THE IMPACT OF DIGITALISATION ON THE INTERNATIONALISATION PROCESS

Lappeenrannan–Lahden teknillinen yliopisto LUT

Tuotantotalouden kandidaatintyö 2023

Deeqo Farah

Tarkastaja: Dosentti Lea Hannola

ABSTRACT

Lappeenrannan–Lahden teknillinen yliopisto LUT
LUT Teknis-luonnontieteellinen
Tuotantotalous

Deeqo Farah

The impact of digitalization on the internationalization process

37 pages, 5 figures, 3 tables, and 0 appendices

Examiner: Adjunct professor Lea Hannola

Keywords: Digitalization, digital transformation, Industry 4.0, manufacturing industry, internationalization process.

This bachelor thesis researches the impact digitalization has on the internationalization process, and how these solutions can be utilized even further. This objective is reached through thoroughly examining both the process of internationalization and digitalization. From this the work advances into how these digital solutions can be utilized when companies are advancing their international operations. After generally examining both concepts the research question is applied to manufacturing companies, which is where the focus in this work lies. The thesis is conducted through analyzing scientific papers, conducting a literary review, and looking over any relevant reports or other publications.

Internationalization in our current world is a prominent growth strategy for many firms. This process, however, has multiple affecting factors, and requires thought out strategies. When internationalization is viewed as a process, it is important to note how this process manifests itself in different industries. International trade can deem itself to be the only viable option when conducting business overseas, but this of course varies. Companies have the option of starting their internationalization by partaking in foreign direct investment for instance. However, it is important to note that risks also vary between the different stages of internationalization.

The findings of the research were heavily focused on what technologies can be utilized within different phases of the production. Digital tools enhance the performance of firms according to different metrics. However, most effects can be exhibited indirectly in the internationalization process. The current available research on this topic is heavily focused on cost reduction and efficiency, but digital tools are versatile and can be applied in various ways. Examples of this are acquiring market knowledge through digital tools, advancing distribution channels, and upkeeping communication with different stakeholders.

TIIVISTELMÄ

Lappeenrannan–Lahden teknillinen yliopisto LUT
LUT Teknis-luonnontieteellinen
Tuotantotalous

Deeqo Farah

Digitalisaation vaikutus kansainvälistymisprosessiin

37 sivua, 5 kuviota, 3 taulukkoa ja 0 liitettä.

Tarkastaja: Dosentti Lea Hannola

Avainsanat: Digitalisaatio, digimuutos, teollisuus 4.0, teollisuusyritys, kansainvälistymis-prosessi.

Tässä kandidaatintyössä tutkitaan, miten digitalisaatio vaikuttaa kansainvälistymisprosessiin ja miten digitaalisia ratkaisuja voidaan hyödyntää entistä enemmän. Tähän tavoitteeseen päästään tarkastelemalla sekä kansainvälistymisprosessia että digitalisaatiota. Tarkastelun jälkeen tutkitaan miten nämä konseptit vaikuttavat toisiinsa. Kun molempia kiäsitteitä on ta kasteltu yleisellä tasolla, tutkimuskysymystä sovelletaan teollisuusyrityksiin. Opinnäytetyö toteutetaan kirjallisuuskatsauksena analysoimalla tieteellisiä artikkeleita sekä käymällä läpi aiheeseen liittyviä raportteja ja muita julkaisuja.

Kansainvälistyminen on nykymaailmassa monille yrityksille merkittävä kasvustrategia. Tähän prosessiin vaikuttavat monet tekijät ja se vaatii harkittuja strategioita. Kun kansainvälistymistä tarkastellaan prosessina, on tärkeää huomata, miten tämä prosessi ilmenee eri toimialoilla. Kansainvälinen kauppa voi tuntua ainoalta mahdolliselta vaihtoehdolta ulkomailla liiketoimintaa harjoittaessa, mutta tilanne ei välttämättä kuitenkaan ole tämä. Yrityksillä on mahdollisuus aloittaa kansainvälistyminen, esimerkiksi ulkomaan investoinnilla. On kuitenkin tärkeää huomata, että riskit vaihtelevat kansainvälistymisprosessin eri vaiheissa.

Tutkimuksen tulokset keskittyivät vahvasti siihen, mitä teknologioita voidaan hyödyntää tuotannon eri vaiheissa. Digitaaliset välineet parantavat yritysten suorituskykyä eri mittareiden mukaisesti. Useimmat digitalisaation aiheuttamat vaikutukset voivat kuitenkin näkyä epäsuorasti kansainvälistymisprosessissa. Aiheesta saatavilla oleva tutkimus keskittyy vahvasti kustannusten vähentämiseen ja tehokkuuteen, mutta digitaaliset työkalut ovat monipuolisia ja niitä voidaan soveltaa eri tavoin. Esimerkkejä soveltumiskohteista ovat markkinatuntemuksen hankkiminen digitaalisten työkalujen avulla, jakelukanavien kehittäminen ja viestinnän ylläpitäminen eri sidosryhmien kanssa.

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1 Introduction

1.1 Background

Internationalization has become a topic of interest for many manufacturing companies, due to the everchanging operating environment firms employ. This results in internationalization playing a major role in the growth and expansion of enterprises. The expansion of the market share is one of the main drivers for operating internationally (Menipaz and Menipaz, 2011). This gives firms more incentive to operate on a more international scale. Internationalization can be conducted through different strategies. These strategies and the tools digitalization provide can further the process along.

The impact of digitalization is continuously increasing. However, understanding the impact of digital transformation in enterprises seems to be in a primitive state (C. Matt Hess A. Benlua, 2015). This results in companies not fully utilizing this tool to their advantage, which can also extend to the internationalization process. There has been limited research on the impact different digital factors have on the internationalization of enterprises, and how these factors can be built upon. (Hervé, Schmitt and Baldegger, 2020)

Due to these mentioned factors, this work consists of a literary review on the ways digitalization has been utilized in the internationalization of manufacturing companies, and how digitalization can be used to make this process more efficient.

1.2 Research question and the objective of the thesis

The objective of the thesis is to garner a wide perspective on the internationalization process, and to research ways on how this can be built upon even further with the help of digitalization. The main research question is:

How is digitalization apparent in the internationalization process of companies currently?

After conducting a thorough understanding of internationalization and digitalization, and analyzing how they interact within each other one, of the objectives is also to note on which areas of the internationalization process can benefit from digitalization even more. This objective will be answered through this sub-question:

How can digitalization be utilized within the internationalization process even further?

Within the research scope, the aim is to focus on manufacturing companies. After dissecting it on a general level, these elements will be tied down to the production process in manufacturing companies. By doing this the thesis will cover the utilized tools in a more detailed manner

1.3 Structure

The topic of the thesis consists of two concepts, and how they affect each other, which is why the structure consists of three main segments in addition to the introduction and conclusion. The first part of the thesis analyzes the internationalization process. Within this segment, the objective is to clarify the process, and dissect how it manifests itself in manufacturing companies. The second segment circles around the concept of digitalization and its main methods of application in enterprises. After both concepts have been introduced, the last segment's goal is to bind these two concepts together with a chapter that provides how these two concepts can be utilized within one another.

2 Internationalization in overview

Due to the global environment, we operate in, many companies engage in some degree of international operations. The internationalization of enterprises can be simplified into the tendency companies have to deepen their international activities (Knight, Riesenberger and Cavusgil, 2019). Internationalization can take many different forms, and companies may choose to operate at different levels and in different formats. International trade being the only form of international operations is a misconception that can easily occur, especially in the manufacturing industry. For example, internationalization can involve not just exporting goods and services, but also engaging in international supply chain activities (Collinson, Narula and Rugman, 2020). In addition to this, the line between companies who have international operations, and enterprises that are multinational is also somewhat hard to distinguish. MNE's which is the shortcut for multinational enterprises, stands for companies who partake in foreign direct investment (FDI) (John H Dunning, 1981). However, FDI is only an element of internationalization (Knight et al., 2019) and international operations can be conducted with multiple different approaches.

This is why during this chapter the focus will be on the different elements that contribute to the internationalization of firms. After this the chapter will put focus on the internationalization process within the manufacturing industry.

2.1 The degree of internationalization

International operations are conducted in most industries around the globe. However, the nature of the conducted operations and the degree of adaptation, varies according to different factors. Key concepts in international operations can be broken down to 4 key pointers. These elements are ***international trade***, ***international investment***, ***international portfolio investment,*** and ***foreign direct investment***. International trade is the exchange of goods across national borders. This can be conducted through exporting and importing. These two terms stand for transferring goods overseas and procuring them across borders respectfully.

International investment is the act of transferring assets to another country or acquiring them from overseas. International portfolio investment stands for the passive possession of capital such as stocks. Within this internationalization concept active control of the assets is not entailed. FDI on the other hand, is an internationalization strategy, where the enterprise establishes their presence in a foreign market through the acquisition of productive material such as labour or technology for instance (Knight et al., 2019).

The internationalization of a firm can be done through using either one, or multiple of the mentioned elements. The definition of internationalization entailed that it's a continuous process for most enterprises (Melin, 1992). After extensive focus on domestic markets has been established companies tend to shift their focus on operating more internationally. The initial entry can be referred to as the experimental involvement, this is commonly conducted through exporting products. This stage of internationalization involves limited international activity. After establishing their presence in said markets, companies tend to expand their involvement gradually. The next stage of internationalization can be referred to as active involvement ss depicted in Figure 1. This stage ties more resources into the new markets and requires more managerial participation. One example of this stage is joint ventures. Joint ventures stand for a partnership, which is commonly conducted by two parties. This partnership produces a 'child' company, which both parties of the partnership administer. The final stage of the internationalization process is committed involvement. Within this stage the company makes international operations a vital source of focus and income within the internal strategy of the company. This stage can be reached through foreign direct investments for instance. (Knight et al., 2019)

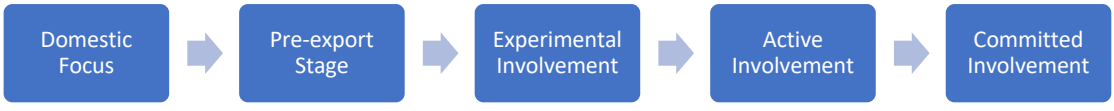

Figure 1: Internationalization process (Knight, Riesenberger and Cavusgil, 2019)

Entry modes, which can be referred to as the initial entry into the foreign market, determine many factors in the process. The entry modes can be divided into export modes, intermediate modes, and hierarchical modes, as depicted in Figure 2. The entry modes are presented in the picture according to the market penetration level, and according to risk and expected outcome levels. Export mode as an entry strategy has the lowest involvement in the foreign market, but also the lowest risk percentage, in comparison to hierarchal mode for instance, that entails high risk, but also high possible outcome (Hollensen, 2020).

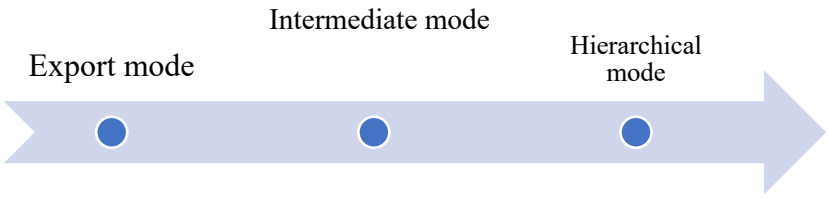

Figure 2: Entry modes (Hollensen, 2020)

Export mode is a strategy where a company produces its products in its local market or in a third country, and then ship them to the target markets (Hollensen, 2020). ***Export mode*** within itself can also be divided into direct exporting and indirect exporting. (Sharma and Erramilli, 2004). The difference between these export modes will be explained in later chapters. Exporting is also a form of entry that is typical for initial market entry. (Hollensen, 2020).

Intermediate mode of entry work as the middle ground between full ownership and redirection of products or capital. Licensing, franchising, and joint ventures are prime examples of this entry mode. The intermediate entry mode can be seen as a tool to transfer assets or knowledge to advance sales. This can be viewed in contrast to export mode where the outcome would be the transfer of the said product. (Hollensen, 2020)

The final mode of entry is the ***hierarchical mode*** of entry. This refers to the complete ownership of the channels the entry is supposed to happen through. This can for instance mean

establishing new offices in foreign marker or buying existing firms to merge into ongoing operations (Hollensen, 2020).

As exhibited within the presented theories, regardless of the process nature of internationalization, the process can start at any stage. It is possible for a company to enter markets through FDI, which is committed involvement. However, it is important to note that the risk levels, industry, and goals play a primal role.

2.2 Factors contributing to internationalization.

Firms also have driving factors that contribute to the decision to internationalize operations. According to the Uppsala model the gradual learning of foreign markets is important. This refers to the assumption that, for firms to obtain international presence in another market, they are ought to achieve competitive advantage in their domestic markets. (Johanson, J., & Vahlne, J. E., 1992). This of course is case sensitive. Some enterprises are born international. This refers to companies that plan from initial stage to have different international operations, such as exporting for instance as a primal part of their operations. (Kundu and Katz, 2003) .

Enterprises can have multiple varying reasons for internationalization. The motives of the internationalization process can be the result of domestic factors and foreign factors. As seen in Figure 3. The domestic factors result in firms wanting to branch out from the markets they are currently operating in. Whereas the factors affecting the foreign markets work as an attractive factor for firms to emerge into these markets. An example of pull factors towards foreign markets is for instance sudden changes in the internal regulations of a country. This can result in easier access to enter markets, and reduced barriers. Foreign competitors in domestic markets can work as a catalyst for pushing companies into branching out internationally (Collinson, Narula and Rugman, 2020)

Growth opportunities within domestic markets might reach their full capacity at some point, especially if the firm has the goal of expanding their revenue and operations. Aiming for higher revenue and margins also serves as a reason for firms to opt for the

internationalization of their operations. Gaining new knowledge and outlook is also a part of why firms decide to internationalize their operations. This automatically exposes them to new products, and operating environments. This can work as a tool to advance the firm's own performance in both current and new markets. (Knight et al., 2019)

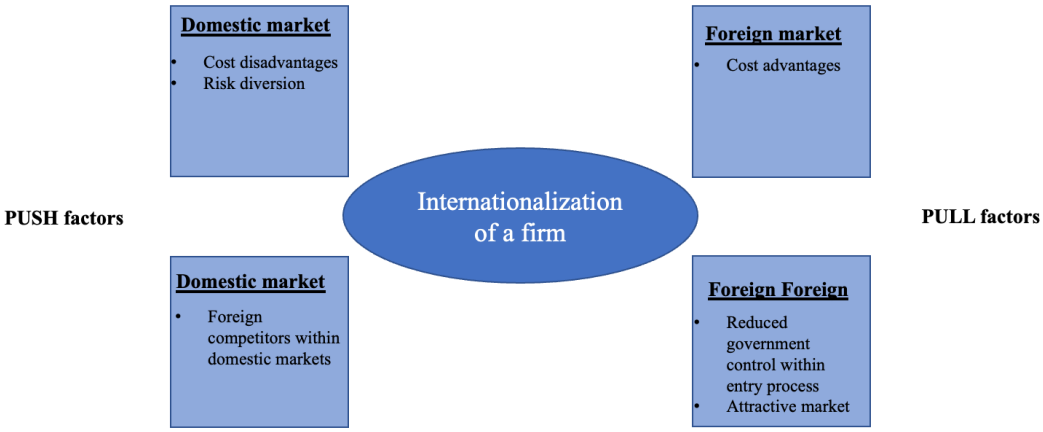

Figure 3: The Internationalization of a firm (Collinson, Narula and Rugman, 2020)

Due to the nature of internationalization being referred to as a process, these processes also manifest themselves differently. In Figure 1 the different stages of internationalization can be depicted. However, a company still must actively determine how this initial entry into markets will be performed, in other words which stage the company wants the process to start from. Enterprises have the active choice of starting from lower risk entry methods like export and gradually advancing their international operations, but they also have the option of focusing more on high risk, but high outcome entry solutions. Entry mode choice operates as a cornerstone for the internationalization of firms. In addition to this, companies have different desired outcomes when making the internationalization decision. (Wan, Sousa, Lengler and Tan, 2023). The outcomes and affecting factors have been closely analysed in different literary works. External factors such as culture and politics are proven to be affecting components within the process of expanding operations overseas (Magnusson et al., 2008). In addition to the external factors, entry mode choice can heavily also be made from internal factors. These internal factors can be the size of the firm for

instance, and the service or product the company plans on expanding with (Hollensen, 2020) . From this it can be concluded that the industry also plays a role in the choice of entry modes.

To combat this rather complicated decision firms must make, there are certain rules that help with this decision. There are three theories that the decision can be based on. ***Naïve rule*** is stands for enterprises using the same entry mode for all the foreign markets they plan on entering. This approach does not consider the different factors that contribute to each market. The second rule, however, is more flexible. The ***pragmatic rule*** entails that firms find entry modes specific to each market. Typically, they start off with lowrisk entry modes. However, within this entry mode not all possible entry modes are accounted for. So, the chances of the chosen entry mode not being the most fitting one is higher. In the last rule, which is referred to as the ***strategy rule***, all possible outcomes per entry mode are considered. When deciding on the entry mode evaluation of risks is conducted, in addition to overlooking the resources of the company and their non-profit objectives. (Root, 1994)

2.3 Internationalization in manufacturing firms

A manufacturing company is a business that uses components, or raw material to produce goods. This also entails that entering new markets with high-risk entry modes might prove itself to be detrimental. To establish a new subsidiary as a manufacturing firm, the company will require a high investment in equipment and inventory (Brouthers and Brouthers, 2003). If the company in question decides to initialize their internationalization process by following the process depicted in Figure 1 (using export), the manufacturing firm can penetrate new markets without making big investments. Export mode as an entry mode, also provides flexibility. Even after choosing export as the initial entry mode, companies still have the chance of affecting their involvement level. As mentioned previously export mode is the entry mode with lowest risk in comparison to intermediate and hierarchical modes. (Hollensen, 2020) However the business still has the choice of choosing between direct exporting, and indirect exporting. These export modes also differ in involvement and risk level, as depicted in Figure 4.

Direct export can be visualized within the value chain process as a transaction between the production company and the distributor of the final product. Indirect export however includes intermediaries within the value chain such as export vendors that are located within the company's domestic markets. In a sense, the firm is not within itself partaking in any global activities, but the product is possibly being distributed overseas (Hollensen, 2020). As figure 4 exhibits both export modes have varying risk levels. This gives the companies a chance at a low-risk entry into markets but also with varying opportunities. Direct exporting has the advantage of providing companies with limited commitment for instance. However, it is important to note that this comes with different disadvantages. By choosing direct exporting, the company also needs to be prepared for having limited contact with said markets. This can make deepening the internationalization process more tedious. In indirect exporting there's direct access to local market experience, which in turn offers companies the chance to acquire more market knowledge. In the contrary within indirect exporting more investments are required especially in sales organization to establish contact with said distributors. The disadvantages and advantages of both exporting modes vary as clearly stated in figure 4. They are also inherently tied to what objective the internationalization firm has in mind. (Hollensen, 2020)

Advantages	Disadvantages
• ***Direct exporting:***	• ***Direct exporting:***
• Minimal market and political risk	• Lack of contact with the market
• Limited commitment	• Limited product experience
• No export experience required	• ***Indirect exporting***
• ***Indirect exporting***	• Limited control over market price (tariffs)
• Shorter distribution chain	• Requires investment in sales organization.
• Access to local market experience	

Figure 4: Advantages and Disadvantages of direct and indirect export modes (modified from (Hollensen, 2020)

When reviewing the difference between the two export modes, the process nature of internationalization can be depicted. Manufacturing firms by nature vary in size and target groups. This makes determining only one mode of entry for such a vast group of businesses more difficult. But by applying the strategic rule, and using the versatility export mode provides, this mode of entry can be utilized within different manufacturing firms.

3 Digitalization in businesses

The impact of digitalization is prominent in our current society. The worldwide shift towards digitalization has not only transformed the economy but also altered the way we view society (Okhrimenko, Sovik, Pyankova and Lukyanova, 2019). Digitalization has also had its effects on businesses internally and externally. It has changed operation models in various industries. Businesses have more access to data, which in turn makes their internal communication and decision-making processes more efficient (Westerman, Bonnet and McAfee, 2014). Externally the effects of digitalization can be seen within the output of the firm. Digitalization widens their perspective into new ways to distribute services and produce products (Sirkiä, 2020). This rapid change has also been commonly referred to as industry 4.0. I.4.0, which is short for the fourth industrial revolution, means using advanced technology like computers and the internet to make factories and other industrial processes more automated and digital (Bigliardi, Bottani and Casella, 2020). The application of said Industry 4.0 technologies have opened new opportunities to use a range of different technologies in the manufacturing sector (Papakostas, Papakostas, Constantinescu and Mourtzis, 2020). Within this next chapter, the focus will be on how digitalization impacts the way companies conclude their external operations. The focus will then shift to how this manifest in manufacturing firms.

3.1 Digitalization in overview

Digitalization has actively had a great effect on the development of technology (Neugebauer, 2019). It has affected most if not all industries, and businesses and been a catalyst for change in many organizational structures. However, digitation is commonly mistaken with ***digitalization***. Digitation works as the force that drives companies towards digitalization. (Ilmarinen and Koskela, 2015).

Defining the term digitalization can prove itself to be complicated in many instances. This is why this term commonly explained through examples. The term can refer to the possibil-

ities brought by the industrial internet, or the changes technology brings in an organizational or societal level. However, digitation is more succesible to definitions. This term refers to the conversion of processes or products into digital format. Digitation within itself is not enough for a process to be called digitalization. It also requires the aftereffects of digitation. When the conversion of a process into digital format changes people's behavior, and the core operation of companies it can be referred to as digitalization. (Ilmarinen and Koskela, 2015). Examples of digitation are also easier to point out. The act of converting a handwritten text into digital format is an instance of digitation (Bloomberg, 2018)

Digitalization can occur in different levels. According to Ilmarinen and Koskela (2015) the three levels of digitalization are from the perspective of select companies, from the perspective of markets, and from the perspective of the society. All these levels have different affecting factors. When digitalization is reviewed from the perspective of specific companies, the factors that are taken into consideration are the strategy, products, services, and operating models. When digitalization is viewed from the perspective of one firm, the change in question can be passive or active. Within the active model, the company itself brings forth the change that comes from the digitalization. When its passive however, the company only adapts to these changes. (Ilmarinen and Koskela, 2015).

When the digitalization expands from just the perspective of one operating company and morphs into something affecting the markets the companies operate in, the digitalization level starts to head more into market level. The factors that contribute to this level of digitalization, on the other hand, are more wholesome. Technological breakthroughs that affect the markets more widely are one great example of this. (Ilmarinen and Koskela, 2015). One example of this can be exhibited in how the promotion of online work has changed labor markets both globally and locally (Chinoracký and Čorejová, 2019). When the technological breakthrough advances and does not only affect the markets but also the customers who acquire these services, we can start referring more into digitalization on a societal level

Ilmarinen and Koskela, 2015). Within this work the focus will be more on the digitalization from the perspectives of companies.

Figure 5: The levels of Digitalization (Ilmarinen and Koskela, 2015, p.24)

3.2 Digitalization in the manufacturing industry

As mentioned above, digitalization from a company's perspective can adhere from change in operation models, products, or for instance services (Ilmarinen and Koskela, 2015). Many executive teams of enterprises are actively trying to understand the impacts of the digital revolution, and how this effect shifts the focus from an industrial perspective to more digital (Björkdahl, 2020). Using digitalization in the process of conducting business is not only limited to conducting online sales. Digitalization can be exhibited within the process of manufacturing as well. In fact, for manufacturing businesses to stay competitive, they are somewhat forced to adapt to more digital approaches within their operations (Buer, Strandhagen, Semini and Strandhagen, 2021). From observation, digitalization mainly results in businesses and factories becoming more efficient and producing better products with new fea- tures. In addition to cyber-physical digitalization tools that have been widely studied in the literature, digitalization can also be utilized in different forms. These include artificial intelligence, digital assistance systems, and data driven product service systems (Lalic et al., 2020).

According to Buer, Strandhane and Semini (2021) the digital tools in question are applied in different stages, which also results in different outcomes. If the company in question has product development as their targeted objective, applying digital solutions can bring them

value. This can be reached through using computational programs to visualize the product. This lessens the chances for error and correlates with the quality the products possess. However, when we move more into the production process itself, digital solutions can apply to not only the product itself but the operating environment. One example of this is using digital factories for instance, and algorithms that detect defects. This also lessens the margin of error and works in making operations more efficient. After the production process comes the affecting logistics. Digitalization can be used in a variety of ways specially in logistics. Tracking the products is more plausible with these solutions. This makes the communication with customers for instance more systematic.

To understand how these stages and goals are achieved, it is important to review how digitalization is apparent in different manufacturing firms currently. Industry 4.0 technologies can be utilized differently according to the industry and goal in question. As mentioned pre viously, digitalization can be seen within multiple phases of the production process. From a case study that was conducted by (Zangiacomi et al., 2020), where the focus was on how I4.0 technologies are present within manufacturing companies, it can be observed that many of the technologies mentioned repeat despite of differences in industry. Out of the mentioned technologies that were utilized by these companies, the most common ones were software systems, IoT (Internet of things), cloud computing, 3D-printing and big data & analytics (Zangiacomi et al., 2020). However, it is important to note that the case study was conducted to only Italian firms, which can of course affect the outcome in question. This case study was conducted in Italy, in the year 2020, where their DESI index was lower in comparison to many European countries (European Commision, 2020). The DESI (Digital Economy and Society Index) compiles data on Europe's digital capabilities and monitors the advancements made by member countries of the EU (European Commision, 2020). From this we can conclude that the digitalization within manufacturing companies is generally higher.

The mentioned technologies affect the manufacturing process differently. Within this work digital technologies have been grouped in accordance with their effect on the manufacturing stage so far. However, the technologies themselves haven’t been categorized. This can be achieved by conducting a more systematic approach. As depicted in Figure 6 the technologies within I4.0 can be divided into two different surfaces. These two surfaces can be referred to as ‘***front-end technologies***’ and ‘***the base technologies***.

These two layers adhere to different outlooks. *The front technologies* consider how the process of utilizing new technologies is apparent in manufacturing firms. in addition to this, it views how raw materials and products are delivered, and how workers can utilize the presented technology within their frame of work. '*The base technologies'* on the other hand, give the front-end technologies the space to be interconnected. This layer initiates the I4.0 concept by providing the existing technologies the chance to co-exist and interact with limited interference. As evident in Figure 6, with the overall effect of all technologies, the manufacturing firm advances into the market (Frank, Dalenogare and Ayala, 2019).

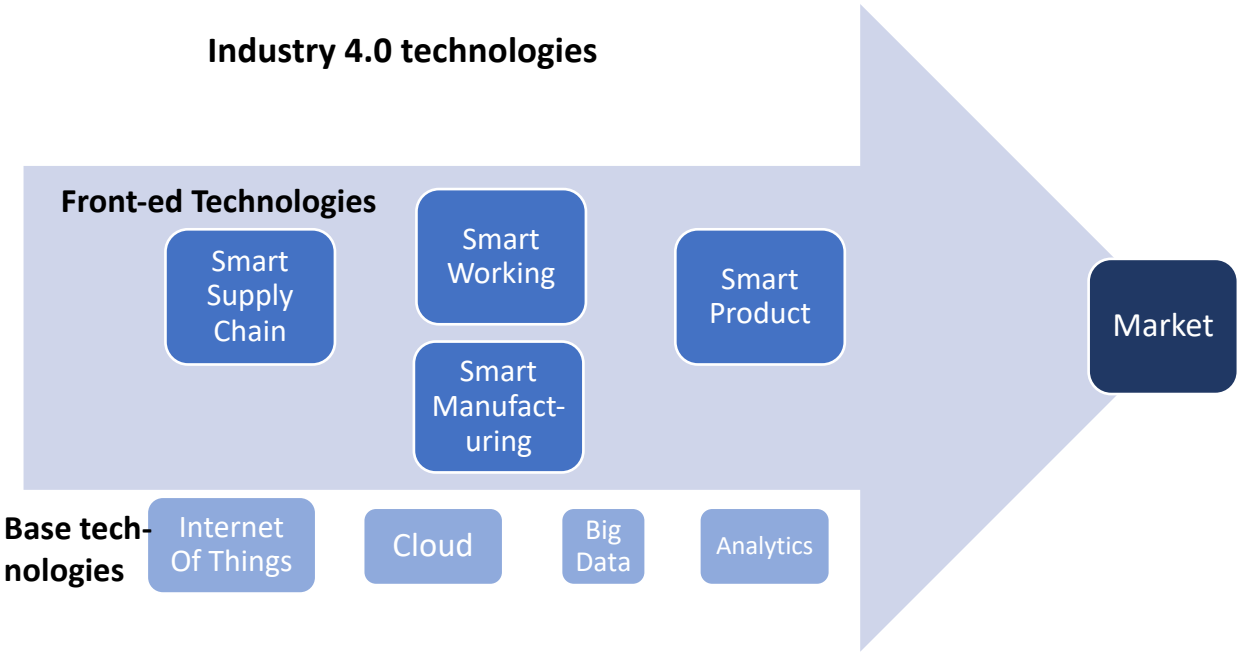

Figure 6 Industry 4.0 technologies. Modified from (Frank et al.,2019)

3.2.1 Front end technologies

'*The front-end technologies'* have affecting subgroups. These subgroupings can be divided into Smart Manufacturing, Smart Products, Smart Supply Chain, and Smart Working (Frank, Dalenogare and Ayala, 2019). Smart manufacturing can be distinguished from other manufacturing platforms due to the "*Smart"* element it provides. The smartness of the system is measured by systematic metrics. These metrics include effectiveness, leanness, robustness, adaptability, and the degree of automation (Zhuming, Lida and Puren, 2022). The technologies used in Smart Manufacturing also widely vary. They can range from manufacturing execution systems (MES), and simulation of processes, to additive manufacturing (Frank et al.,, 2019). The applied technologies and how they are categorized can be seen in Table 1. Additive manufacturing is a form of Smart Manufacturing technology that can work as an example as to how the presented categorization works. Additive manufacturing can also be referred to as 3D-printing, and it entails fabricating new parts. This form of manufacturing can be differentiated from the traditional way of producing new parts, due to its operating scheme. Instead of building the parts piece by piece, this form of technology subtracts it from the bulk material producing the final part (Rhaye, Davison and Blessie A. Basilia, 2022). This can operate as a catalyst for flexibility within the manufacturing process, by providing more leeway for the production. AM has been referred to as a prime example of flexibility within manufacturing technologies due to its nature (Weller, Kleer and Piller, 2015) This gives room for more customization, which results in the usage of the same re- sources to manufacture different end products (Frank et al., 2019).

Table 1: Technologies for Smart Manufacturing (Frank et al., 2019)

Categories	Technologies for Smart Manufacturing
Vertical integration	Sensors, actuators and Programmable Logic Controllers (PLC)
	Supervisory Control and Data Acquisition (SCADA)
	Manufacturing Execution System (MES)
Virtualization	Virtual commissioning
	Simulation of processes (e.g. digital manufacturing)
	Artificial Intelligence for predictive maintenance
	Artificial Intelligence for planning of production
Automation	Machine-to-machine communication (M2M)
	Robots (e.g. Industrial Robots, Autonomous Guided Vehicles, or similar)
	Automatic nonconformities identification in production
Traceability	Identification and traceability of raw materials
	Identification and traceability of final products
Flexibility	Additive manufacturing
	Flexible and autonomous lines
Energy management	Energy efficiency monitoring system
	Energy efficiency improving system

Whilst Smart Manufacturing serve as the primary foundation of internal operating activities, Smart Products focus more on the external value that products offer. This is achieved through the integration of customer information and data with the production system. However, these two subgroupings are intertwined, because they both asses the direct effects on the manufactured products. Smart Products are made of intelligent parts that allow them to have digital functions and services beyond their basic features (Frank et al., 2019). As seen from Table 1, the categorization in Smart Product is inherently narrower. The mentioned categorization for Smart Product technologies is smartness and interconnectivity. Products monitoring is one example, that can bring great value to customers. This requires sensors that are installed in physical products within the

manufacturing process. These sensors keep track of their usage and condition, which gives customers the capability to monitor the condition of the product and the usage factors. (Frank et al., 2019)

Table 2: Technologies for Smart Production (Frank et al.,2019)

Categories	**Technologies for Smart Products**
Capabilities of Smart, connected products	Product's connectivity
	Product's monitoring
	Product's control
	Product's optimization
	Product's autonomy

The way Smart Products and Smart Manufacturing operate alongside each other, the same concept can also be applied to Smart Supply Chain and Smart Working. These two dimensions opt to make operational activities more efficient. Smart Supply Chain impacts operational costs and delivery time, by integrating external suppliers with the factory. Smart Working, however, is more focused on what happens within the factory. As a a concept Smart Working gives workers the ability to be more flexible and efficient while attending to the set manufacturing systems. It achieves this goal by providing them with technologies that simplify their tasks. (Frank., 2019). Smart Working also requires extensive planning and can involve varying costs from employee to employee for instance (Bednar and Welch, 2018).

In Table 3 the technologies that are utilized in both Smart Working and Smart Supply Chain can be noted. Smart working opts to give workers more optimal conditions, whilst adding productivity. The technologies that work towards the goal of this dimension include augmented reality and virtual reality. In maintenance, virtual reality can advance the training process for workers through immersing simulations of the maintenance process. Smart Supply Chain technologies are inherently more focused on providing digital solutions to different stakeholders. This includes setting digital platforms, where suppliers

can exchange information in real-time about production orders with different distribution centers. Another prime example of Smart Supply Chain technology is digital platforms that connect different factories within the same company with each other. This enables the sharing of information in real-time between these factories, and makes communication more effective (Frank et al., 2019). Siemens' Digital Enterprise is one example of such digital platform (Siemens, 2023)

Table 3: Technologies for Smart Supply chain and Smart Working (Frank et al.,2019)

Technologies for Smart Supply Chain
Digital platforms with suppliers
Digital platforms with customers
Digital platforms with other company units
Technologies for Smart Working
Remote monitoring of production
Remote operation of production
Augmented reality for maintenance
Virtual reality for workers training
Augmented and virtual reality for product development
Collaborative robots

3.2.2 Base-end technologies

Base end technologies operate as the second layer of technology within the manufacturing process. They provide support for the smart technologies mentioned and are apparent in all dimensions. They build up on the I4.0 dimensions presented and make interconnectivity more possible. They bring the "smart" aspect more into play within these different dimensions. These technologies are IoT, cloud services and big data & analytics. (Frank et al., 2019)

IoT which is short for Internet of things, is a tool that combines the attributes presented by the internet, analytics, and the processing of data into the real world of physical objects. In practice this means that many appliances can take instructions with very limited human interference. This can bring efficiency to physical manufacturing (Gold, 2020). IoT also can be utilized within the supply chain process, ranging from sourcing to logistics (Zangiacomi et al., 2020). An example of IoT being utilized in different manufacturing processes can be seen in ABB. This company specializes in automation technologies. Due to their robots

being connected to the cloud through IoT, ABB can sell production simulations to their customers as services (Björkdahl, 2020).

Cloud services make the possibility of storing data in an internet server possible. This also entails that this data is available from remote connections (Frank et al., 2019). Having IT resources available through cloud services has significant economic potential, especially for small and midsized companies (Sanguineti and Zucchella, 2022). Big data analytics stand for large datasets, that require sophisticated management, visualization, and analysis technologies (Chen, Chiang and Storey, 2012). The combination of both IoT and cloud services, makes it possible to manage Big data and analytics. This exhibits how these technologies operate alongside each other to add more value for customers. (Frank et al., 2019). Big data can be an essential tool within companies that have complex and varying processes (Auschitzky, Hammer, Rajagopaul, 2017). This can be exhibited in manufacturing firms within production lines. It supports the self-organization of these lines through utilizing data.

4 Digitalization in the process of internationalization

Digitalization affects the value companies offer to their customers immensely. As previously established digitalization does not only affect the way businesses operate internally, but also externally, and this can also include international expansion. The degree of digitalization has an impact on how early firms internationalize (Lee, Falahat and Sia, 2019)Digitalization also affects the interactions of different stakeholders with locations, products, services, and data (Manyika et al., 2016). Digitalization has also worked as a catalyst in reducing the importance of geographic boundaries, in addition to the costs of international interactions and transactions (Knight et al., 2019). The degree of digital applications can influence how companies expand internationally in multiple various ways. These include the timing of international expansion, the choice of location, the entry mode into foreign markets, knowledge acquisition about foreign markets, resource allocation in both foreign and domestic markets, and managing potential risks arising from entering foreign and unfamiliar markets (Coviello, Kano and Liesch, 2017). The digital tools that are utilized in the internationalization process also vary according to which phase is in question. In addition to this, the industry also has an impact.

Different digital tools can also be utilized in different parts of the internationalization process. As depicted in Figure 1, companies tend to deepen their international involvement gradually. For instance, during the experimental stage, which entails initial entry, and is commonly conducted by export, utilizing marketing technologies can be a value adding tech nology. (Sanguineti and Zucchella, 2022). The implementation of ICT (Information and communication technologies) into the marketing strategy during initial entry is proven to expose companies to more partnerships (Westerlund, 2020). In addition to this, utilizing digital channels as a part of the export process can lessen entry costs which results in lower barrier for entry (Sanguineti and Zucchella, 2022). E-commerce is a tool that can utilized within the export process, which can make it more efficient. E-commerce, which stands for the selling and purchasing of goods through the connection of the internet (Mourya and

Gupta, 2015), makes it possible for goods to be exchanged between different parties, whilst minimizing the human factor.

In the active involvement stage (See Figure 1), the company in question is asserting more capital, and more stakes into the internationalization process. Which also means the assisting technologies opt to be more forthcoming. Joint ventures are complicated procedures, that also entail many stakeholders. For the profit margin to be optimal, it is advised for companies to utilize digital solutions within their integration. AI (Artificial Intelligence) and analytics are tools that can advance this goal. These two digital solutions can be for instance used by the financial team to optimize the procedure and provide rapid insights. Decision making also benefits from data-driven approaches (Ward, 2021). This is especially important in the case of joint ventures, since aligning goals is one of the biggest difficulties companies are faced with (Knight et al., 2019) Artificial intelligence is mentioned to be transforming the global financial services industry. Algorithmic Trading is one application that can help in advancing this goal. This term stand for a machine learning approach that learns the data and opts to predict what is coming next financially. Corporates fall under the target audience for algorithm trading, which means joint ventures have high chances of benefiting from them (Hilpisch, 2020)

In the committed involvement stage, the risks are even higher. One example of this stage of internationalization is FDI. Foreign direct investment stands for the acquisition of different capital. This includes labor, or technologies for instance. (Knight et al., 2019). FDI's can be divided into outward FDI and inward FDI's. Outward FDI refers to the amount of money that investors from a country have invested in businesses in foreign countries. On the other hand, inward FDI refers to the amount of money that foreign investors have invested in businesses located in the country reporting the data (OECD, 2022)

Digitalization can have a positive impact on a company's outward foreign direct investment by enhancing its overall productivity and alleviating constraints related to financing (Hilpisch, 2020). Yang and Bi (2019) also discovered that using "internet+"-based big data analysis can lower the risk associated with the mismatch of proprietary assets between companies, leading to an increase in foreign direct investment among firms seeking to acquire assets from overseas. In other words, digital tools that incorporate big

data analysis can help companies better understand and manage the risks associated with acquiring these assets from overseas, making them more likely to pursue FDI. One other problem that occurs when companies opt to invest overseas is the lack of information about the prospective market.

Companies can now use different digital tools such as big data and cloud computing to gather this information, which in turn makes the collection of information more effective (Peng, Yang and Jiang, 2022).

4.1 Digitalization in the internationalization process: Manufacturing industry

As previously exhibited, manufacturing firms have very diverse ways of applying digital solutions to their applications. Technology makes companies more efficient and opens them up to new possibilities, which then can be utilized within the value chain. Additive manufacturing (3D-printing) enhances the performance, by making customizable products for customers even easier (Hervé et al., 2020). These same technologies are also noted to affect the productivity, which in turn affects international competitiveness (Neugebauer, 2019).

As seen from the effects these technologies provide, the effects of digitalization in the internationalization process are somewhat indirect (Sanguineti and Zucchella, 2022). This factor is even more prominent in the manufacturing industry. Key takeaways like efficiency and lowering production costs are of interest for most companies, even when internationalization or expansion is not what the company is aiming for. This gives room for adopting digital tools in other dimensions within the internationalization process. The technologies that were analyzed in previous chapters throughout the thesis, aim to make the operations of manufacturing firms easier, and bring more value for customers. However, value can be brought to customers in other ways.

4.2 Future of digitalization in the internationalization process.

When reviewing mentioned technologies, a trend can be depicted. Most of the technologies mentioned are more focused on efficiency and the lowering of costs. However, these factors are not the only thing that contributes into the internationalization of firms. The decision to internationalize operations requires multiple cornerstones. Herve, Schmitt and Baldgger identified four primary areas of interest for entrepreneurs when engaging in international business (2020). The fields in question are:

1. Cost, accessibility, resources, and competence
2. Market knowledge
3. Distance and location
4. Relational competence and partner networks.

Digitalization can also be applied to the other elements of internationalization. Market knowledge is an extremely important factor when entering new markets. One example is export performance which is implicated by the market knowledge available to firms (Faroque et al., 2021). Being more aware of the characteristics of the market the company opts to expand to makes the process of expanding internationally more precise. Technologies that connect potential customers with the expanding company could provide them with more understanding before opting to branch out. Market research is one optimal way to acquire market knowledge in new countries. Conducting market research plays a vital role in the internationalization of the company (Puth, 2018). This stands for techniques and operating ways to garner more information about customers. Big data has been mentioned as a tool to advance market research. It provides the research with more scale, detail, automacity and timing (McQuarrie, 2016). By using digital tools in market research, higher understanding of said markets is reached.

Distance and location of the potential market also work as catalyst to either advance the internationalization of the firm or make it slower. The importance of distance is evident within the internationalization process (Williams and Grégoire, 2015). Psychic distance is also a term that falls under this category. This refers to factors that make it harder for com-

panies to understand foreign markets. The more psychic distance is exhibited the harder it is to make the new relationships in these new markets (Johanson, Jan and Vahlne, 2009). Digital tools can be used to make the effect of the distance less prominent within the process. One digital tool that is predicted to affect how distance affects the process are logistic drones. They are predicted to be a prominent force of change in distribution and logistics (Strange and Zucchella, 2017). These drones have been utilized in e-commerce for a few years. DHL, Google, and UPS are amongst the companies who have taken this feature as part of their operations (Roca-Riu and Menendez, May 2019). However, UAV regulations continue to

develop over the years. UAV's (Unmanned aerial vehicles) which is another term for drones are dual-use items (Herrick, 2017), which means they are subject to trade regulations and security concerns (Cerna, 2016). Dual-use items refer to products, software or technology that can be used in both military and civilian applications (EU, 2022). UAV's have immense potential in making the distance factor of the internationalization process more efficient, however this might require updating regulations and bigger societal changes. This can be implemented best through thorough research into international trade within the current world.

Relational competence and parent networks within this context stand for maintaining and building partnership with different stakeholders. Technology can be used in this dimension thoroughly. According to Strange and Zuchella customers can be used as providers of information in addition to providing feedback on products for firms (2017). This highlights the importance of relational competence even further, especially when the market in question is foreign. One aspect where digitalization can be used to advance this is customer relationships, and experiences. Pricing, customer experience, and customer management can be personalized through digitalization. These factors are the core of the customer experience (Rekettye, 2019). Applying more digital tools within these factions, can open companies to more opportunities, and widen their horizons. Digital tools connect people more efficiently than ever. These same techniques can be used to garner a wider audience, and customer segment. Testing products can also be done through digital tools, depending on the nature of the product.

5 Conclusions

The aim of this thesis was conducting research, adhering to different internationalization elements and how they can further benefit from digital solutions. It is very apparent the way digitalization is continuously changing how organizations operate. Growth strategies, such as internationalization also benefit from this transformation The result of this thesis proves that the research on this topic has been unilateral up to some extent. Most focus has been on the way digitalization affects the efficiency of companies, which then works as a catalyst in making the internationalization process more optimal. In other words, the effects of these digital solutions can be seen in the process, but in an indirect manner. However as established when analyzing internationalization as a process efficiency is not the only factor affecting this process. Other factors such as cultural sensitivity, distance, market position are all af- fecting factors when a company wants to expand their operations. The research on how these other elements can be impacted with digitalization seems to be somewhat narrow.

Most internationalization theories also haven't been updated to consider how digital the op- erating scheme for companies currently is. For instance, the threshold to advance in interna- tional operations might be lower, due to how connected the world is through digitalization. The process nature of internationalization can also be somewhat debunked in some instances. More and more companies are either born international or just simply integrate the interna- tionalization process into their operations from a very early stage. This highlights the im- portance of addressing all factors that contribute into the internationalization of firms. Fol- low up research can be conducted within these themes. Research on how internationalization theories can take digitalization more into observation is needed. With this research more understanding of both elements will be provided, and the cause-and effect can be noticed easier. In addition to this it opens more doors for research on the other elements of interna- tionalization, where the impact of digitalization isn't as easy to exhibit.

Within manufacturing companies, we can notice the previously mentioned trends even more. Manufacturing companies tend to require more investments in initial stages, which

can also highlight the need for efficiency even more. However, it is important to note that efficiency

within itself is not enough to conduct successful international operations. Especially when the company is planning on furthering their internationalization and not just sticking to initial entry. The research on how digitalization is used in manufacturing firms on a general manner is extensive. The same cannot be said when discussing the internationalization process. Many factors are overlooked, which results in potential being wasted. In other words, digi- talization's impact can be further utilized by applying it to affecting parts of the internation- alization process. These parts should be re-identified. This can be conducted through updat- ing internationalization theories and taking the effects of digital solutions more into consid- eration.

Through updating models and putting more focus on internationalization in the sphere of the digital world, companies can benefit immensely. The information becomes more structured and is also more efficiently integrated into growth strategies.

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