NTNU – Trondheim
Norwegian University of
Science and Technology

On Technology and Internationalisation

An Empirical Study of Norwegian
International SMEs

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Oppstartsdato	Innleveringsfrist
15. jan 2014	**11. jun 2014**
Oppgavens (foreløpige) tittel	
Technology and competitiveness of international new ventures	
Oppgavetekst/Problembeskrivelse	
An empirical study of the competitiveness and internationalisation of the Norwegian business sector.	
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Partene er gjort kjent med avtalens vilkår, samt kapitlene i studiehåndboken om generelle regler og aktuell studieplan for masterstudiet.

Trondheim 9.1.2014
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Sted og dato

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Kandidatene skal ha *individuell* bedømmelse
Kandidatene skal ha *felles* bedømmelse   ☒

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PREFACE

This master thesis marks the conclusion of the authors' master of science program in Industrial Economics and Technological Management at the Norwegian University of Science and Technology. The thesis was written during the spring semester of 2014.

The study is within the field of international business and explores the relationship between different aspects of technology and their influence of the internationalisation on small- and medium-sized enterprises (SMEs).

There are several people that have been valuable to the completion of this study. First of all, we would like to thank our academic supervisor Professor Arild Aspelund for his invaluable guidance, constructive feedback, and supportive demeanour.

Further, we would like to thank PhD candidate and supervisor Ann Elida Eide and PhD candidate Mohammed Javadinia Azari. Working together on the questionnaire was a great experience, and we also appreciate their ability to motivate and encourage us through the entire process.

Last, we would like to give a shout out to the creators, developers and contributors of the 9gag- and Curvefever-communities. In times of procrastination, no other sites gave so much joy and spill over-effects to our thesis as these communities.

Trondheim, 2014-06-10

Morten Urdal Bakke   Erik Hjørnevik

ABSTRACT

This empirical study investigates the relationship between technology and the internationalisation process of small- and medium-sized enterprises. First, a theoretical overview of globalisation, internationalisation, and technology is given. Drawing on the literature from these fields, two hypotheses regarding the relationship between internationalisation, technology, and firm age are presented. Thereafter, a quantitative analysis of SMEs is performed and the results of this analysis is related to the theory and thoroughly discussed. Finally, some implications for researchers, managers, and policy-makers are discussed.

The analysis of this paper reveals that there is no significant relationship between technology and the degree of internationalisation suggesting that technology is not a driver of degree of firm internationalisation. This could be due to the spread of technology throughout industries, giving all firms access to technologies that either mitigate challenges with internationalisation or removes competitive advantages that some firms had some decades ago due to unique technology. Further, it is discovered that firm age is significantly related to the speed of internationalisation, suggesting that the changing macro-environment of firms is a driver for internationalisation behaviour.

The implications for researchers are that more focus should be directed to international SMEs in low-tech sectors. These firms have been mostly overlooked in international strategy research the last couple of decades but should be interesting to study as technology is not a driver for degree of internationalisation. The results also suggest that managers should focus on areas such as networks and firm attitudes to help their internationalisation process. For policy-makers the results indicate that other measures than technology development should be deployed to improve a country's export performance.

Sammendrag

Denne oppgaven utforsker sammenhengende mellom teknologi og internasjonaliseringsprosessen til små og mellomstore selskaper (SMEs). Oppgaven vil først presentere en oversikt over ulike teorier innen globaliserings-, internasjonaliserings- og teknologilitteraturen. Deretter vil disse teoriene benyttes til å utvikle to hypoteser som omhandler forholdet mellom internasjonalisering og teknologi, og forholdet mellom internasjonalisering og alderen på et selskap. Videre vil en kvantitativ analyse utføres basert på et datasett med små og mellomstore selskaper før resultatene blir analysert og diskutert. I forbindelse med diskusjonen vil det bli reflektert over hvilke betydninger disse resultatene kan ha for forskere, ledere og beslutningstakere generelt.

Analysen avslører at det ikke er noen signifikant kobling mellom teknologi og graden av internasjonalisering til små og mellomstore internasjonale selskaper. Årsaken kan være at teknologi de siste årene har spredd seg i mange industrier og dermed er tilgjengelige for mange SMEs. Dette kan ha redusert barrierene for å gjøre forretninger internasjonalt eller redusert konkurransefortrinnet som tidligere var forbundet med slike teknologier. Videre ble det også funnet i analysen at selskapsalder er relatert til internasjonaliseringshastighet i signifikant grad. Dette tyder på at endringen i selskapers makroomgivelser er knyttet til disse selskapenes internasjonaliseringsaktiviteter.

Det anbefales at forskere øker sitt fokus på internasjonale SMEs som befinner seg i lav-teknologi-sektorer. Disse selskapene har i de siste årene blitt oversett i internasjonal forskning, men bør ut fra våre funn relatert til teknologi være interessante å undersøke nærmere. Det foreslås også at ledere bør fokusere på områder som nettverksbygging og selskapsholdninger i stedet for teknologi dersom de ønsker å øke sine aktiviteter internasjonalt. For politikere kan resultatene tyde på at man bør iverksette andre virkemidler enn teknologiutvikling for å øke eksport til utlandet.

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"Technology and ideology are shaking the foundation of the twenty-first century capitalism. Technology is making skills and knowledge the only sources of sustainable strategic advantage."

- Lester Thurow

CHAPTER

1

INTRODUCTION

The relationship between internationalisation and technology has occupied the research agenda of international strategy researchers for a long time. One area of interest has been the ways in which technological knowledge enables a firm to internationalise (Buckley and Casson, 1976; Caves, 2007; Dunning, 1988; Morck and Yeung, 1991). More specific, technological knowledge is often regarded as a pre-condition for firms' expansion and a dominant determinant of a firm's level of internationalisation (Spender, 1996; Teece, 1982; Geisler Asmussen et al., 2011).

Within the field of international strategy several models have been proposed in order to explain the internationalisation process of firms. The 1970s saw the emergence of the stage theories of internationalisation represented by the U-model and the I-model (Johanson and Vahlne, 1977; Bilkey and Tesar, 1977; Cavusgil, 1980). In the early 1990s a new internationalisation model describing firms that internationalise shortly after inception and in a rapid

manner challenged the stage models. These firms are most commonly referred to as International New Ventures (Oviatt and McDougall, 1994) or Born Globals (Rennie, 1993; Knight, 1997). This paper will refer to the phenomenon as INVs.

INVs internationalise at a young age in spite of facing several liabilities (Zahra, 2005). Given the ability of INVs to compete at pair with incumbent firms they must possess one or several unique advantages. Knowledge, and technology in particular, has been suggested as a factor helping INVs with their rapid internationalisation (e.g. Oviatt and McDougall, 1994; Madsen and Servais, 1997; Bell, 1995). This may be due to new ventures ability to be flexible in times of industry shifts and introduce new, advanced technology (Jolly et al., 1992), or due to the simplicity of transferring intangible assets such as knowledge or technology across national borders (Kotha et al., 2001). Researchers also argue that technology-intensive firms in general have a propensity to internationalise due to their small size or due to strong competition in the domestic market (Oesterle, 1997; Crick and Jones, 2000).

While several authors point to technology as a source for INVs' ability to compete in the marketplace, little effort have been done to investigate how different types of international firms, including INVs, differ from each other in terms of technology. Given the radically different behaviour of INVs to other firms it could be expected that INVs use technology differently.

Research objective The objective of this study is to investigate the relationship between technology and degree of internationalisation. More specifically the study will try to determine how different types of international firms differ in terms of technology. Extra attention will be paid to INVs as the literature suggests a strong reliance on technology for these firms and because INVs have occupied the research agenda the last two decades.

Goals The goal of this study is to investigate one of the proposed drivers of internationalisation, namely technology. The authors wish to expand the

understanding of how technology affects the internationalisation decision of young firms. Hopefully, by investigating the subject this paper will be able to contribution to the international strategy literature in general and the INV literature in particular. The authors hope that findings made in this study may encourage and inspire other researchers to follow up or make similar investigations in order to create a more balanced view of the role of technology in internationalisation.

Configuration of thesis   The thesis starts of by giving a presentation of theory on internationalisation and technology. Next, different aspects of technology are presented before the hypotheses are developed. After a short stop in the methodology department for an explanation of the research method the dataset and results are presented. This is followed by a discussion of the findings before the thesis arrives at the conclusion. Limitations of the study are presented at the end.

CHAPTER

2

THEORETICAL OVERVIEW

In this chapter a theoretical overview will be given. First, theory on internationalisation and technology is given. Next, four types of international firms are presented. Then different aspects of technology are summarised before the hypotheses are presented.

2.1 DRIVERS OF INTERNATIONALISATION

2.1.1 GLOBALISATION

One of the most noticeable trends of the international business today is the globalisation of markets (Cavusgil et al., 2012; Bang and Markeset, 2011). Stiglitz (2006) argues that globalisation has led to international flow of ideas and knowledge, and closer economic integration worldwide through increased flow of goods and services, capital, and labour.

According to Bang and Markeset (2011) globalisation may be divided into two distinct parts, namely drivers and effects. Five drivers that have been most frequently mentioned within the globalisation literature are lower trade barriers, lower transportation costs, lower communication costs, information and communication technology (ICT) development, and spread of technology. Lower trade barriers contribute to opening channels to foreign technology and facilitate investment and participation in the global economy (IMF, 2008). Lower transportation and communication costs increase the opportunity for a product to be more competitive across markets, and have established a stronger link and integration between economies and world markets (Bang and Markeset, 2011). The ICT development has simplified the challenge of people working together despite being at different locations, and has enabled a great expansion of international supply chains, leading to potential cost reduction through increased foreign investments and foreign supplier partnerships (Friedman, 2007; Milberg and Winkler, 2009). Technologies such as digital, manufacturing, and production technology are spreading across the world and access to these technologies is increasing (Bang and Markeset, 2011).

In terms of effects of globalisation, Bang and Markeset (2011) argue that globalisation has led to size effects, pressure effects, and location effects. The size of the markets that a firm operates in today is now significantly larger, meaning that the market potential of products and services may be considered to

be global rather than local. This has led to more potential clients, more potential competitors, and more potential suppliers and co-operating partners. Further, the increased numbers of competitors in the market has led to an intensified competitive pressure (van Liemt, 1991), and have increased the cost and price pressure within the markets (Burda and Dluhosch, 2002). Last, location effects describe the potential effect on the activities of the firm. Globalisation has increased the fragmentation of a firm's value chain into more standardised activities, enabling firms to focus on core activities and outsourcing a variety of business functions (Krugman, 1995; Flecker, 2009).

One reason for the fragmentation of the value chain could be described using the Smiley Curve concept developed by Stan Shih (Zakaria, 2008). The smiley curve shows the relationship between profit margin and stage in the value chain. As can be seen in figure 2.1 the highest profit margins are found in the engineering and development stages at the beginning as well as the marketing and sales stages at the end of the value chain. Manufacturing and shipping of the product is generally associated with lower profit margins. As firms in countries with a high level of living standard will have trouble supporting their lifestyle when operating in low profit margin stages they will prefer to outsource these activities. This will increase the international posture of these firms as they have to develop international networks.

2.1.2   COMPETITIVE ADVANTAGE

The globalisation of markets and economic activities has resulted in increased firm competition (Alvarez et al., 2009). Therefore, creating competitive advantage over competitors seems to be more difficult than ever, but nevertheless just as important in order to be competitive. By expanding their business portfolio to include foreign markets, firms are able to diversify risk and open up new areas in which potential sales can be made. Thus, as firms go abroad they increase the opportunity of gaining competitive advantage on international basis, an international competitive advantage. This is "either the
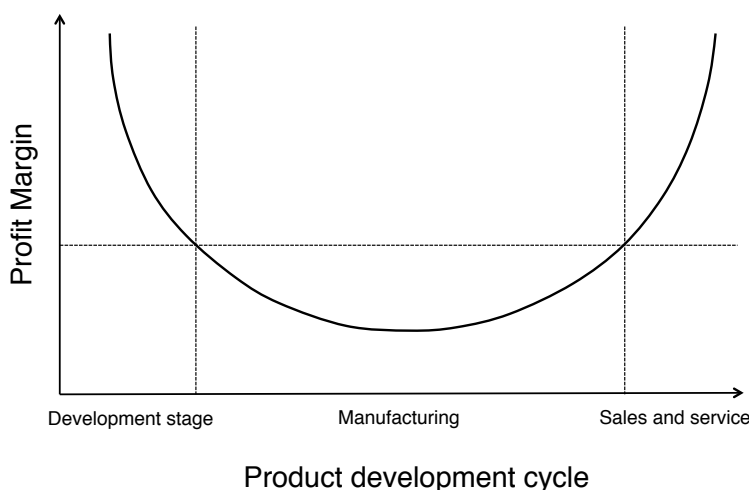
Figure 2.1: The smiley curve

presence of substantial and sustained exports to a wide array of other nations
and/or significant outbound foreign investment based on skills and assets created
in the home country" (Porter, 1990, p. 19).

Lately, technology-based industries have increased their international presence
mainly due to multinational technology-based firms (Karagozoglu and Lindell,
1998).   Although large and mature firms with extensive international
activities have driven this change (Kobrin, 1991), this has also opened for
technology-based SMEs gaining international perspectives (Litvak, 1990). These
firms, which may be characterised as knowledge-intensive firms, tend to
internationalise faster as they hold a competitive advantage that may be
exploited in foreign markets (Oviatt and McDougall, 2005). This competitive
advantage may emerge as a result of these companies holding unique assets,
which an increasing number of researchers perceive as important in order to gain
internationally sustainable advantage (Barney, 1991; Caves, 1982; Prahalad and
Hamel, 1990; Stalk et al., 1992). In this regard technology may be recognized

as such an asset. Technology, and more specifically technological knowledge, often has a tacit knowledge component that together with firm specificity and complexity makes the resource inimitable (Kogut and Zander, 1993) and thus a source of competitive advantage for SMEs.

2.2 TECHNOLOGY

Different researchers have suggested different definitions and explanations for the word technology. However, there does not seem to be a common agreed upon definition (van Wyk, 1984; Grinstein and Goldman, 2006). In this paper technology is defined as "those tools, devices, and knowledge that mediate between inputs and outputs (process technology) and/or that create new products or services (product technology)" (Rosenberg, 1972). Technology could both contribute directly in the product offering or indirectly through production and administrative processes.

An important part of technology is the knowledge component. Knowledge is an intangible resource that many researchers argue to be valuable, rare, difficult to imitate, and organisation-specific (Barney, 1991; Kogut and Zander, 1996; Spender, 1996). In the resource-based view theory, where competitive advantage of firms is thought to be a consequence of their resources, a resource with these four characteristics is believed to be a source of competitive advantage.

A firm's ability to acquire knowledge is decided by their absorptive capacity. Absorptive capacity is a concept describing how firms transfer and apply knowledge from the environment (Cohen and Levinthal, 1990). Zahra and George (2002) view this transformation as a two-step process. First, knowledge is transferred from an external source into the firm. This is known as knowledge acquisition. Second, the knowledge is applied in the firm through development of new products and processes or through refinement of existing products and processes. This is reffered to as knowledge exploration and knowledge exploitation.

A distinction is often made between high-technology industries (high-tech) and low-technology industries (low-tech). As with technology there seems to be no agreed upon definition of these two categories (Dean et al., 1998; Lee and Miller, 1996). Covin et al. (1990, p. 393) say that high-tech industries are technologically sophisticated industries while low-tech industries are not. Wong (1990) claims that due to the high rate of change in the industry, no standard definition of high-tech exists. However, there seems to be a general understanding that high-tech is closely related to the use of state-of-the-art technology in manufacturing and/or the product offering itself (Wong, 1990). The low-technology industry is based on "an established technology that can be purchased through well-known market channels" (Boter and Holmquist, 1996) and includes all industries not categorised as high-tech. Due to technological development a high-tech industry could very well fall into the low-tech industry category over time as the technology utilised will become standardised.

Technology could also be categorised according to the radicalness of the technological innovation. Innovation leads to increased productivity and is thus one of the main drivers of economic growth (Lucas Jr, 1988; Sood and Tellis, 2005). Henderson and Clark (1990) suggest that all innovation can be place on a scale ranging from incremental, through modular and architectural, to radical. Thus, technology can be categorised based on the radicalness of the technological innovation.

2.3 ASPECTS OF TECHNOLOGY

While the definition of technology is vague and varying in nature, several aspects of technology have been identified. These include the acquisition of technology, the refinement of technological knowledge, and the technological innovation radicality. These aspects of technology will be presented next.

2.3.1 Technology acquisition

To add technological knowledge to their resource base a firm first has to acquire this knowledge. Zahra and George (2002) list three possible ways to access technological knowledge: Develop technology through R&D, buy it in the marketplace, or transfer it from other firms or institutions.

Developing technology through internal R&D will facilitate the creation of a new and unique technology and is thus more likely to give a unique resource that will give a firm a sustainable competitive advantage (Barney, 1991). Buying technology in the market, either from suppliers or competitors, will also add to the knowledge-base of a firm. However, this technology will not be unique as other firms can buy the same technology (Arora and Nandkumar, 2012) making it a less likely source of competitive advantage according to the resource-based view of the firm (Barney, 1991). The third option is to acquire technological knowledge from other institutions like universities or research establishments. Technology transfer could be done through research links facilitating technology and knowledge transfers between the firms and the institution or through the establishment of a spin-off firm from the institution (Lindelöf and Löfsten, 2004). Narula (2004) says that both large and small firms prefer to outsource applied research and product development to institutes as this reduces the risk of losing valuable technology to current or potential competitors.

2.3.2 Technological refinement

When a firm acquires new technological knowledge this knowledge has to be processed internally. This is done through a firm's exploration and exploitation capabilities (Yalcinkaya et al., 2007). Exploration and exploitation capabilities are the second step of what Zahra and George (2002) refers to as absorptive capacity. March (1991, p. 85) defines exploration as "experimentation with new alternatives having returns that are uncertain, distant, and often negative" while exploitation is defined as "the refinement and extension of existing competencies,

technologies, and paradigms exhibiting returns that are positive, proximate, and predictable." Exploration could be viewed as the development of brand new products and processes, making a firm capable of developing and implementing new knowledge (Miller, 2003). Exploitation entails further enhancement of existing products and processes.

Yalcinkaya et al. (2007) find that exploration capabilities influence both the degree of product innovation and market performance positively. Exploitation capabilities on the other hand are negatively related to product development and market performance. This is in line with Lisboa et al. (2011) who find that only exploration capabilities have a positive effect on new product differentiation and market effectiveness. Garcia-Muina and Navas-Lopez (2007) argue that firms with a high level of exploration capabilities will perform better in a competitive and dynamic environment. In a dynamic environment the dominant design cycles are short forcing firms to respond quickly to a new dominant design (Danneels, 2002).

2.3.3 Niche position and radicalness of technology

When entering a market a new firm will meet competition from incumbents. According to Porter (1985) a new firm can beat the competition in two ways: Either they can have lower cost, a low-cost position, or they can choose a differentiation position through targeting new customer segments or differentiate their product offering. Due to lack of economies of scale new and small firms will have difficulty in competing on cost due to lack of economies of scale and an established supplier network (Zahra, 2005; Oviatt and McDougall, 1994). Thus, a niche position seems to be the best choice for these firms, while established firms seem more likely to compete on cost.

To enter a market with a niche position a firm has to take a new product to the customers. Usually this product is based on a technology resulting from a radical innovation. Anderson and Tushman (1990) say that new entrants will bring radical innovations to the market. There seems to be several reasons for

this. Henderson and Clark (1990) argue that already established organisational filters and routines will keep a firm in the same track and only give incremental innovations. Teece et al. (1997, p. 522) blame path dependency and say that "a firm's previous investments and its repertoire of routines (its 'history') constrain its future behaviour. Some researchers also blame the bureaucratic inertia of larger firms saying that this inertia makes the firms slower in terms of reacting to radically new products (Kimberly, 1976; Tornatzky and Fleischer, 1990). Mukoyama (2003) argues that the Arrow effect gives incumbents less incentive to innovate than outsiders. The Arrow effect says that an outsider will get greater profits from a new technology compared to an incumbent because the incumbent are already selling a product in the market (Etro, 2004).

Even though many researchers claim that new firms are behind most radical innovation, Chandy and Tellis (2000) argue otherwise. They found that incumbent firms were behind a substantial part of the radical innovation introductions since World War II. Christensen and Rosenbloom (1995) give a possible explanation for this through their differentiation between sustaining and disruptive innovations. They argue that the value network will determine what kind of technologies a firm will invest in. The value network is a firm's suppliers, distributors, customers, partners, and ancillary providers that together limit a firm's ability to be disruptive (Christensen, 1997). A disruptive innovation is an innovation that breaks the technology trajectory. A sustaining innovation on the other hand follows the trajectory. However, both types of innovations can be radical (Christensen and Rosenbloom, 1995). Incumbents will therefore take radical innovations to the marketplace as long as these are sustaining innovations. New firms, on the other hand, should be expected to focus on disruptive innovations.

2.4   International firm categorisation

Firms differ in their internationalisation behaviour. Aspelund et al. (2005), when looking at different traits describing a firm's internationalisation pattern,

identified four types of firms: International New Ventures (INVs), Early Internationals, Late Internationals, and Late Globals. Of these firm types INVs stand out as being more intensive in their internationalisation behaviour. INVs and Early Internationals use short time from inception to their first sale, while INVs and Late Globals get a large portion of their revenue from foreign markets. Thus, INVs are aggressive compared to other firms on several aspects of internationalisation behaviour and could give clues to what drives internationalisation in a firm.

The INV phenomenon, also referred to as born globals (Rennie, 1993; Knight and Cavusgil, 1996; Madsen and Servais, 1997), high-technology start-ups (Jolly et al., 1992), and infant multinationals (Lindqvist, 1991), got considerable attention following the paper of Oviatt and McDougall (1994). According to McDougall et al. (1994) INVs do not fit the established stage-theory of internationalisation and represents a new way to view the internationalisation pattern of firms. Other researchers, however, claim that the way INVs internationalise in a pattern that fits a modified view of the establishment chain and is thus in accordance with the stage-theory (Johanson and Vahlne, 2009; Madsen and Servais, 1997).

INVs utilise an innovative approach to products, markets, and staff to internationalise in a more rapid manner, jumping steps in the stage-theory internationalisation model (McDougall et al., 2003). Specifically several authors points to the use of alternative governance structures including strategic alliances with other firms and partnerships as a distinguishing character of INVs (Oviatt and McDougall, 1994; Freeman et al., 2006; Gabrielsson and Kirpalani, 2004; Madsen and Servais, 1997).

INVs experience three types of liabilities at inception: Liability of newness, smallness, and foreignness (Zahra, 2005). Being new and inexperienced in new markets restricts the access to resources and existing networks, while the smallness of INVs limits slack resources and thus their capability of withstanding the challenges of internationalisation. In addition, being a foreigner in most

markets INVs must also overcome barriers to entry, create links to customers and suppliers, and make themselves attractive towards potential customers. To overcome these liabilities INVs need to have some competitive advantages over incumbent firms. According to Oviatt and McDougall (1994), the sources of such competitive advantages are location-specific advantage and unique resources. As INVs often are small and technology-oriented firms (Bell, 1995; Knight and Cavusgil, 1996), unique technological knowledge could prove to be a resource that may create a sustainable competitive advantage for INVs. Aspelund et al. (2005) support this when finding that INVs have a technology advantage compared to Late Internationals.

Several factors have contributed to the emergence of INVs. Oviatt and McDougall (1994) believe that the changing international environment is a key reason. Due to a dramatic increase in speed, quality, and efficiency in international communication and transportation countries are linked more efficiently than before. Further, employees' increased international experience and knowledge about conducting international business have been attributed to the emergence of INVs, as these skills are believed to facilitate firm internationalisation (McDougall et al., 1994; Terjesen et al., 2008). This is concurrent with Madsen and Servais (1997) who note changing market conditions such as liberalisation of physical and financial markets, technological changes in areas such as production, transportation and ICT, and increased capabilities of people as drivers behind the development in international business.

2.5 HYPOTHESIS 1: INTERNATIONALISATION AND TECHNOLOGY

Different groups of international firms have different characteristics. This seems likely to also affect their choices in terms of technology.

When acquiring a new technology larger and older firms often have the resources to develop this knowledge internally. Smaller firms will thus be at a disadvantage to older firms as they have fewer resources to use on R&D (Narula, 2004). Thus, smaller firms seem likely to turn to external sources like the marketplace or universities to acquire technological knowledge.

If the smaller firm is an international firm, for example and INV, it will get access to information and products from different geographical areas due to their presence in several markets abroad (Porter, 1990; Zaheer and Bell, 2005). This could give a highly international firm a possibility to buy a technology that other, less international firms will not be aware of (Priem and Butler, 2001). The degree of internationalisation, like the number of foreign markets, could thus affect the advantage derived from buying technology in the marketplace. Keller (2000) finds that technological knowledge is local and that the distance from the source of innovation influences the adoption rate. This supports the notion of advantage from being present in certain geographical areas. However, several authors argue that technological knowledge is exchanged between regions on an international basis and is therefore global (Bathelt et al., 2004; Doloreux and Parto, 2005). Second, in the increasingly globalised world of today information spreads quickly and the advantage gain from buying technology in the marketplace is at best temporary. This would be an argument against the notion of a competitive advantage derived from being present in more foreign markets.

In terms of refinement of the technological knowledge there could also be differences between different groups of firms. For example, INVs, due to their international focus from inception (Oviatt and McDougall, 1994), operate in a competitive and dynamic marketplace characterised by great competitive pressure (Rodriguez and Rodriguez, 2005). Thus, it seems that exploration capabilities will positively influence an INV's performance. On the other hand, exploration is riskier, slower, and more costly than exploitation (March, 1991; Levinthal and March, 1993; Bierly III et al., 2009). Excess resources would therefore be preferable for a firm undertaking explorative activities and would also allow a firm to better absorb external uncertainties (Cheng and Kesner, 1997;

Galbraith, 1968). Larger and older firms like Late Internationals and Late Globals
have a stronger resource base than INVs and Early Internationals, and would
therefore be in a better position to undertake explorative activities (Carayannis
and Roy, 2000). However, large firms have an established value network and cost
structure. This leads the firms to focus on exploitation rather than exploration
because the fit with their customers' demand and their organisational structure
is better (Miller and Friesen, 1984; Wischnevsky and Damanpour, 2005). Young
firms do not have the same established value network making it easier for them
to engage in exploration activities. Chang (1996) confirms this with his findings
that larger firms are more likely to exploit current technologies. On the other
side, firms lacking former financial success are more likely to engage in explorative
activities.

In terms of the radicality of a technological innovation newer firms appear to be
more radical than older firms. First, new firms lack a value network giving them
greater flexibility with regard to what type technologies to develop. Technology
based on incremental innovations will give products that are very similar to
existing products, placing new firms in direct competition with incumbent
firms. These firms will often have a cost-advantage over new firms due to size
and age. Thus, products based on radical innovations, and ideally disruptive
innovations, seems more likely to make new firms competitive. This has been
supported by research findings. Investigating new technology-based firms the
Aspelund et al. (2005) found that firms with more radical innovations had a
greater chance of survival. Other researchers have also shown that firms with
international connections are well positioned in terms of radical innovations.
Fitjar and Rodriguez-Pose (2011) find that firms with a greater diversity of
international partners have a tendency to introduce more radical innovations.
Given the high degree of internationalisation of for example INVs compared to
Early Internationals it seems likely that INVs will rely on more radical technology.
On the other hand, Christensen and Rosenbloom (1995) argue that many radical
innovations is introduced by incumbent firms. While these innovations tend to
be sustaining rather than disruptive, they are still radical. This is supported by

Chandy and Tellis (2000) who find not only that incumbent large firms are behind about half of all radical innovations, but that the portion of radical innovations from these firms has increased over time.

While some of the arguments above may indicate a lack of difference between firms in terms of technology the literature in general seems to suggest that different types of firms will use technology differently. As a firm needs to have resources and technological knowledge to build a product before it can begin to sell and internationalise, it seems that technology could be a driver for internationalisation behaviour. This leads to the first hypothesis:

> ***H1:*** *Technology will influence the internationalisation behaviour of firms.*

2.6   HYPOTHESIS 2:   INTERNATIONALISATION AND AGE

The development of hypothesis 1 touched upon firm age when describing different technological choices made by firms. For example, older firms are more likely to have more resources, leading to a higher dependence on R&D (Narula, 2004). Further, age is creating a rigid value network, removing the flexibility of older firms to undertake radical, disruptive innovation (Christensen and Rosenbloom, 1995). As technology is hypothesised to be a driver of internationalisation older firms seems likely to internationalise in another manner than younger firms.

Another factor that could affect the internationalisation of firms in terms of age is globalisation. Older firms emerged at a time when the competitive environment was far different compared to today. As technology is accelerating at an exponential rate (Kurzweil, 2005) the influence of technology and

internationalisation could have change over the last decades, influencing the role of technology on internationalisation. Today technology is spreading at an increasing rate giving more firms access to technology that could help them in the internationalisation process (Bang and Markeset, 2011). Second, markets are more interconnected making it easier for new companies to reach out to customers in other countries. Further, the technological development has lowered the cost both in terms of production and communication technology (Stiglitz, 2006; Friedman, 2007), allowing smaller and more resource-scarce firms to internationalise earlier and faster compared to firms some decades ago.

The changing nature of the technological landscape and the difference between young and old firms in terms of technology when they emerged leads to the second hypothesis:

> **H2:** *The internationalisation behaviour of a firm is influenced by firm age.*

CHAPTER

$$3$$

METHODOLOGY

Research may be considered as a search for knowledge. To produce good research and acquire this knowledge, research should be systematic, logical, empirical and replicable. In order to achieve this, researchers must pay attention to the research design and follow the appropriate methodology if they are to improve the quality of their research. Thus, it is important to choose a proper research methodology (Kothari, 1990). This part will explain the underlying methods and techniques that have been used to answer this paper's research objective. Initially, the choice of research method is presented. Thereafter, the data set of this paper is presented before the constructs and statistical methods will be introduced.

3.1   Choice of research method

A question that frequently arises in relation to educational research is how the desired data should be collected. Two major approaches tend to be preferred, namely quantitative and qualitative research methods (Yilmaz, 2013). This paper uses a quantitative approach based on the arguments that follows.

First, the hypotheses presented in this paper are to a large degree generalisations of the relationship between technology and internationalisation. In order to test this paper's hypotheses it is beneficial to investigate as many firms as possible. According to Borrego et al. (2009), quantitative studies facilitate the possibility to project findings onto larger populations and thus make valid generalisations. This is supported by Yilmaz (2013), who states that the aim of quantitative research is to make predictions and generalisations. Following this line of argument the quantitative approach was acknowledged as a good fit for the purpose of this thesis.

Further, a quantitative approach facilitates use of a questionnaire when collecting data, which is a popular and common data collecting tool in economics and business studies (Kothari, 1990). According to Yin (2012), survey methods such as questionnaires are advantageous when the research goal is to investigate an incident or the prevalence of the phenomenon in question, when the researcher has no control over the behavioural events, or when the research is based on contemporary events. As this paper is looking into the prevalence of the relationship between technology and internationalisation, using survey methods to investigate this subject seems appropriate.

Last, the use of a quantitative research method limits bias and interaction with participants (Borrego et al., 2009). The research method will therefore mitigate the impact of a researcher's own perceptions on the data set and make the data sampling and analysis more objective. Together with the above mention arguments this lead to the choice of a quantitative research method.

3.2 DATASET

3.2.1 SURVEY

Data collection To collect the necessary data a questionnaire was developed by two PhD students from the Institute of Industrial Economics and Technology Management department. To ensure validity the questions in the survey build upon previous work by researchers (Branzei and Vertinsky, 2006; Gatignon et al., 2002; Kuivalainen et al., 2007). Then a draft of the final questionnaire was prepared. The draft was thoroughly reviewed and altered with the guidance from professors at the Department of Industrial Economics and Technology Management at the Norwegian University of Science and Technology. before being deployed. In addition a pilot study involving ten companies was performed. The questionnaire was then divided into three batches sorted in alphabetical order and was sent in the time span of 28th of April to 2nd of May. In addition an E-mail was sent to all the companies inviting them to participate in a web-based survey identical to the survey sent out by mail. To increase the response rate a random sample of the companies were called and asked if they wanted to participate. In addition two reminders were sent out by E-mail.

Variables in survey The data from the survey consists of three types of variable categories: Natural scale, nominal scale, and ordinal scale. Only natural scale and ordinal scale variables was used in the analysis in this paper. Natural scales were used when the output is a number, for example year of establishment. Ordinal scales were used to indicate the position on a 7-levelled Likert scale in which the number represents a degree of agreement or disagreement with a statement.

3.2.2 SAMPLE

In total, 2262 small and medium-sized (SMEs) Norwegian companies from the KOMPASS database were contacted. SMEs are companies with a maximum of 500 employees and they makes up more than 99.9% of all firms in Norway (SSB, 2014). A total of 300 firms replied, giving a response rate of 13.26%. 74 responses were delivered by mail and the remaining 226 responses were completed on the web. Of the 300 responses, three companies were removed due to exceeding the maximum limit for employees. Two more companies were detected by data from PROFF Forvalt to have exceeded the limit, but as the firms were subsidiaries and reported a size below the maximum of 500 employees, it was decided to keep the firms in the data set. Further, 97 companies were removed due to insufficient answers regarding speed of internationalisation and/or foreign sales. Two firms were recognised as outliers in the data set and removed. Last, seven firms were removed due to lack of export sales. This left a total of 191 responses for the analysis. The survey was mostly answered by a firm's managing director or financial manager which should indicate that the information given is correct.

In order to assess the validation of the sample, a comparison with Aspelund and Moen's sample from 1997 was performed. Comparing main characteristics such as company age, size and international commitment may indicate whether this paper's sample is valid or not. Both samples contained firms of similar size (44 employees versus 43 employees). In terms of age, the firms in this paper's sample was also identical to those of Aspelund et al. (2005) (44.6 years versus 44.1 years). The results chapter will show that the samples are equal also in terms of internatinoal commitment. Based on the similarity between the two samples it is concluded that two samples are of similar basic characteristics. This indicates that the response rate is acceptable and that the sample can be considered representative for the population.

3.2.3   Sample characteristics

The characteristics of the dataset is summarised in table 3.1. An interesting observation is that there seems to be great heterogeneity in the sample. Firm age varies from 1 to 138 years with an over- representation of younger firms. With regard to industry the sample is cross-sectional with industries from aquaculture to high-technology represented. Foreign sales vary from 0.1% to 100% with an average of 45.4%, and the firms operate in 12-13 foreign markets on average. Firm size varies from 0 to 440 employees while turnover in 2012 ranges from 0 to 6,278,000,000 NOK with an average of 198,300,000 NOK.

Table 3.1: Sample characteristics

	Min	Median	Max	Mean	Std. Dev.	N
Firm Age	1	35	138	43.1	27.31	191
NACE Business Sector	8.118	28.3	88.990			191
Share of Foreign Sales	0.1 %	40 %	100 %	45.4 %	35.43 %	191
Number of Foreign Markets	1	7	100	12.5	16.43	188
Employees 2012[1]	0	25	440	44	58.81	190
Turnover 2012[2]	0	45.9	6 279	198.3	618.8	190

[1] Based on numbers reported by the companies in the survey   [2] Numbers in MNOK

3.3   Statistical methods

In order to answer the hypotheses presented in the theory several statistical tools was applied. To classify the firms in the dataset this paper used the K-Means cluster method.   To investigate whether there are any significant differences between the groups, different tests for assessing the equality of means will be used.

3.3.1 K-Means Cluster Method

This thesis employed the K-means cluster method which is applicable to "the problem of 'similarity grouping'" (MacQueen, 1967, p. 288). The method parts the data set into a requested number of mutually exclusive clusters iteratively and offers groupings that are as homogenous and as well-separated as the data set allows (Faber, 1994). The K-Means cluster method offers several applications that are beneficial to this paper. First, it creates clusters in a relatively easy and effective way as well as creating a cluster for INVs that are in line with definitions mentioned in the INV literature. Further, creating four unique clusters provides an opportunity for comparing the INVs with other clusters. This is beneficial as it allows us to investigate whether potential traits of INVs are unique to them or if they also occur within other groups.

3.3.2 Test for equality of means

ANOVA To test for differences between clusters an analysis of variance model (or ANOVA) may be used. By choosing a dependent variable ANOVA tests whether the means of three or more samples are the same for these variables. This is useful in order to detect diversities in the data set. However, as ANOVA is an omnibus test, it does not provide any information regarding which group or groups that differ significantly from the others. Thus, ANOVA may only indicate which dependent variable that has various effects on the different groups (Field, 2009). For the ANOVA test to be reliable the dataset has to have homogeneity of variance and a normal distribution. In addition the cases have to be independent.

To find which groups that differ significantly from each other post hoc tests can be performed. Post hoc tests "consist of pairwise comparisons that are designed to compare all different combinations of the treatment groups" (Field, 2009, p. 372) and help researchers discover which groups that are different from each other. For cases in which the sample size are very different Field (2009)

recommend that Hochberg's GT2 test to be used. However, as this test tends to be unreliable when the population variances are different from each other, it is also recommended to use post-hoc tests that are specially designed for such situations. In this regard, the Games-Howell procedure is the most powerful test when sample sizes are of sufficient size and is also accurate when sample sizes are unequal (Field, 2009).

The Welch t-test   An alternative to ANOVA is the Welch t-test. The Welch t-test is similar to ANOVA in that it also tests whether the mean value for several samples are the same. However, this test is also applicable to comparison of samples in which the population variances are unequal (Welch, 1938). In order for the Welch t-test to used, the samples must be normally distributed.

Brown-Forsythe   The Brown-Forsythe test is, like the Welch t-test, a viable alternative when the variances of the samples in question are statistically unequal. This is a robust test which investigates whether the median of the different groups are equal (Brown and Forsythe, 1974).

Kruskal-Wallis   The Kruskal-Wallis one-way analysis of variance is a non-parametric test that can be used to compare means. As opposed to the Welch t-test, Kruskal-Wallis does not assume the samples to be normally distributed. Instead the Kruskal-Wallis requires the population distribution of the samples that are to be compared to be equal (Kruskal and Allen, 1952).

Mann-Whitney   When researchers want to test the difference between two conditions and each condition has had a different set of participants, the Mann Whitney test is a good option. This non-parametric test is an equivalent of the independent t-test and checks whether the null hypothesis, that the two conditions are equal, holds. This test is more valid than the t-test for samples that are not normally distributed (Field, 2009). Mann-Whitney is often used as a post-hoc test to the Kruskal-Wallis one way analysis.

Test of assumptions   In order to decide which statistical method that is most appropriate to use it is recommended to test if the assumptions required when using a certain test hold for the data set. In this regard Levene's test is a popular alternative. Levene's test is used to test the homogeneity of variance between groups in a data set (Gastwirth et al., 2009). The test is specially fitting in cases where the samples are not normally distributed, as this test is less dependent of normality than others. The Kolmogorov-Smirnov test and the Shapiro-Wilks test are also valuable in terms of assumptions testing, as these test whether the distribution of a sample deviates from a comparable normal distribution. They compare the scores in the sample to a normally distributed sample that has the same mean and variance as the data set that it is being tested (Field, 2009).

3.4   CONSTRUCTS

In chapter 2 of this thesis three aspects of technology were described. In this section a description of the constructs used to measure the different aspects will be given. Cronbach's α, a measurement of scale reliability, can be found in Appendix A. The questions used in in the survey can be found in Appendix B.

3.4.1   TECHNOLOGY ACQUISITION

Technology acquisition is described on a nine-point scale measuring the extent of external sourcing. The construct is inspired by Branzei and Vertinsky (2006) and is created by counting the number of distinct public and private sources from which the firm has obtained ideas for innovative products. A total of nine categories were provided: Suppliers, customers, competitors, consultants, universities and colleges, governmental support schemes, the Internet, activities sponsored by industry and trade associations, and trade fairs and exhibitions.

3.4.2 Technology refinement

When comparing technology refinement a construct for exploration is used. Exploration, rather than exploration and exploitation, is used because it seems from the theory that exploration is where firms will differ. The questionnaire asks firms to evaluate their innovation effort on a seven-point Likert scale in four different areas: Products, services, production processes and business model. The construct used is calculated by taking the maximum score of the four questions. This is done because the interest is on whether the firms are explorative in their technology refinement rather than in what part of their product or service offering they are explorative.

3.4.3 Radicalness

Radicalness is measured using a single question in the questionnaire regarding the radicalness of a firm's most important product the five last years.

3.4.4 Niche

Due to the close ties to radicalness of innovation the firms will also be compared on a niche index. The niche index is adopted from Knight and Cavusgil (2004). It is constructed taking the average of five questions related to the product/service offering of the firm and indicates to what extent the firms seek to avoid competition by entering niche markets.

CHAPTER

4

RESULTS

4.1 H1: TECHNOLOGICAL DIFFERENCE OF INTERNATIONAL FIRMS

To test hypothesis 1 the sample firms was classified into two typs of clusters. The first clustering used internationalisation behaviour as a basis and was used to compare difference in technology between different firms. The second cluster used technology intensity as basis and compared internationalisation behaviour for the different firms. This way the relationship between technology and degree of internationalisation was compared using both internationalisation behaviour and technology as a starting point. Next, the different clusters were compared using the Kruskal-Wallis test.

4.1.1 CLUSTER ANALYSIS

Internationalisation behaviour While most of the research on internationalisation of firms the last years has focused on INVs, there is a lack of concurrence on the operational definition of these firms in the literature. Several researchers have unveiled that INV research to this day is disintegrated, thus failing to contribute to a common understanding of the INV phenomenon (Aspelund et al., 2007; Keupp and Gassmann, 2009). A part of this disintegration emerges as researchers fail to take the contextual complexity of the INV phenomenon into account. Researchers often use different cut-off points when defining INVs, leading them to look at different phenomena in different contexts (Cesinger et al., 2012). Cesinger et al. (2012) and Madsen (2013) suggest the use of three core characteristics in order to create a "definitional corridor" for INVs: speed, degree, and scope of internationalisation. Speed refers to the time from inception to entry into the first foreign market (Jones and Coviello, 2005). Degree of internationalisation takes the amount of foreign sales into account, and is considered to be a key defining dimension, reflecting the importance of foreign markets compared to the home market (Oviatt and McDougall, 1997; De Clercq et al., 2005). Scope

of internationalisation is a measure for the geographic diversity of the firm in terms of number of countries in which the firm operates (De Clercq et al., 2005; Khavul et al., 2010).

Speed and *Degree of Internationalisation* was chosen as the defining factors of INVs and other types of international firms as these were the only characteristics that were obtainable from the dataset. Although it was not possible to define the firms by applying all three core characteristics, it still creates a definitional corridor based on two important indicators, thus preventing us from applying a single definition which Cesinger et al. (2012) view as dysfunctional.

Table 4.1: Cluster Centers Internationalisation

	INVs	Early International	Late Internatinal	Late Global
Share of Foreign Sales	80.61 %	16.04 %	11.29 %	60.79 %
Time to Internationalisation	3.93	8.60	51.41	37.00
Number of Cases	75	80	17	19
Percentage	39 %	42 %	9 %	10 %

The cluster analysis provided four different clusters that are represented in table 4.1. Figure 4.1 gives a visual representation of the cluster. The first group had a foreign sales share of 80.8% and internationalised after approximately four years. As *Time to Internationalisation* and *Share of Foreign Sales* is within the definitional area of European INV literature (Cesinger et al., 2012), this cluster was named INV. The next cluster had a foreign sales share of almost 15% and internationalised after 9 years. This cluster was labelled Early Internationals. The third cluster had a larger share of foreign sales but a much slower internationalisation process, averaging at almost 43 years. This group was called Late Internationals. Finally, the fourth group had almost all of their sales in foreign markets, but entered foreign markets long after their inception. Therefore, this group was labelled Late Globals.
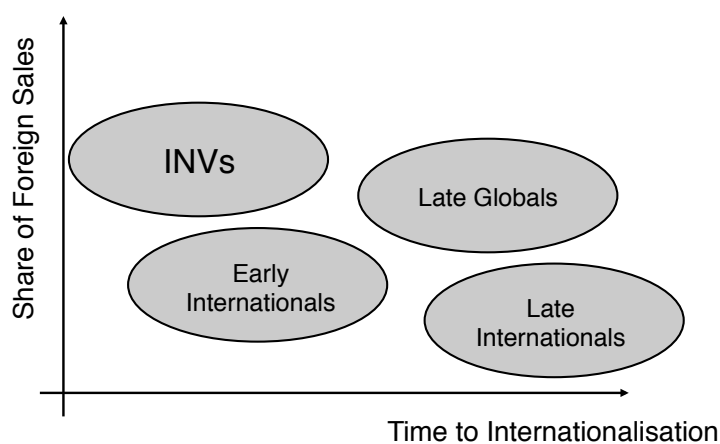
Figure 4.1: The four different firm clusters

The cluster groups created in our analysis seems to be coherent with those of Aspelund et al. (2005). The notable differences are that the INV group constitutes a larger part of the data set and that the speed of internationalisation and share of foreign sales have increased slightly. However, this is to be expected as more firms are expanding rapidly into foreign markets today in order to gain global scale quickly (Chang and Rhee, 2011).

Technology In terms of technology intensity the data set was clustered into three different groups on the basis of the OECD-classification of high-, medium, and low-tech companies. A firm is considered to be a high-tech company if their R&D-intensity, that is the firm's expenditure to turnover, exceeds 5%. If the firm has a R&D-intensity within the area of 3 to 5%, the firm is classified as a medium-high-tech, while R&D-intensities below 3% is classified as medium-low and low-tech (Hirsch-Kreisen, 2008). For practical reasons, the groups were labelled "high-tech" for firms with R&D-intensity above 5%, "med-tech" within the 3 to 5% range, and "low-tech" for all firms below 3%. Due to missing data, 22 cases were excluded in the clustering. In total, 169 firms were divided into

three different groups. 46 firms was found to be high-tech firms, 40 firms fell within the medium technology sector, and 83 firms were discovered to be low technology firms. An overview of the clusters is given in table 4.2.

Table 4.2: Cluster Centers Technology

	Low-tech	Medium-tech	High-tech
R&D ratio[1]	< 3 %	3 % - 5 %	> 5 %
Employees 2012	49.2	33.1	34.9
Turnover 2012[2]	337.7	73.7	58.3
Number of Cases	83	40	46
Percentage	49 %	24 %	27 %

[1] R&D ratio is calculated as R&D expenditure divided by the total revenue of the firm
[2] Turnover in MNOK

4.1.2 STATISTICAL METHODS

To test hypothesis 1 a comparison of the means of the different groups from the cluster analysis was performed.

To determine which statistical method to use the data set was tested for homogeneity of variance using the Levene's test. Further, the Kolmogorov-Smirnov test and the Shapiro-Wilk test were performed to check for normality distribution in the sample.

As can be seen in table 4.3 the Levene's test is significant for the *Technology Acquisition* construct, *Speed*, *Foreign Sales*, and *Number of Countries*, indicating that the variance in the sample is heterogeneous. Further, all variables break the normality assumption for one or several group. Thus, neither ANOVA nor Welch t-test seemed like a good option for comparing the means as the assumptions are broken and The Kruskal-Wallis method was used.

Table 4.3: Test of assumptions

	Levene's test		Kolmogorov-Smirnov		Shapiro-Wilk	
	df	Statistic	df	Statistic	df	Statistic
Technology acquisition	186	**2.671***				
INV			68	**0.127****	68	0.966
Early Int			73	0.102	73	**0.965***
Late Int			16	0.191	16	0.896
Late Global			19	0.185	19	0.934
Technology refinement	185	0.898				
INV			68	**0.201*****	68	**0.866*****
Early Int			73	**0.179*****	73	**0.871*****
Late Int			16	**0.280****	16	**0.838****
Late Global			19	**0.214****	19	**0.890****
Niche	179	0.924				
INV			68	0.101	68	**0.952***
Early Int			73	0.083	73	0.980
Late Int			16	0.179	16	**0.884***
Late Global			19	0.177	19	0.946
Radicalness	179	0.899				
INV			68	**0.129****	68	**0.920*****
Early Int			73	**0.135****	73	**0.932****
Late Int			16	0.201	16	**0.828****
Late Global			19	0.175	19	0.945
Speed	166	**4.654***				
Low tech			82	**0.232*****	82	**0.749*****
Medium tech			40	**0.210*****	40	**0.784*****
High tech			45	**0.226*****	45	**0.766*****
Foreign sales	166	**9.843*****				
Low tech			82	**0.211*****	82	**0.825*****
Medium tech			40	0.126	40	**0.939***
High tech			45	0.103	45	**0.942***
Foreign countries	165	**14.519*****				
Low tech			82	**0.246*****	82	**0.677*****
Medium tech			40	**0.211*****	40	**0.697*****
High tech			45	**0.307*****	45	**0.696*****

*$p < 0.05$ **$p < 0.01$ ***$p < 0.001$

4.1.3   Results hypothesis 1

Table 4.4 and 4.5 presents the results of the Kruskal-Wallis test. While the mean rank differs for the different cluster groups none of the chi-square test statistics are significant. This indicates that there are no significant differences between the groups and hypothesis 1 is not supported.

Table 4.4: Results of the Kruskal-Wallis test for the internationalisation clustering

Variable	Mean Rank				df	Chi-Square
	INVs	Early Int	Late int	Late Global		
External Sourcing	94.25	104.00	71.56	86.53	3	5.758
Niche	100.89	92.56	70.63	74.95	3	6.572
Exploration	99.92	92.20	86.26	95.32	3	1.328
Radicalness	3.97	4.24	3.94	4.26	3	1.016

Table 4.5: Results of the Kruskal-Wallis test for the technology clustering

Variable	Mean Rank			df	Chi-Square
	Low-Tech	Medium-Tech	High-Tech		
Speed	81.10	94.81	83.50	2	2.195
Foreign Sales	80.63	78.23	98.77	2	5.082
Foreign Countries	76.84	90.03	91.70	2	3.584

4.2   H2: Age and internationalisation

Hypothesis 2 was tested in the same way as hypothesis 1. The firms were clustered in three groups based on *Firm Age* using the K-means cluster method.

Then means in the different groups was compared using the Kurskal-Wallis and the Mann-Whitney test.

4.2.1   Cluster analysis

The sample was clustered into three groups using the K-means cluster method. This resulted in one group of young firms, one group of medium-aged firms, and one group of old firms. The young firms group is largest with 98 firms; the medium-aged group has 66 firms, while the old firm cluster has 27 firms. Table 4.6 presents the clusters.

Table 4.6: Cluster Centers Age

	Young firms	Medium-aged firms	Old firms
Firm Age	21.76	53.48	95.44
Number of Cases	98	66	27
Percentage	51 %	35 %	14 %

4.2.2   Statistical methods

The results of the Levene's test and the test of normality are presented in table 4.7. Once again both the assumption of homogeneity of variance and the assumption of normality is broken. Thus, Kruskal-Wallis was used.

Table 4.7: Test of assumptions

	Levene's Test		**Kolmogorov-Smirnov**		**Shapiro-Wilk**	
	df	Statistic	df	Statistic	df	Statistic
Speed	188	**49.422*****				
Young firms			98	**0.211*****	98	**0.784*****
Medium-aged firms			66	**0.189*****	66	**0.856*****
Old firms			27	0.151	27	**0.908***
Foreign Sales	188	0.529				
Young firms			98	**0.122****	98	**0.911*****
Medium-aged firms			66	**0.174*****	66	**0.884*****
Old firms			27	**0.233****	27	**0.836****
Foreign Countries	185	0.300				
Young firms			96	**0.281*****	96	**0.582*****
Medium-aged firms			65	**0.286*****	65	**0.613*****
Old firms			27	**0.259*****	27	**0.762*****

* p < 0.05 ** p < 0.01 *** p < 0.001

4.2.3   Result hypothesis 2

The results from the Kruskal-Wallis test are presented in table 4.8. The chi-square statistics are significant for *Speed* while they are non-significant for *Foreign Sales* and *Number of Countries*. Thus, there is a significant difference between the groups in terms of speed to internationalisation.

Table 4.8: Results of the Kruskal-Wallis test for firm age clustering

Variable	**Mean Rank**			**df**	**Chi-Square**
	Low-Tech	Medium-Tech	High-Tech		
Speed	71.11	113.61	143.31	2	**46.782*****
Foreign Sales	102.77	88.95	88.67	2	3.025
Foreign Countries	86.47	98.64	113.07	2	5.644

* p < 0.05 ** p < 0.01 *** p < 0.001

To reveal which firm groups that differ the Mann-Whitney test was utilised. The results are presented in table 4.9.

Table 4.9: Results of the Mann-Whitney test for firm age clustering

	Mean Rank	Mann-Whitney U
Test 1		
Young firms	66.26	**1642.5***[***1]
Medium-aged firms	106.61	
Test 2		
Young firms	54.35	**475.0***[***1]
Old firms	94.41	
Test 3		
Medium-aged firms	40.49	**461.5***[***1]
Old firms	62.91	

[*] $p < 0.05$ [**] $p < 0.01$ [***] $p < 0.001$ [1] Exact significance used

As can be seen in table 4.9 all groups differ significantly. The youngest firms are fastest in terms of *Speed to Internationalisation* while the oldest firms are slowest. As one of the three variables used to measure internationalisation behaviour is significant hypothesis 2 is partly supported.

CHAPTER

5

DISCUSSION

The results from the analysis produced some interesting findings. The results does not support the first hypothesis which stated that technology will influence internationalisation behaviour. However, the results show that there is a significant linkage between the firm age and SMEs' speed of internationalisation. These findings partially breaks with the prevailing opinion of the internationalisation literature today, namely that technology is a driver for degree internationalisation.

5.1 Degree of internationalisation and technology

In the analysis international firms were categorised according to their internationalisation behaviour. INVs differ significantly from Early Internationals, Late Internationals, and Late Globals in terms of speed to internationalisation and scope of internationalisation (foreign sales). However, INVs are not significantly different from the other groups when comparing the different technological aspects described in the methodology chapter. Further, when firms were classified according to their technology intensity no significant differences were found between the groups in terms of internationalisation behaviour. These results indicate that technology is not a driver for internationalisation behaviour.

The finding is supported by several researchers. Elango (1998), testing industry drivers' and firm drivers' influence on internationalisation for 158 larger U.S. firms, finds that most of the industry drivers influence the rate of internationalisation positively while half of the firm drivers did not. More specifically, R&D investments, a firm driver, did not influence internationalisation. Pinkwart and Proksch (2014), while concluding that technological factors are positively related to internationalisation, rejected the hypothesis that international firms had more advanced technology than domestic firms.

The findings of the analysis also contradict the finding of Aspelund et al. (2005). Using the same clustering method utilized in this paper Aspelund et al. (2005) find a significant difference in terms of technology advantage between INVs and Early Internationals. This difference could off course be due to difference in the way technology is measured in which case the actual measurement of technology should be re-evaluated. However, as their research is based on a dataset from 1997 this could also point to a change in the importance of technology for the internationalisation behaviour of firms.

Much has happened in the world since 1997, especially in terms of technology and connectedness. The globalisation process has made the world "smaller" and markets more interconnected (Bang and Markeset, 2011). A new firm today will face fewer challenges when entering an international market now compared to some decades ago. The adoption of the Internet makes communication easier across border and increases the market knowledge of the firm (Prashantham and Young, 2004). Together with lower trade barriers, lower transportation costs, lower communication costs, information and communication technology (ICT) development, and spread of technology this has substantially lowered the barriers to internationalisation for smaller firms as less resources are needed to internationalise.

Loveman and Sengenberger (1991), after investigating the re-emergence of small firms in the 1970s, point to the spread of microelectronic production and communication technology as some of the drivers for small firm emergence. Due to changes in technology and demand, larger more resourceful firms lost some of their advantage as an operating form, otherwise firms would still be large. The rapid internationalisation pattern of new firms today (INVs and Early Internationals) could be seen as an extension of the re-eremgence of small firms. While the stage-theories describe the internationalisation of firms as a stage-wise procedure that demanded resources and time the development of technology now allows firms to move internationally from inception when they have less resources. The results also supports this as it was found that firm age was significantly influencing speed of internationalisation. This indicates that younger firms enter foreign markets significantly faster compared to firms being established several decades ago due to changes in the environment. Thus, technology seems to remove the advantage of larger firms in terms of internationalisation.

However, this would still point to technology as a driver for internationalisation. If a small firm has the right technology it is able to mitigate the advantage held by larger and older firms in terms of resources. The point is that every firm in the modern world has access to the technology needed to lower the

internationalisation barrier. As one example Internet is available to almost everyone, meaning that anyone can get the information they require. Thus, technology does not discriminate between firms or sectors anymore.

Loveman and Sengenberger (1991) also point to increasing consumer demand for more customised goods and services as a reason for the re-emergence of small firms. Some decades ago one could imagine some firms being better at creating customised goods due to better production technology. These products could be shipped internationally due to the products unique nature, increasing the demand for the products. This could give these firms an advantage in internationalisation. However, today most firms have access to the production technology they prefer allowing everyone to customise their product.

Another reason for the lack of difference in terms of technology could be that similar technology is available to all firms. Since firms differ in terms of internationalisation it could seem like technology is not a driver for internationalisation. However, this does not seem to be the case. The above argumentation points to the development of technology as a reason for the fast and substantial internationalisation of young firms today compared to technology some years ago. Thus, technology would be a driver for internationalisation. However, the findings indicate that technology is not a driver for the difference in degree of internationalisation. All firms have access to mostly the same technology meaning that it is not possible for a firm to differentiate itself on technology.

5.2 INTERNATIONALISATION AND THE HIGH-TECHNOLOGY SECTOR

Most of the research on firm internationalisation, specifically INVs, the last decades has either been done on firms in the high-technology sector or on new technology-based firms. This has led to low-technology firms being overlooked. However, given the results in this thesis one could expect that low-technology

firms will constitute a large portion of the international firms. As most business sectors are represented in the dataset this seems to be the case. For example, in the INV category half of the firms are in the low-technology cluster. This finding supports Spence et al. (2011) who discovered that even though INVs are relatively concentrated in particular sectors, they still operate across sectors including services.

Thornhill (2006) found that there is a positive relationship between innovations and firm performance both in the high-tech and low-tech sector. The level of industry dynamism did not influence the effect of innovations on firm performance. As innovation is tightly connected to technology this indicates that whether a firm operates in the high- or low-tech sector does not really affect their opportunity of increasing their profits through new technology. One argument often used to explain the choice of looking at high-technology firms is that these firms will have a stronger incentive to internationalise due to return on their innovations (Coviello and Munro, 1997). However, following the arguments of Thornhill (2006), high-technology firms will not have a stronger incentive than low-technology firms.

Oviatt and McDougall (1994) remarke the existence of low-technology INVs in their seminal paper on INVs. Other researchers (e.g. Aspelund et al., 2007; Evers, 2011) have also highlighted this fact. However, research on low-tech INVs has still been mostly omitted. In terms of explaining the drivers behind the internationalisation behaviour of INVs and other firms in general the one-sided focus on high-technology firms could have led to researchers missing other drivers in their analysis. Low-technology firms, due to their difference in choice of industry and focus on R&D, could reveal other drivers for internationalisation not found when only analysing high-technology firms.

5.3 DRIVERS OF INTERNATIONALISATION

The findings suggest that technology is not a driver for degree of internationalisation of firms. Thus, the source of INVs' significant different internationalisation behaviour has to lie somewhere else. Aspelund et al. (2005) find that INVs differs in terms of the motivation regarding internationalisation. This is confirmed by Kyvik et al. (2013) who find a strong causal relationship between global mindset and internationalisation behaviour. Thus, the experience and knowledge of a firm's employees could be an important factor in terms of degree of internationalisation. This could also contribute to explaining the increased tendency to internationalise in today's business environment. More people have international experience from earlier jobs giving more firms the knowledge they need to internationalise.

As the analysis revealed, firm age may be considered a predictor of internationalisation. The fact that younger firms are more likely to internationalise at an earlier stage than older companies shows that the probability of going international is more likely today. There may be several reasons for this. Zhou and Wu (2014) found that earliness of internationalisation was positively associated with the sales growth of new ventures, indicating that young firms experience a greater sales potential of going abroad soon after inception. Further, due to more integrated markets and the fact that the competitive pressure is higher right after inception in the current business environment (Bang and Markeset, 2011; van Liemt, 1991), firms may have greater incentives of performing international sales in order to be competitive. This is supported by the findings of Zhou and Wu (2014), and indicates that the trend of firms internationalising at young age is likely to continue.

Other researchers point to the industry a firm operates in when explaining their internationalisation behaviour (Pinkwart and Proksch, 2014; Thai and Cong, 2008; Kaur and Sandhu, 2013). Viewing the industry sector as a driver for internationalisation is interesting. As new technology is developed new industries

emerge, creating a space in which new firms can grow and prosper. Given the increased connectedness of markets over the last decades it seems likely that an industry emerging today will be more global in nature compared to an older industry. Further, new firms will more likely be part of new industries in which they to some extent can avoid competition from established firm. If the new industry is global, these new firms may be pulled into international markets. As a result, many firms that appear in these industries may be INVs. This does not necessarily mean that new firms which emerge in established sector cannot be an INV. As older industries also are international in nature or have developed such traits over time, new firms that establish themselves in such industries may also internationalise at inception. However, firms that have emerged in older industries could be less likely to be an INV due to slower globalisation process of these industries.

The smiley curve (Zakaria, 2008) could further explain why industries are more international in nature today. As many countries have a standard of living that cannot be sustained with the profit margins from certain stages in the value chain they have no alternative but to outsource these stages. This will lead to a more globalised industry sector. It is also important to point out that this goes for different kind of industries in terms of technology-intensity. While most of the development in the early stages of the value chain is connected to technological innovation the latter stages with marketing and sales have to be innovative in other aspects than technology. Thus, the smiley curve is applicable to all types of industries, not just the ones in which technology is important.

The nature of demand for a firm is also suggested to be a driver of internationalisation (Kaur and Sandhu, 2013; Evers, 2011). A firm operating in a small domestic market is more likely to internationalise as the domestic market is saturated faster. In order to grow the firms has to internationalise. Two factors help speed this process. First, the lowered barriers to internationalisation mean that it is easier for a firm to internationalise, giving them a stronger incentive to do so. Second, the development in production technologies has made it easier to customize products to consumers' tastes, leading to a smaller market for each

product. Thus, a domestic market is easier saturated (Beckman and Rosenfield, 2008). This could be mitigated by moving into foreign markets.

5.4 IMPLICATIONS

As the results unveiled, there is no significant difference between internationalisation clusters in terms of technology. On the other hand, firm age is found to be significantly linked with the speed of internationalisation.

5.4.1 IMPLICATIONS FOR RESEARCHERS

The findings of this paper may be of interest to researchers as previous studies on internationalisation and export performance have found technology to be an important contributor (Andersson and Ejermo, 2008). The results suggest that a more integrated and distinct view of technology and internationalisation should be established. As the results indicate that there are no reason to differentiate between low-technology and high-technology firms in terms of internationalisation research, this should open the door to a greater inclusion of low-tech firms in the research on the internationalisation process of SMEs. Although SMEs use ICT differently in their internationalisation process, it has been observed that both low-tech and high-tech SMEs internationalise (Tseng and Johnsen, 2011).

Second, the findings suggest that technology is not a driver of the degree of internationalisation. This does not mean that technology will not influence the internationalisation process of SMEs. On the contrary, several researchers have discovered that various types of technology have been applied in both high-tech and low-tech in order to internationalise (e.g. Tseng and Johnsen, 2011; Aspelund and Moen, 2004). However, herein lies what the authors of this paper perceive as the important distinction: technology such as ICT is to a large degree a commodity in the modern society. As a result, firms are not able to differentiate

themselves in the internationalisation process with regard to technology because it is available to any firm. Thus it may drive the internationalisation process of any firm and not just high-tech companies. It may therefore be interesting to investigate the internationalisation patterns of low- and high-tech companies rather than exploring if they internationalise or not.

Along the same lines it is suggested that the importance of technology as a driver for internationalisation is diminishing. Further, it is believed that the occurrence of INVs will increase in the coming years due to more interconnected markets. Both of these ideas are possible to investigate using a research design that is more longitudinal in nature.

Several factors are suggested as drivers for internationalisation. As there does not seem to be an agreed upon set of drivers to internationalisation, more research is needed in the international strategy domain. In terms of INVs Oviatt and McDougall (1994) points to unique resources in general, not necessary technology, as a requirement for a sustainable INV. Further, Carmeli (2001) suggests that high-performance may be attributed to intangible resources at the executive level. Future research could look closer at the employees of firms and determine if, and how much, they influence the internationalisation behaviour. In the case of INVs they are said to have an innovative approach to products, markets and staff (McDougall et al., 2003) so there is reason to suspect that these firms will differ from other firms in some ways.

Also, investigating the relationship between technology and internationalisation in other countries could be worthwhile. A similar study in other countries could unveil whether the findings of this paper is only characteristic for the Norwegian business sector or if this phenomenon is occurring elsewhere as well. This is interesting for several reasons. If such research support this paper's notion that technology does not influence the degree of internationalisation, it signals that more focus on the internationalisation process of low-tech firms should be given. However, if such research results in contradictory findings it may indicate that there are aspects unique to the Norwegian business sector that affects the degree

of internationalisation. This would call for a closer investigation of what makes the Norwegian business sector different in terms of technology influence on the internationalisation process.

A last issue to be research is effect of macro factors versus micro factors. Several researchers points to macro factors such as industry and domestic demands as drivers to internationalisation. However, most research seems to focus on micro factors such as technology, marketing, and other firm factors. The discussion in this thesis points to macro factors as a major driver of internationalisation. Whether this actually is the case would be interesting to investigate further.

5.4.2 IMPLICATIONS FOR MANAGERS

For managers the findings of this paper has some interesting implications. As different aspects of technology did not influence the internationalisation process significantly, managers may turn their attention to other parts of the firm in this regard. Attitude toward internationalisation and international experience in the firm are two areas that seems to influence international activities. Sommer (2010) found that attitude proved to have a significant impact on managers' intention to behave as international entrepreneurs. In terms of international experience, Papadopoulos and Martin (2010) discovered that such experience has a positive influence on the internationalisation commitment of firms, which again led to a higher level of internationalisation. Thus, it is recommended that managers investigate such options if they are to start up or increase their international commitment.

Managers may also benefit from focusing more on competitive strategies rather than technological progress regarding internationalisation. As globalisation has intensified the competitive pressure in which firms exist (van Liemt, 1991) and communication technology is spreading fast (Bang and Markeset, 2011), the challenge of making a competitive internationalisation strategy may be imminent for managers. This can be especially noticeable for managers of low-tech

SMEs, as such firms are more restricted in terms of both technological and internationalisation developments (Tseng and Johnsen, 2011). Therefore, these authors suggest more emphasis on other areas on the firm that may aid the internationalisation of the firm such as network relationships. Cannone and Ughetto (2014) found that network relationships built by entrepreneurs are a key driver for both early internationalisation and the scope of international expansion. This in line with Lee et al. (2012) who suggest that manager of technology-based SMEs should be aware of external relationships. Focusing on such areas may therefore be more beneficial for SMEs.

The findings regarding firm age and speed of internationalisation are also interesting from a manager's point of view. The tendency that younger SMEs internationalise more rapidly than older indicates that manager's also should be aware that internationalisation may happen soon after inception. SMEs may find themselves facing liabilities common to INVs such as liability of newness and smallness. Lee et al. (2012) argue that it is important for managers of technology-based SMEs to have a global perspective and should therefore focus on developing capabilities in order to overcome such liabilities. Therefore, managers should to a larger degree be aware of these challenges when going international.

5.4.3   IMPLICATIONS FOR POLICYMAKERS

Technological development is important for a country because it increases the productivity efficiency, allowing a country to produce more output with the same input (Beckman and Rosenfield, 2008). As the input resource of a country is approximately fixed, technological development is a way to increase the export revenues for a country through increasing the available goods for sale. Countries would also want the nation's firms to sell as much of their products abroad as possible to increase the export revenue further. In this regard the findings in this thesis are interesting. While a policy support technological development is positive for an increase in output, it does not influence the degree of foreign sales.

Thus, different policies have to be put in place for increase in output and degree of internationalisation. While funds that support R&D could have a positive effect on technological development, resources in relation to networking, market search, and internationalisation help could be more influential on the degree of internationalisation of firms.

Another finding is that technology does not discriminate between low-technology and high-technology firms. This suggest that policymakers should avoid putting all resources on high-tech companies and put more emphasis on aiding firms all over the technology scale. This is in line with Wright et al. (2007) who encourage policy-makers to provide a more balanced and refined policy support if they are to facilitate internationalisation for SMEs. Smaller firms may face attitudinal, resource, operational, and strategic barriers in the internationalisation process, making this process more difficult to pull through. This does not mean that policy-makers should be uncritically support any firm that wish to internationalise, as the costs and benefits of intervening in the market should be carefully considered (Storey, 1994). However, authors of this paper believe that assisting firms across different technology sectors may aid firms that strive to increase firm growth due to a limited home market.

CHAPTER

6

CONCLUSION

This paper sought to investigate the linkage between technology and internationalisation. More specifically an effort was made to determine the influence of technology on the degree of firm internationalisation.

The results of the analysis suggest that there is no significant linkage between the investigated aspects of technology and the degree of internationalisation. This was confirmed through a clustering of the firms according to their R&D-intensity. These findings are interesting as they contradict earlier research done on internationalisation (e.g. Grant, 1996; Spender, 1996). The difference in results may be due to increased spread of and access to technology. Technology is still considered to be a contributor to the internationalisation process, but the results indicate that it does no longer discriminate between different types of international firms.

The analysis also revealed that firm age had a significant influence on the

speed of internationalisation, and that younger firms internationalised more rapidly than older firms. This confirms the notion that it is important to look at the macro environment when explaining why firms have a different internationalisation pattern, and why this pattern has changed over time.

The results implicates that researchers should focus more on exploring the relationship between low-technology companies and the degree of internationalisation. For managers the results indicate that more emphasis should be made on competitive strategies in order to internationalise, and capabilities should be developed to overcome liabilities such as newness and smallness. Last, policy-makers should introduce different policies in order to increase output and degree of internationalisation of firms. In addition, more resources should be devoted to firms all over the technology scale.

LIMITATIONS

There are certain limitations about this study that the reader should be aware of. First of all, the questionnaire that was used in the analysis was a not specifically created to answer this paper's research object. As a result, the scope of the questions that were used as variables or to construct variables may have been too general. In addition adding further questions regarding different aspects of technology and internationalisation may have generated a more distinct image of technology's influence on the internationalisation process.

Another limitation is that this paper only investigated Norwegian exporting SMEs which may have reduced the external validity of the findings. Also, this paper was only able to apply two of the three corridors with regard to the INV classification. Cesinger et al. (2012) argue that all three core characteristics should be present in order to clarify the context of the findings. Therefore, precautions should be taken if other researchers are to use these findings in investigation of the linkage between internationalisation and technology in other contexts.

This paper may also have experienced limitation regarding time. As the data set used in this paper was only accessible at a late stage in the process the time available for data analysis was limited. Also, it may have restricted the authors from investigating other linkages between technology and internationalisation, and restricted the search for more alternative explanations for the outcome of the analysis.

Last, the thesis has only been investigating the link between technology and internationalisation of export firms. No effort has been made on investigating how large enterprises use technology to internationalise. In addition the paper did not assess how technology was perceived and used in domestic firms. Therefore, the reader should use these findings with care if comparisons are made with these firms.

BIBLIOGRAPHY

Alvarez, I., Marin, R., and Fonfria, A. (2009). The role of networking in the competitiveness of firms. *Technological Forecasting and Social Change*, 76(3):410–421.

Anderson, P. and Tushman, M. L. (1990). Technological discontinuities and dominant designs: A cyclical model of technological change. *Administrative Science Quarterly*, 35(4):604–633.

Andersson, M. and Ejermo, O. (2008). Technology specialization and the magnitude and quality of exports. *Economics of Innovation and New Technology*, 17(4):355–375.

Arora, A. and Nandkumar, A. (2012). Insecure advantage? Markets for technology and the value of resources for entrepreneurial ventures. *Strategic Management Journal*, 33(3):231–251.

Aspelund, A., Berg-Utby, T., and Skjevdal, R. (2005). Initial resources' influence

on new venture survival: A longitudinal study of new technology-based firms. *Technovation*, 25(11):1337–1347.

Aspelund, A., Madsen, T. K., and Moen, O. (2007). A review of the foundation, international marketing strategies, and performance of international new ventures. *European Journal of Marketing*, 41(11-12):1423–1448.

Aspelund, A. and Moen, O. (2004). Internationalization of small high-tech firms: The role of information technology. *Journal of Euromarketing*, 13(2-3):85–105.

Bang, K. E. and Markeset, T. (2011). Identifying the drivers of economic globalization and the effects on companies' competitive situation. In *IFIP WG 5.7 International Conference*.

Barney, J. B. (1991). Firm resources and sustained competitive advantage. *Journal of management*, 17(1):99–120.

Bathelt, H., Malmberg, A., and Maskell, P. (2004). Clusters and knowledge: Local buzz, global pipelines and the process of knowledge creation. *Progress in Human Geography*, 28:31–56.

Beckman, S. L. and Rosenfield, D. B. (2008). *Operations strategy. Competing in the 21st century*. Boston, MA: McGrew-Hill/Irwin.

Bell, J. (1995). The internationalization of small computer software firms: A further challenge to "stage" theories. *European Journal of Marketing*, 29(8):60–75.

Bierly III, P. E., Damanpour, F., and Santoro, M. D. (2009). The application of external knowledge: Organizational conditions for exploration and exploitation. *Journal of Management Studies*, 46(3):481–509.

Bilkey, W. J. and Tesar, G. (1977). The export behavior of smaller-sized Wisconsin manufacturing firms. *Journal of International Business Studies*, 8(1):93–98.

Borrego, M., Douglas, E. P., and Amelink, C. T. (2009). Quantitative, qualitative, and mixed research methods in engineering education. *Journal of Engineering Education*, pages 53–66.

Boter, H. and Holmquist, C. (1996). Industry characteristics and internationalization processes in small firms. *Journal of Business Venturing*, 11(6):471–487.

Branzei, O. and Vertinsky, I. (2006). Strategic pathways to product innovation capabilities in smes. *Journal of Business Venturing*, 21:75–105.

Brown, M. B. and Forsythe, A. B. (1974). Robust tests for equality of variances. *Journal of the American Statistical Association*, 69(346):364–367.

Buckley, P. J. and Casson, M. (1976). *The future of the multinational enterprise*. New York, NY: Holmes & Meier.

Burda, M. C. and Dluhosch, B. (2002). Cost competition, fragmentation, and globalization. *Review of International Economics*, 10(3):424–441.

Cannone, G. and Ughetto, E. (2014). Born globals: A cross-country survey on high-tech start-ups. *International Business Review*, 23:272–283.

Carayannis, E. G. and Roy, R. I. S. (2000). Davids vs Goliaths in the small satellite industry: The role of technological innovation dynamics in firm competitiveness. *Technovation*, 20(6):287–297.

Carmeli, A. (2001). High- and low-performance firms: Do they have different profiles of perceived core intangible resources and business environment? *Technovation*, 21(10):661–671.

Caves, R. E. (1982). *Multinational enterprise and economic analysis*. Cambridge, MA: Cambridge University Press.

Caves, R. E. (2007). *Multinational enterprise and economic analysis*. New York, NY: Cambridge University Press.

Cavusgil, S. T. (1980). On the internationalization process of firms. *European Research*, 8(6):273–281.

Cavusgil, S. T., Knight, G., Riesenberger, J. R., Rammal, H. G., and Freeman, S. (2012). *International Business: Strategy, Manadement, and the New Realities*. Upper Saddle River, NJ: Pearson Prentice Hall.

Cesinger, B., Fink, M., Madsen, T. K., and Kraus, S. (2012). Rapid internationalizing ventures: How definitions can bridge the gap across contexts. *Management Decision*, 50(10):1816–1842.

Chandy, R. K. and Tellis, G. J. (2000). The incumbent's curse? Incumbency, size, and radical product innovation. *Journal of Marketing*, 64(3):1–17.

Chang, S. J. (1996). An evolutionary perspective on diversification and corporate restructuring: Entry, exit, and economic performance during 1981-89. *Strategic Management Journal*, 17(8):587–611.

Chang, S.-J. and Rhee, J. H. (2011). Rapid FDI expansion and firm performance. *Journal of International Business Studies*, 42:979–994.

Cheng, J. L. C. and Kesner, I. F. (1997). Organizational slack and response to environmental shifts: The impact of resource allocation patterns. *Journal of Management*, 23(1):1–18.

Christensen, C. M. (1997). *The innovator's dilemma: When new technologies cause great firms to fail*. Bosten, MA: Harvard Business Press.

Christensen, C. M. and Rosenbloom, R. S. (1995). Explaining the attacker's advantage: Technological paradigms, organizational dynamics, and the value network. *Research Policy*, 24(2):233–257.

Cohen, W. M. and Levinthal, D. A. (1990). Absorptive capacity: A new perspective on learning and innovation. *Administrative Science Quarterly*, 35(1):128–152.

Coviello, N. E. and Munro, H. J. (1997). Network rrelationship and the internationalization process of small hardware firms. *International Business Review*, 6(4):361–386.

Covin, J. G., Slevin, D. P., and Covin, T. J. (1990). Content and performance of growth-seeking strategies: A cocomparison small firms in high- and low-technology industries. *Journal of Business Venturing*, 5(6):391–412.

Crick, D. and Jones, M. V. (2000). Small high-technology firms and international high-technology markets. *Journal of International Marketing*, 8(2):63–85.

Danneels, E. (2002). The dynamics of product innovation and firm competences. *Strategic Management Journal*, 23(12):1095–1121.

De Clercq, D., Sapienza, H. J., and Crijns, H. (2005). The internationalization of small and medium-sized firms. *Small Business Economics*, 24(4):409–419.

Dean, J. B., Brandes, P., and Dharwadkar, R. (1998). Organizational cynicism. *Academy of Management Review*, 23(2):341–352.

Doloreux, D. and Parto, S. (2005). Regional innovation systems: Current discourse and unresolved issues. *Technology in Society*, 27:133–153.

Dunn, T. J., Baguley, T., and Brunsden, V. (2013). From aplha to omega: A practical solution to the pervasive problem of internal consistency estimation. *British Journal of Psychology*, pages 1–14.

Dunning, J. H. (1988). The eclectic paradigm of international production: A restatement and some possible extensions. *Journal of International Business Studies*, 19(1):1–31.

Elango, B. (1998). An empirical examination of the influence of industry and firm drivers on the rate of internationalization by firms. *Journal of International Management*, 4:201–221.

Etro, F. (2004). Innovation by leaders. *Economic Journal*, 114(495):281–303.

Evers, N. (2011). International new ventures in "low tech" sectors: A dynamic capabilities perspective. *Journal of Small Business and Enterprise Development*, 18(3):502–528.

Faber, V. (1994). Clustering and the continuous k-means algorithm. *Los Almos Science*, 22:138–144.

Field, A. (2009). *Discovering statistics using SPSS*. London: SAGE Publications, 3 edition.

Fitjar, R. D. and Rodriguez-Pose, A. (2011). When local interaction does not suffice: Sources of firm innovation in urban Norway. *Environment and Planning*, 43(6):412–431.

Flecker, J. (2009). Outsouconsequences relocation and the fragmentation of employment. *Competition & Change*, 13(3):251–266.

Freeman, S., Edwards, R., and Schroder, B. (2006). How smaller born-global firms use networks and alliances to overcome constraints to rapid internationalization. *Journal of International Marketing*, 14(3):33–63.

Friedman, T. L. (2007). *The world is flat: A brief history of the twenty-first century*. New York, NY: Picador, 3 edition.

Gabrielsson, M. and Kirpalani, V. H. M. (2004). Born globals: How to reach new business space rapidly. *International Business Review*, 13(5):555–571.

Galbraith, J. K. (1968). *The new industrial state*. New York, NY: Hamish Hamilton.

Garcia-Muina, F. E. and Navas-Lopez, J. E. (2007). Explaining and measuring success in new business: The effect of technological capabilities on firm results. *Technovation*, 27(1-2):30–46.

Gastwirth, J. L., Gel, Y. R., and Miao, W. (2009). The impact of Levene's test of equality of variance on statistical and theory and practice. *Statistical Science*, 24(3):343–360.

Gatignon, H., Tushman, M. L., Smith, W., and Anderson, P. (2002). Astructural approach to assessing innovation: Construct development of innovation locus, type, and characteristics. *Management Science*, 48:1103–1112.

Geisler Asmussen, C., Hashai, N., and Delios, A. (2011). The co-evolution of internationalization and technological knowledge. In *Proceedings of the 53rd annual meeting of the academy of international business*, volume 53, page 161.

Grant, R. M. (1996). Toward a knowledge-based theory of the firm. *Strategic Management Journal*, 17:109–122.

Grinstein, A. and Goldman, A. (2006). Characterizing the technology firm: An exploratory study. *Research Policy*, 35(1):121–143.

Henderson, R. M. and Clark, K. B. (1990). Architectural innovation: The reconfiguration of existing product technologies and the failure of established firms. *Administrative Science Quarterly*, 35(1):9–30.

Hirsch-Kreisen, H. (2008). "Low-technology": A forgotten sector in innovation policy. *Journal of Technology Management and Innovation*, 3(3):11–20.

IMF (2008). International monetary fund issue brief issue 02/08.

Johanson, J. and Vahlne, J. E. (1977). The internationalization process of the firm-a model of knowledge development and increasing foreign market commitments. *Journal of International Business Studies*, 8:23–32.

Johanson, J. and Vahlne, J. E. (2009). The Uppsala internationalization process model revisited: From liability of foreignness to liability of outsidership. *Journal of International Business Studies*, 40(9):1411–1431.

Jolly, V. K., Alahutha, M., and Jeannet, J. P. (1992). Challenging the incumbents: How high technology start-ups compete globally. *Journal of Strategic Change*, 1(2):71–82.

Jones, M. V. and Coviello, N. E. (2005). Internainternational: Conceconceptual and entrepreneurial process of behaviour in time. *Journal of International Business Studies*, 36(3):284–303.

Karagozoglu, N. and Lindell, M. (1998). Internationalization of small and medium-sized technology-based firms: An exploratory study. *Journal of Small Business Management*, 36(1):44–59.

Kaur, S. and Sandhu, M. S. (2013). Internationalisation of born global firms: Evidence from malaysia. *Journal of the Asia Pacific Economy*, 19(1):101–136.

Keller, W. (2000). Geographical localization of international technology diffusion. National Bureau of Economic Research.

Keupp, M. M. and Gassmann, O. (2009). The past and the future of international entrepreneurship: A review and suggestions for developing the field. *Journal of Management*, 35:600–633.

Khavul, S., Perez-Nordtvedt, L., and Wood, E. (2010). Organizational entrainment and international new ventures from emerging markets. *Journal of Business Venturing*, 25(1):104–119.

Kimberly, J. (1976). Organizational size and the strstructural perspective: A review, critique, and proposal. *Administrative Sociological Review*, 21(4):571–597.

Knight, G. (1997). *Emerging paradigm for international marketing: The born global firm*. PhD thesis, Michigan State University.

Knight, G. and Cavusgil, S. T. (1996). The born global firm: A challenge to traditional internationalization theory. *Advances in International Marketing*, 8:11–26.

Knight, G. and Cavusgil, S. T. (2004). Innovation, organizational capabilities, and the born global firm. *Journal of International Business Studies*, 35:124–140.

Kobrin, S. J. (1991). An empirical analysis of the determinants of global integration. *Strategic Management Journal*, 12(Summer):17–32.

Kogut, B. and Zander, U. (1993). Knowledge of the firm and the evolutionary theory of the multinational corporation. *Journal of International Business Studies*, 24(4):625–645.

Kogut, B. and Zander, U. (1996). What firms do? Coordination, identity, and learning. *Organization Science*, 7(5):502–523.

Kotha, S., Rindova, V. P., and Rothaermel, F. T. (2001). Assets and actions: Firm-specific factors in the internationalization of U.S. internet firms. *Journal of International Business Studies*, 32(4):769–791.

Kothari, C. R. (1990). *Research Methodology*. New Age International, 2 edition.

Krugman, P. (1995). Growing world trade: Causes and consequences. *Brookings Paper on Economic Activity*, 25(1):327–377.

Kruskal, W. H. and Allen, W. (1952). Use of ranks in one-criterion variance analysis. *Journal of the American Statistical Association*, 47(260):583–621.

Kuivalainen, O., Sundqvist, S., and Servais, P. (2007). Firms' degree of bornborn-global, international entrepreneurial orientation and export performance. *Journal of World Business*, 42(3):253–267.

Kurzweil, R. (2005). *The Singularity is Near*. New York, NY: Viking Books.

Kyvik, O., Saris, W., Bonet, E., and Felicio, J. A. (2013). The internationalization of small firms: The relationship between the global mindset and firms' internationalization behavior. *Journal of International Entrepreneurship*, 11:172–195.

Lee, H., Kelley, D., Lee, J., and Lee, S. (2012). SME survival: The impact of internationalization, technology resources, and alliances. *Journal of Small Business Management*, 50(1):1–19.

Lee, J. and Miller, D. (1996). Strategy, environment, and performance in two technological contexts: Contingency theory in korea. *Organization Studies*, 17(5):729–750.

Levinthal, D. A. and March, J. G. (1993). The myopia of learning. *Strategic Management Journal*, 14(2):95–112.

Lindelöf, P. and Löfsten, H. (2004). Proximity as a resource base for competitive advantage - university-industry links for technology advantage. *Journal of Technology Transfer*, 29(3/4):311–326.

Lindqvist, M. (1991). *Infant mmultinational, The internationalization of young, technology-based swedish firms*. PhD thesis, Stockholm School of Economics, Institute of International Business.

Lisboa, A., Skarmeas, D., and Lages, C. (2011). Entrepreneurial orientation, exploiitative and explorative capabilities, and performance outcomes in export markets: A resouce-based apporach. *Industrial Marketing Management*, 40(8):1274–1284.

Litvak, I. (1990). Instant international: Strategic reality for small high-technology firms in canada. *Multinational Business*, 2(Summer):1–12.

Loveman, G. and Sengenberger, W. (1991). The re-emergence of small-scale production: An international comparison. *Small Business Economics*, 3(1):1–37.

Lucas Jr, R. E. (1988). On the mechanics of economic development. *Journal of Monetary Economics*, 22(1):3–42.

MacQueen, J. (1967). Some methods for classification and analysis of multivariate observations. In *Proceedings of the Fifth Berkeley Symposium on Mathematical Statistics and Probability*, volume 1: Statistics, pages 281–297. University of California Press.

Madsen, T. K. (2013). Early and rapid internationalizing ventures: Similarities and differences between cclassification based on the original international new

venture and born global literatures. *Journal of International Entrepreneurship*, 11(1):65–79.

Madsen, T. K. and Servais, P. (1997). The internationalization of born globals: An evolutionary process? *International Business Review*, 6(6):561–583.

March, J. G. (1991). Exploration and exploitation in organizational learning. *Organization Science*, 2(1):71–87.

McDougall, P. P., Oviatt, B. M., and Shrader, R. C. (2003). A comparison of international and domestic new ventures. *Journal of International Entrepreneurship*, 1(1):59–82.

McDougall, P. P., Shane, S., and Oviatt, B. M. (1994). Explaining the formation of international new ventures: The limits of theories from international business research. *Journal of Business Venturing*, 9:469–487.

Milberg, W. and Winkler, D. (2009). Globalization, offshoring and economic insicurity in industrialized countries. *Economic and Social Affairs*.

Miller, D. (2003). An asymmetry-based view of advantage: Towards an attainable sustainability. *Strategic Management Journal*, 24(10):961–976.

Miller, D. and Friesen, P. (1984). *Organizations: A quantum view*. Upper Saddle River, NJ: Prentice-Hall, Englewood Cliffs, NJ.

Morck, R. and Yeung, B. (1991). Why investors value multinationality. *The Journal of Business*, 64(2):165–187.

Mukoyama, T. (2003). Innovation, imitation, and growth with cumulative technology. *Journal of Monetary Economics*, 50:361–380.

Narula, R. (2004). R&D collaboration by SMEs: New opportunities and limitations in the face of globalisation. *Technovation*, 24(2):153–161.

Oesterle, M.-J. (1997). Time-span until internationalization: Foreign market entry as a built-in-mechanism of innovations. *Management International Review*, 37(2):125–149.

Oviatt, B. M. and McDougall, P. P. (1994). Toward a theory of international new ventures. *Journal of International Business Studies*, 25(1):45–64.

Oviatt, B. M. and McDougall, P. P. (1997). Challenges for internationalization process theory: The case of international new ventures. *Management International Review*, 37(2):85–99.

Oviatt, B. M. and McDougall, P. P. (2005). The internainternational of entrepreneurship. *Journal of Internataional Business Studies*, 36(1):2–8.

Papadopoulos, N. and Martin, O. M. (2010). Toward a model of the relationship between internationalization and export performance. *International Business Review*, 19:388–406.

Pinkwart, A. and Proksch, D. (2014). The internationalization behavior of German high-tech start-ups: An empirical analysis of key resources. *Thunderbird International Business Review*, 56(1):43–53.

Porter, M. E. (1985). *Competitive advantage : Creating and sustaining superior performance*. New York, NY: The Free Press.

Porter, M. E. (1990). *The competitive advantage of nations*. New York, NY: Free Press.

Prahalad, C. K. and Hamel, G. (1990). The core competence of the corporation. *Harvard Business Review*, 68(3):79–91.

Prashantham, S. and Young, S. (2004). The internet and the internationalisation of small knowledge-intensive firms: Promises, problem and prospects. *International Journal of Entrepreneurship and Small Business*, 1(1/2):153–175.

Priem, R. L. and Butler, J. E. (2001). Is the resource-based "view" a useful perspective for strategic management research? *The Academy of Management Review*, 26(1):22–40.

Rennie, M. W. (1993). Global competitiveness: Born global. *The McKinsey Quarterly*, (4):45–52.

Rodriguez, J. L. and Rodriguez, R. M. G. (2005). Technology and export behaviour: A resource-based view approach. *International Business Review*, 14(5):539–557.

Rosenberg, N. (1972). *Technology and american economic growth*. Armonk, NY: M. E. Sharpe.

Sommer, L. (2010). Internationalization processes of small- and medium-sized enterprises - a matter of attitude? *Journal of International Entrepreneurship*, 8:288–317.

Sood, A. and Tellis, G. J. (2005). Technological evolution and radical innovation. *Journal of Marketing*, 69(3):152–168.

Spence, M., Orser, B., and Riding, A. (2011). A comparative study of international and domsetic new ventures. *Management International Review*, 51:3–21.

Spender, J.-C. (1996). Making knowledge the basis of a dynamic theory of the firm. *Strategic Management Journal*, 17(Winter Special Issue):45–62.

SSB (2014). Virksomheter, 1. januar 2014. Web.

Stalk, G., Evans, P., and Shulman, L. E. (1992). Competing on capabilities: The new rules of corporate strategy. *Harvard Business Review*, 70(2):57–69.

Stiglitz, J. E. (2006). *Make globalization work*. New York, NY: W. W. Norton & Company, Inc., 1 edition.

Storey, D. J. (1994). *Understanding the Small Business Sector*. London: Routledge.

Teece, D. J. (1982). Towards an economic theory of the multiproduct firm. *Journal of Economic Behavior & Organization*, 3(1):39–63.

Teece, D. J., Pisano, G., and Shuen, A. (1997). Dynamic capabilities and strategic management. *Strategic Management Journal*, 18(7):509–533.

Terjesen, S., O'Gorman, C., and Acs, Z. J. (2008). Intermediated mode of internationalization: New software ventures in Ireland and India. *Entrepreneurship & Regional Development: An International Journal*, 20(1):89–109.

Thai, M. T. T. and Cong, L. C. (2008). Born-global: The case of four vietnamese smes. *Journal of International Entrepreneurship*, 6(2):72–100.

Thornhill, S. (2006). Knowledge, innovation and firm performance in high- and low-technology regimes. *Journal of Business Venturing*, 21(5):687–703.

Tornatzky, L. G. and Fleischer, M. (1990). *The process of technological innovation*. Lexington, MA: Lexington Books.

Tseng, K.-M. K. and Johnsen, R. E. (2011). Internationalisation and the internet in UK manufacturing SMEs. *Journal of Small Business and Enterprise Development*, 18(3):571–593.

van Liemt, G. (1991). Economic globalization: Labour options and business strategies in high labour cost countries. *International Labour Review*, 134(4-5):453–470.

van Wyk, R. J. (1984). Panoramic scanning and the technological environment. *Technovation*, 2(2):101–120.

Welch, B. L. (1938). The significance of the difference between two means when the population variances are unequal. *Biometrika*, 29(3/4):350–362.

Wischnevsky, J. D. and Damanpour, F. (2005). Punctuated equilibrium model of organizational transformation: Sources and consequences in the banking industry. *Research in Organizational Change and Development*, 15:207–239.

Wong, F. (1990). High-technology at work. *Perspectives*, 2(1):17–28.

Wright, M., Westhead, P., and Ucbasaran, D. (2007). Internationalization of small and medium-sized enterprises (SMEs) and international entrepreneurship: A critique and policy implications. *Regional Studies*, 41(7):1013–1030.

Yalcinkaya, G., Calantone, R., and Griffith, D. (2007). An examination of exploration and exploitation capabilities: implications for product innovation and market performance. *Journal of International Marketing*, 15(4):63–93.

Yilmaz, K. (2013). Comparison of quantitative and qualitative research traditions: Epistemological, theoretical, and methodological differences. *European Journal of Education*, 48(2):311–325.

Yin, R. K. (2012). *Case study research: Design and methods*. Washington, DC: Sage, 5 edition.

Zaheer, A. and Bell, G. G. (2005). Benefiting from network position: Firm capabilities, structural holes, and performance. *Strategic Management Journal*, 26:809–825.

Zahra, S. A. (2005). A theory of international new ventures: A decade of research. *Journal of International Business Studies*, 36(1):20–28.

Zahra, S. A. and George, G. (2002). Absorptive capacity: A review, reconceptualization, and extension. *Academy of Management Review*, 27(2):185–203.

Zakaria, F. (2008). *The Post-American World*. W. W. Norton & Company.

Zhou, L. and Wu, A. (2014). Earliness of internationalization and performance outcomes: Exploring the moderating effects of venture age and international commitment. *Journal of World Business*, 49(1):132–142.

APPENDIX

A

CRONBACH'S α

Table A.1: Cronbach's α for the constructs

Construct	Cronbach's α
Technology aquisition	0.763
Technology refinement	0.654
Niche	0.769

Values above 0.6 is seen as acceptable (Dunn et al., 2013).

B

QUESTIONS FROM QUESTIONNAIRE

The questions are written in Norwegian as this is the original language of the survey.

The questions were answered on a seven point Likert-scale. If a firm answered with a value of four or higher the alternative was counted as an external source. The construct was made by summing up all the external sources, that is all sources with a value of four or higher.

The questions were answered on a seven point Likert-scale. The construct was calculated by taking the maximum score of the three questions to account for

Technology acquisition

Hvilke av de følgende har vært kilder til nye/viktige ideer for bedriftens utviklingsaktiviteter?

> Leverandører
> Kunder
> Konkurrenter
> Konsulenter
> Universiteter, høyskoler og/eller forskningsinstitusjoner
> Støtteordninger
> Internett
> Bransjemesser og utstillinger
> Konferanser og vitenskaplige publikasjoner

Technology refinement

Hvor mye fokus har bedriften på de utviklingsaktivitetene som er nevnt under?

> Utvikling av nytt produkt
> Utvikling av ny tjeneste
> Utvikling av ny produksjonsprosess

firms that only operates in one of the areas, for example a firm only offering services.

Technology refinement

Når du sammenlikner bedriftens produkter/tjenester med konkurrerende løsninger i Norge og utlandet, vil du da si at deres viktigste vare:

> Er spesialisert mot en avgrenset type kunder (nisje)
> Løser et spesialisert behov hos kunden
> Representerer en ny, innovativ måte å imøtekomme kundenes behov på
> Er unikt med hensyn til teknologi
> Er unikt i bruk

The questions were answered on a seven point Likert-scale. The construct was calculated by taking the average of the reported values.