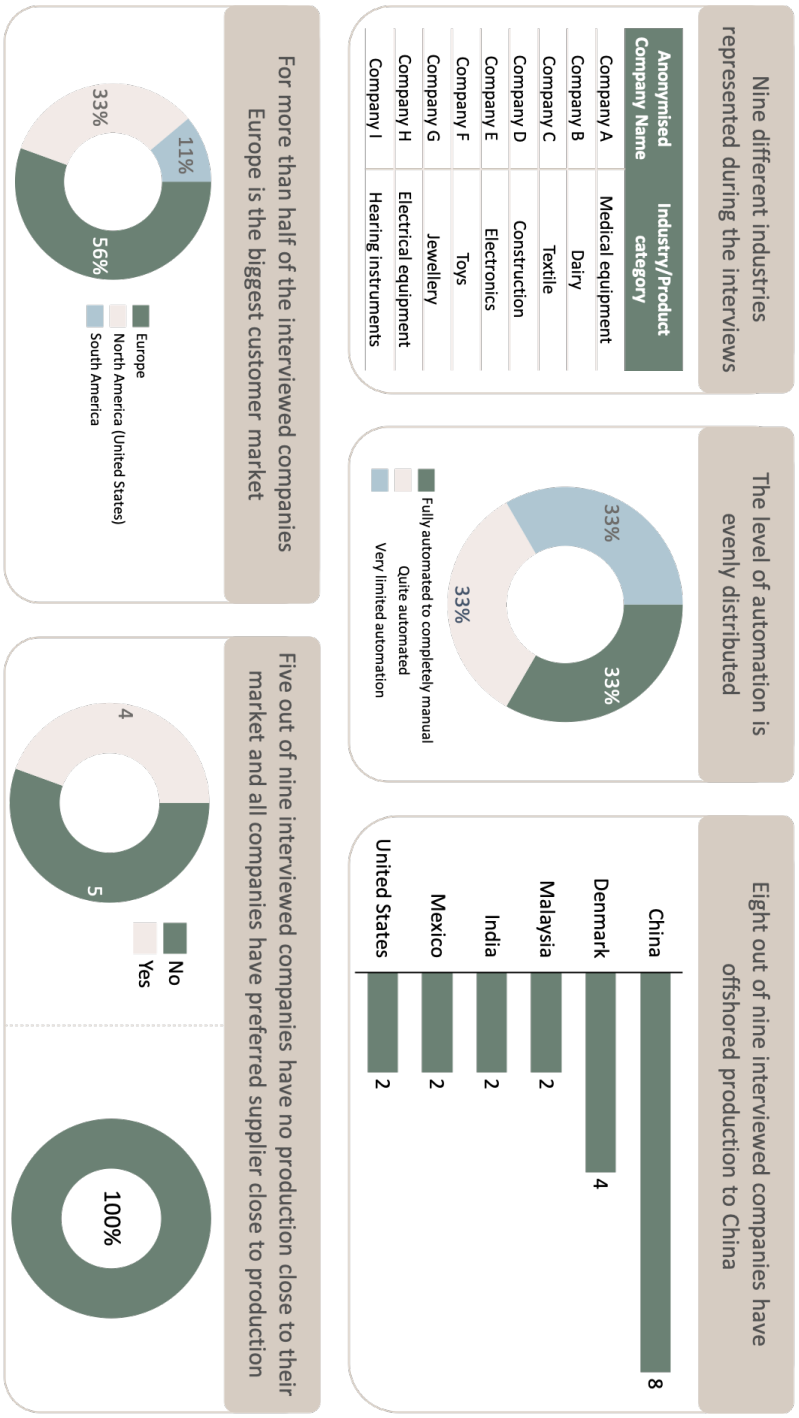


*Figure 18: Interviewed companies dashboard (large)*

# D Production location decision-making matrix

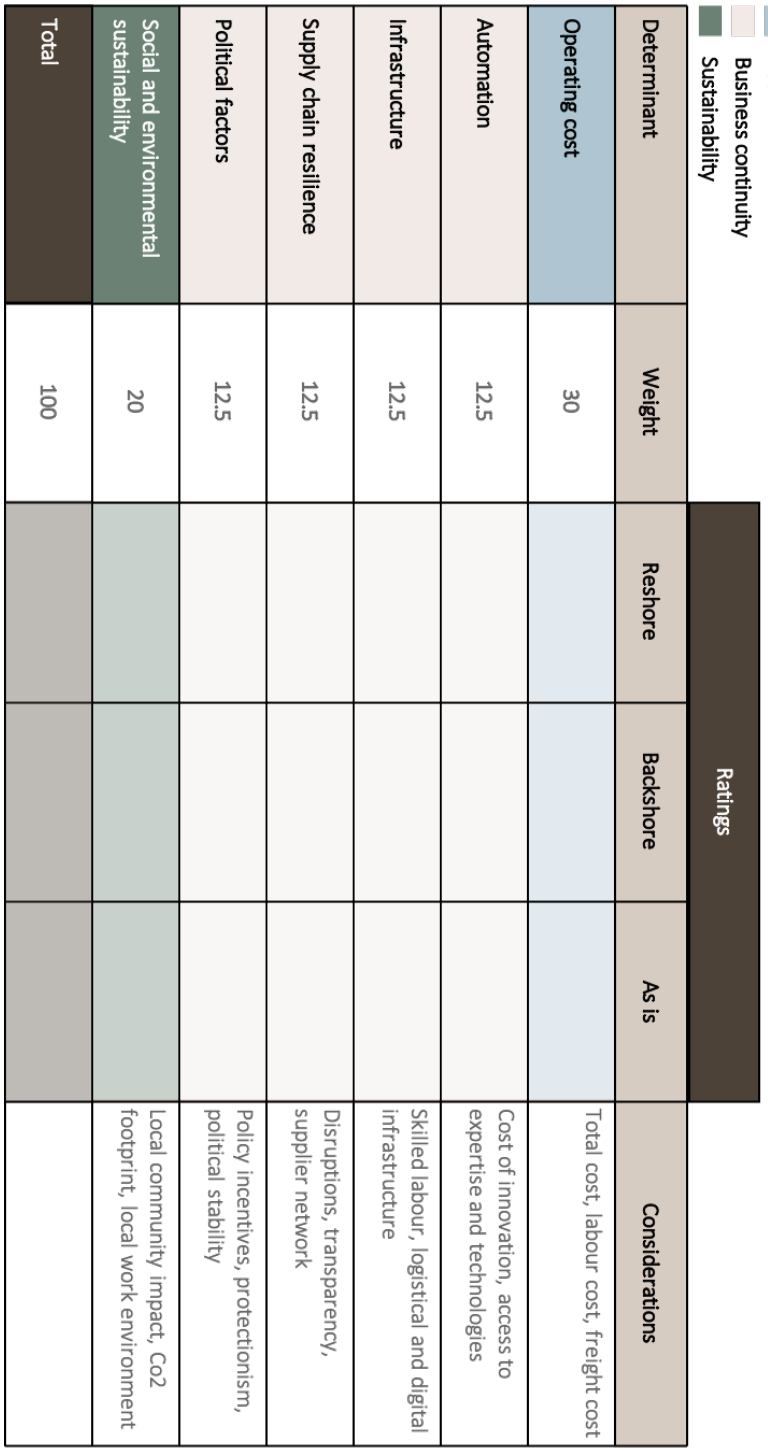


*Figure 19: Production location decision-making matrix (large)*