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Master of Business Administration, Lappeenranta
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The impact of Venture Capital firms on Business Model innovation and internationalization of Finnish cleantech growth companies

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Abstract

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The purpose of the study was to explore how venture capitalists (VCs) influence on business model innovation and internationalization of Finnish cleantech growth companies. We investigated evaluation criteria and investment preferences, VCs' value-added and impact on the barriers and business model (BM) specific success factors of cleantech ventures' internationalization.

The empirical part was based on a multiple case study and survey-based exploration. Digital survey with open-ended questions was conducted within an expert sample of leading venture capitalists investing in cleantech growth companies in Finland and key managers of Finnish entrepreneurial cleantech ventures. To gather the data, we also used secondary sources of information: web-sites of case-companies, media and archival sources in the Internet.

The findings of the study show that before VC approaching cleantech growth companies should focus on sustainable business model innovation, prepare strong business plan and develop a sustainable value proposition with innovative technology/service characterised by scalability, providing cost savings and requiring low capex. In return, VC firms are found to contribute significantly to internationalization in cleantech industry through overcoming main failure factors and facilitating BM-specific success factors of internationalization. Key challenges affecting the viability of cleantech firms' internationalization involve perceived business and technical risks, high transaction costs and problems with financing. While, key enablers of rapid expansion abroad are network, human and financial resources. Thus, VC firms positively influence internationalization process through lending their funds and contacts, but require a sustainable business model to be designed before their involvement in advance. More research is required for further insights on the contribution of VC firms to the performance of portfolio companies in various industries, countries and contexts.

Key concepts: business model, business model innovation, business model change, internationalization, failure factors, success factors, venture capital, Finnish cleantech, qualitative survey, multiple case study

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Table of contents

Abbreviations	6
1 Introduction	7
1.1 Background and importance of the study	7
1.2 Research objective and research question	10
1.3 Theoretical framework	11
1.4 Research methodology	12
1.5 Delimitations	13
1.6 Structure of the study	16
2 Venture Capital	18
2.1 Venture Capital definition and classification	19
2.2 Venture Capital approaching	21
2.3 VC firm's purpose and productivity	25
3 Cleantech	27
3.1 Cleantech definition and categories	27
3.2 Characteristics of clean technology and cleantech company	31
3.3 Cleantech ecosystem in Finland	33
4 Business Model innovation	39
4.1 Business Model concept and its elements	40
4.2 The concept of business model innovation	48
4.3 Scalable and internationally viable business model	49
4.4 Characteristics of Business Model changes	51
5 Internationalization	55
5.1 Incremental theory	56
5.2 Network theory	57
5.3 International entrepreneurship theory (Born global theory)	58
5.4 Influential factors on internationalization	64
5.4.1 Failure factors of internationalization	64
5.4.2 Business model specific success factors of internationalization	66
6 Research Methodology	71
6.1 Research approach	71
6.2 Research design	72
6.3 Research method	74
6.4 Data collection	78
6.5 Data analysis	82
6.6 Validity and reliability	84
7 Findings and Analysis	86
7.1 Case companies' description	86
7.1.1 Venture capital firms	86
7.1.2 Cleantech companies	90
7.2 VC approaching particularities in cleantech industry	98
7.3 Characteristics of Business Model changes after VC firm involvement	101
7.4 Factors influencing internationalization	108
7.5 VC firm's purpose and productivity criteria	114
8 Summary and Discussion	117
8.1 Summary	117
8.2 Theoretical contribution	124
8.3 Managerial implication	125
8.4 Limitations and future research	127

Figures	130
Tables	131
References	132
Appendices	
Appendix 1	Structured survey for VC firms
Appendix 2	Structured survey for CT companies

Abbreviations

B2B – Business to Business

BG – Born Global

BM – Business Model

BMA – Business Model Adaptation

BMI – Business Model Innovation

CT – Cleantech (Clean technology)

DCV – Dynamic Capability View

ICT – Information and Communications Technology

INV – International New Venture

R&D – Research and Development

RBV – Resource Based View

SaaS – Software-as-a-Service

SMEs – Small and Medium sized enterprises

VC – Venture Capital

VCs – Venture Capitalists

1 Introduction

1.1 Background and importance of the study

Fast changing environment arises issues of sustainability of the planet, and new laws and policies change market conditions. The United Nations Sustainable Development Goals (SDGs) included in the United Nations Resolution A/RES/70/1 of 25 September 2015 (United Nations 2015) provide priorities for the governments and corporations to facilitate the implementation of sustainable development up to 2030. The consequences of the climate change affect the policies of all countries around the world and particularly in the EU. In 2014, the European Council agreed on the 2030 EU climate and energy policy framework - to improve energy savings in 2030 by at least 27 % compared with the business-as-usual scenario (European Council 2014). The Energy Efficiency Directive (2012/27/EU) establishes binding measures to all EU countries - to use energy more efficiently at all stages of the energy chain from its production to its final consumption (European Commission 2016a).

According to the data of EPSRC Centre for Industrial Sustainability (2013) the global challenges are significant: by 2050 the global industrial system is targeted by governments to double its output while using 50% of current resources and generating 20% of current CO₂, which requires radically novel approaches that may be termed “industrial sustainability” (Bocken, Short, Rana & Evans 2013). Customers and other stakeholders are increasingly aware of the environmental impact of the industrial growth. They are concerned with the type of energy, range of low-carbon services and impact to the society. To reduce the impact on the environment, the firms should reconfigure their resources and gain additional resources to adapt to changes in the business context (Floreddu & Vitari 2013). Such dynamic capabilities especially refer to the companies in specific sectors of clean technologies.

Some believe the existing energy system can only be overturned by a process of Schumpeterian creative destruction initiated by entrepreneurs. Given venture capital’s prominent role in the last such wave of destruction, the information technology industry, policy makers are turning to the venture capital (VC) model

as a means for funding new firms whose success could affect an energy transition (Zysman & Huberty 2013). However, cleantech venture capital investment differs from the typical venture capital funding as it tends to be very capital intensive and faces greater technology risks associated with the functioning of the technology, scalability and exit requirements than the typical VC investment (Migendt 2017; Cumming, Henriques & Sadorsky 2016; Kenney 2011).

Some publications are devoted to specific sectors of cleantech with such topics as challenges in mobilizing the financial resources needed for large-scale diffusion of biomass gasification and offshore wind power in Europe (Karlton 2016); characteristics of investors in onshore wind power in Sweden (Darmani, Niesten & Hekkert 2017); attractiveness (the risk and return correlation), barriers and fostering factors of VC investing in sustainable energy technologies (Wustenhagen & Teppo 2006). Even such an alternative form of investment as crowdfunding has already got an overview with the link to cleantech in some publications (Cumming, Leboeuf & Schwienbacher 2017; Lam & Law 2016).

However, in the field of international entrepreneurship literature very little work has been done to discover the role and impact of venture capital firms in cleantech industry. The previous research related to the questions of financing cleantech in general has examined the decision-making processes of cleantech actors and their influence in cleantech investment networks (Georgeson, Caprotti & Bailey 2014), differences of overall value added by business angels and venture capitalists (VCs) (Luukkonen & Maunula 2007); differences between mainstream and green VC firms, as well as a problematic relationship between eco-entrepreneurs and green VCs (Randjelovic, O'Rourke & Orsato 2003).

The superior performance of VC funded companies has attracted a lot of research interest to the role of VCs in the companies' development. Megginson and Weiss (1991) ascertain that one of the key roles of VCs is to provide start-up funding for new firms (Carpenter & Petersen 2002). Holmes and Schmitz (1990) focus on the influential role of VCs in technological innovation and matching up the entrepreneurs with appropriate projects (Jeng & Wells 2000).

Despite the importance assigned to the VC firms in technology innovation, empirical research in the fields of strategic management and entrepreneurship has not yet comprehensively examined the impact of VCs on business model innovation. Evidence suggests that venture capital is quite significant in the context of entrepreneurial challenges, while business model innovation is one of the most substantial success factors contributing to the development of sustainable start-ups (Bocken 2015). Both business model innovation and venture capital are crucial for success of enterprises. That is why we try to explore these concepts separately and find their relation to each other. To put simply, we aim to understand whether VCs contribute to the business model innovation or BMI and well-designed BM attract VCs. The previous research reveals that 'substantial' business model changes are supported by venture capital firms (Gerasymenko, De Clercq & Sapienza 2015), and that phenomena has increased our interest in this research area.

On the backdrop of technological innovations and globalization the entrepreneurial firms aim to internationalize rapidly into the foreign markets. Due to this increasing speed of internationalization of many companies, this study intends to identify the impact of venture capital on the international growth of so called Born Global firms. The previous research confirms the positive influence of VC firms on internationalization of funded firms, however we have no awareness about the specific study in the context of cleantech industry. We seek to respond to these omissions by illustrating how VC firms drive entrepreneurial internationalization among Finnish cleantech growth companies, and how Business Model specific (BM-specific) success factors and challenges of rapid internationalization are intertwined with this impact.

To summarize, this study aims to identify some aspects of investor-entrepreneur relationships in cleantech industry, i.e. VC approaching and the characteristics of clean technology and cleantech company which are favorable for VC investing in general, and determine the influence of VC firms on internationalization and business model innovation as one of the determinants of successful international growth.

The findings can bring a theoretical contribution to the fields of business model innovation and international entrepreneurship, and managerial implications for the entrepreneurs and VCs in prioritization of their decisions regarding the elements of business model during the international pathway.

1.2 Research objective and research question

The main purpose of the study is to explore the impact of VC firms on business model innovation and internationalization process of Finnish cleantech growth companies. The focus of the study is on Finnish growth companies - start-ups on the expansion stage - that operate in cleantech sectors. To achieve this research objective, we formulate the following research question.

Research Question: How do VC firms influence in business model innovation and internationalization process of Finnish cleantech growth companies?

To answer this research question comprehensively, we target to explore the relationship between venture capitalists (VCs) and entrepreneurs regarding the initial approach of VC, managerial input of the VCs in business model innovation and their influence on the international growth of portfolio companies. The study seeks to examine the characteristics of “clean technology” and cleantech company which influence the likelihood of VC funding, as well as determine the preparation actions before VC approaching. Further on the research aims to investigate the characteristics of business model changes after VC firm involvement. We also study the elements of a business model playing the most key role in the success of internationalization of cleantech new ventures and examine the key failure factors hindering the internationalization process in cleantech industry. In order to understand how VC firms affect business model innovation and international growth of Finnish cleantech companies we plan to figure out the main purpose of VC firms and the VC firm’s productivity criteria.

Sub question 1: What are the characteristics of “clean technology” and capabilities of a cleantech company which are looked for by VC firms, and what are the primary preparation actions before VC approaching?

Sub question 2: What is the type of Business Model changes after VC firm involvement?

Sub question 3: What are the key failure and success factors influencing internationalization process in cleantech industry?

Sub question 4: What are the main purposes of VC firms and their productivity criteria?

1.3 Theoretical framework

Theoretical framework illustrates the main concepts, related theories, definitions and classifications which provide guidelines for empirical study and help to find answers to the research question and sub questions. Making meaningful sense of empirical data is impossible without theory (Voss, Tsikriktsis & Frohlich 2002).

The theories and concepts utilized in this study are conceptualized into theoretical framework of the study where the interlinkages between different theoretical constructs are visualized (Figure 1.1). After reviewing the relevant literature, a conceptual framework is developed which integrates the positions of Dynamic Capability View and Relational View. Based on this framework, the hypotheses about preparation actions before VC approaching, characteristics of business model changes, and failure and business model specific success factors of born global firms in cleantech industry are derived. Moreover, the purposes of VC firms and criteria of their productivity are conceptualized on the basis of the literature review.

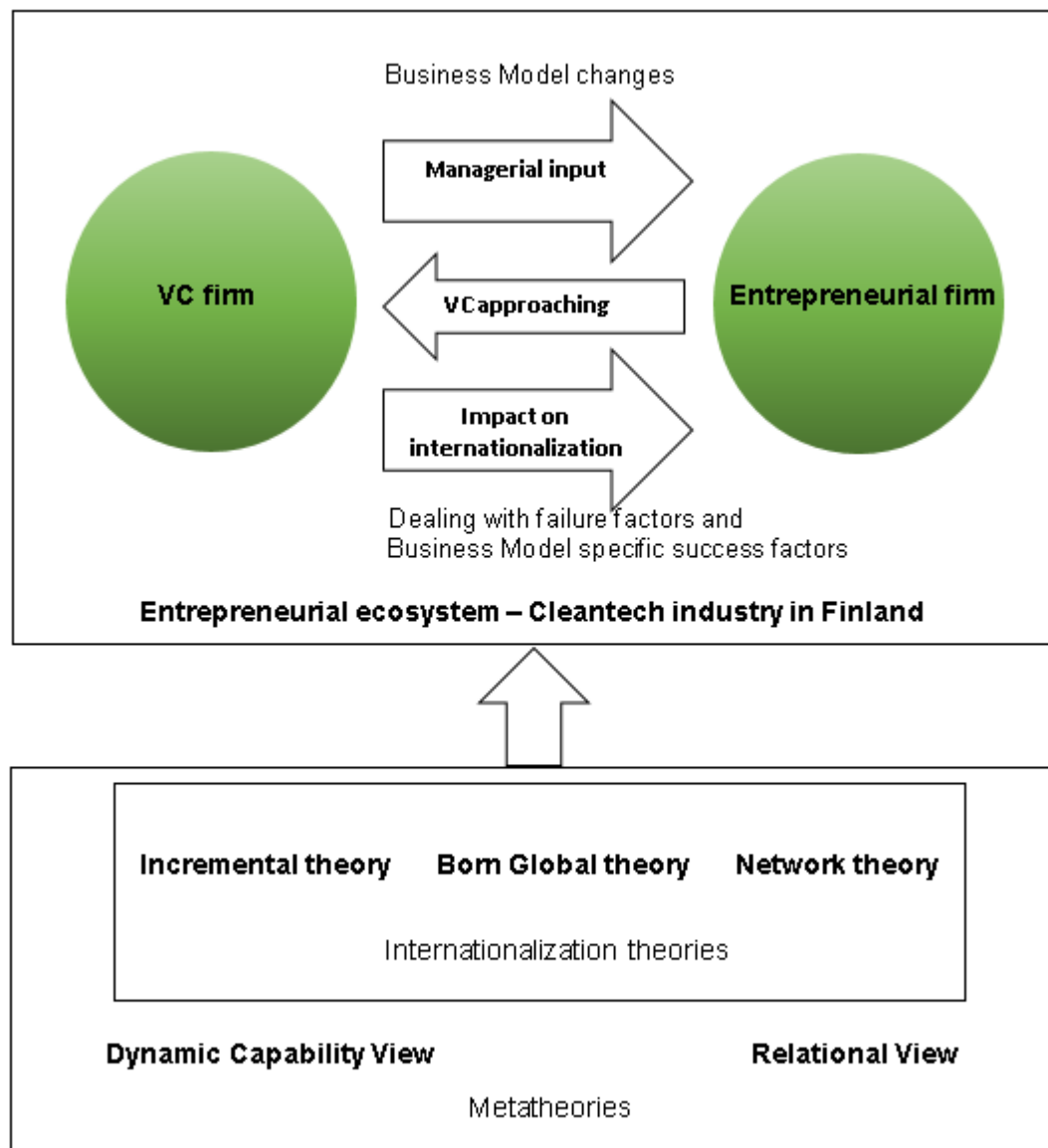


Figure 1.1. Theoretical framework of the study

1.4 Research methodology

There has been very little industry-specific academic research on venture capital investments in the cleantech industry to date. Therefore, to investigate the impact of venture capital firms on business model changes and internationalization in cleantech industry, and to gain greater insights we rely on explorative qualitative research method. The goal of a qualitative research method is to enhance the understanding of a phenomena with emphasis on the meanings, experiences and views of all participants (Neergaard & Ulhoi 2007).

To meet the research objective, we plan to apply the explorative qualitative research method including theoretical and empirical parts. The theoretical framework will contain careful examination of academic literature addressing the main phenomena of the research. The selected theories will be justified by explaining their applicability and significance to the study.

The empirical part of the research is planned to be conducted as a multiple case study of five VC firms and five Finnish cleantech growth companies specializing in different cleantech sectors. Traditional qualitative technique for data generation is in-depth interview (Schwandt 2007; Thorpe & Holt 2008). However, we have conducted structured digital survey with open-ended questions among the senior managers of the case companies, including shareholders and CEOs, as the key informants to collect data. We also have used secondary data as multiple sources of evidence enable to cover a broader range of views and issues (Yin 2009).

The multiple case study will provide the thorough understanding of the relationship between VC firms and cleantech companies, as well as the impact of VC firms on business model innovation and internationalization process of Finnish cleantech start-ups. The purpose of every case study is to get knowledge on the studied phenomena from various perspectives. The cross-case analysis and comparison of the results can give the findings for theoretical summarization and managerial implications. Reliability and validity of the study will be evaluated to assess the quality of the research.

1.5 Delimitations

Most of the academic research is concentrated on SMEs because these enterprises are ascertained to be *the backbone of the EU's economy* (European Commission 2018b). They have a key role in creating opportunities for new employment and stimulating industrial growth.

The EU defines the main factors determining whether a company is a micro, small or medium enterprise (SME): staff headcount, and either turnover or balance sheet total (Table 1.1).

Company category	Staff headcount	Turnover	or	Balance sheet total
Medium-sized	< 250	≤ € 50 m		≤ € 43 m
Small	< 50	≤ € 10 m		≤ € 10 m
Micro	< 10	≤ € 2 m		≤ € 2 m

Table 1.1. SME definition by the EU (European Commission 2018c).

The 2016/2017 annual report on European SMEs reveals that start-ups and innovative high-growth firms are important drivers of economic growth as well. They play a significant role in employment creation increasing EU innovation and competitiveness, and have been supported by EU's initiative since 2016. This initiative 'Europe's next leaders: the Start-up and Scale-up Initiative' combines a range of actions to reduce existing barriers to growth so that to enable start-ups and scale-ups to expand their business across Europe and beyond. (European Commission 2018b.)

Our research is implemented in the framework of the companies on the growth or expansion stage. They have not yet reached the target of 2 M€ turnover and are still considered to be micro enterprises or start-ups. But they have already set up a sales and distribution network, as well as started production. European Commission (2018b) defines start-ups as the new enterprises undergoing rapid (i.e., above average) growth. Depending on the risk, investment sources and the amount of sales new enterprises can be divided in start-ups, growth companies and later-stage enterprises how it is illustrated in Figure 1.2 (MaRS 2013). Growth companies focus on scaling marketing efforts and work on increasing market presence, while VC firms finance their operations, provide business expansion expertise and consultation to achieve positive cash flow (Feimster 2016).

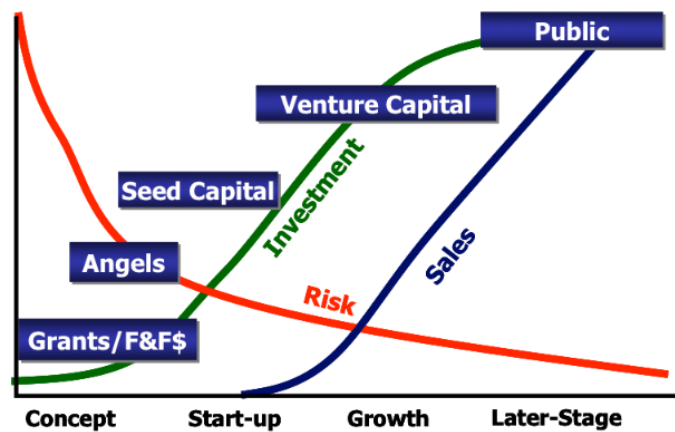


Figure 1.2. The Company Financing Lifecycle (MaRS 2013).

Policymakers in Europe have recognized the importance of promoting markets for risk capital for the development of small, high-technology companies (Carpenter & Petersen 2002). Megginson and Weiss (1991) ascertain that one of the roles of venture capitalists is to provide funding for new firms - start-ups (Carpenter & Petersen 2002). However, Finnish and Nordic market has a shortage of private capital interested in early stage investments. Many VC firms have switched to more mature companies with already developed products and established customers, typically, leaders in the sector. (University of Oulu 2013.)

This phenomenon explains our interest in the Finnish cleantech companies on the growth stage. They may have not yet reached the target of 2 M€ turnover but have already developed their products and customers' network. Hence, this study is focused on the Finnish cleantech growth companies which are born global, internationalize their products and/or services from inception (Oviatt & McDougall 1994) and funded by VC firms. We examine cleantech companies in several sectors of cleantech industry: Energy & resource efficiency, Bioenergy & biofuels, Energy production & distribution, Clean water technology, Marine & shipping and Smart transport & logistics, delimitating other areas of the cleantech categories. We do not explore growth companies utilizing other forms of financing instead of VC.

Taking into consideration the VC investment cycle consisted of such phases as selection, investment, monitoring, and exit (Tyebjee & Bruno 1984), we explore

the peculiarities of VC-entrepreneur relationship in selection and monitoring phases particularly focusing on VC approaching and VCs' performance criteria. We do not cover the structure of investment deal, compensation schemes for the mutual incentives of entrepreneurs and VCs, and exit peculiarities (Jeng & Wells 2000). We do not look into the cleantech ventures' motives for VC funding, as well as negative aspects of relationship with VCs (e.g., replacing management personnel or share price returns).

We concentrate on the business model innovation as a managerial input of VC firms neglecting the application of other managerial tools for company development. We try to characterize the type of changes in business models of VC-backed companies after raising the venture capital, while requiring more research in other specific spheres as which components of BM are changed, what are the reasons and outcomes of changes, what challenges exist with the current business models.

Exploring the impact of VC firms on internationalization we focus on the mediating factors that influence internationalization, i.e. challenges and business model specific success factors, and plan to figure out VC firms' impact on them: overcoming or facilitating, responsively. We omit the description of the process of internationalization with its modes and strategies, and the motivation for internationalization (Zahra & George 2002, Mtigwe 2006) which are the delimitations of our study.

A general perspective to the main purpose of VC and VC firms' productivity criteria in combination with the above-mentioned facets of the research helps us to answer the research question and determine the impact of VC firms on BMI and internationalization in cleantech context.

1.6 Structure of the study

The structure of the study is as follows. Chapter 2 gives an overview of the venture capital industry, while chapter 3 describes the emergence and development of cleantech industry. Chapter 4 and 5 represent the theoretical part on such concepts as business model innovation (BMI) and internationalization, respectively. Our data set of VC firms and VC-backed

cleantech companies is presented in chapter 6, where we outline research design and our data collection procedure, and describe key attributes of the sample and case companies. In chapter 7, we present empirical evidence of venture capitalists' participation in the cleantech case-companies and analyze the effects of venture capital performance on the business model innovation, and internationalization of the backed cleantech firms. The last chapter of the thesis reviews the findings and tackles the research question. We conclude with the theoretical contribution, and provide recommendations for cleantech entrepreneurs seeking VC funding and international growth, as well as for VCs investing in cleantech growth companies. Limitations of the study and suggestions for future research about unexplored avenues of the topic finalize the investigation on the introduced research area.

Table 1.2 demonstrates the structure of the research as inputs and outputs of the chapters.

Part	Chapter	Input	Output
Introductory part	1 Introduction	Background and research gap	Research objective and questions, Theoretical framework, Methodology, Delimitations
Theoretical part	2 Venture Capital	Literature review	Definitions and theoretical findings on the main concepts of the research
	3 Cleantech		
	4 Business Model innovation		
	5 Internationalization		
Empirical part	6 Research Methodology	Data collection	Explanation of databases and description of research process, Evaluation of reliability and validity of the used method
	7 Findings and Analysis	Data analysis	Empirical findings on the main concepts of the study, Cross case analysis
Concluding part	8 Conclusion and Discussion	Results of the research	Answers to the sub questions and research question, Theoretical and managerial implications, Limitations and further research considerations

Table 1.2. Structure of the study

2 Venture Capital

The previous research on VC has demonstrated that VC-backed companies have a leading role in commercializing breakthrough technologies. The past performance of VC-backed companies shows that venture capital has been very successful at backing companies with innovative technologies and tremendous growth potential (Jeng & Wells 2000). The beneficial impact of venture capital on revenue growth, job creation and GDP growth is supported by theoretical and empirical research (Jeng & Wells 2000). VC firms are claimed to generate jobs, and contribute to the growth of international activates and regional development. Moreover, they provide non-financial benefits through advice and managerial input, which lead to better performance than companies without VC funding.

Historically, academic research on venture capital has concentrated on Information and Communications Technology (ICT) and biotech, since the data is available in these two sectors. Emergence of Cleantech as a new industry for VC investment facilitates the development of sustainable VC market. The entrenched perception of the harmful influence of the industry and technology to the environment (negative “footprint”) has changed to looking for technological solutions for prevention of climate change and achieving sustainable business development. Venture capitalists struggle for gaining above-normal returns accompanied by the environmental and social positive impact, so called “handprint”.

VCs investment behavior, due diligence and various issues related to decision-making have always attracted a great interest to the researchers. Understanding of VCs screening and evaluation criteria is essential for entrepreneurs to apply for and get funds. That is why the key influential factors in VCs’ decision-making process have been studied for several decades. Preparation of an entrepreneurial firm for VC approaching is rather specific in every case, as VCs’ evaluation criteria differs with different ventures based on the type of industry, geographic location, stage and size of investment (Sharma 2015; Sorenson & Stuart 2001). The basic categories discussed in academic literature are the entrepreneur’s characteristics, product, competitive strategies,

market size and growth, but they are weighted differently in every case (Sharma 2015). Consequently, the determination of the primary criteria and the primary actions before VC approaching is still under the investigation and we target to contribute to this scientific field with certain delimitations. Very few publications investigate the peculiarities of VC approaching in cleantech industry, and no one is implemented for Finnish business environment. Therefore, answering to the first subquestion we aim to study which business models and capabilities are looked for by VC investors and what Finnish cleantech growth companies should prepare before application to VC funding.

This chapter provides Venture Capital definition and classification applicable in this study. Further on, such aspects of VC approaching as assessment criterion of VC seeking companies and preparation actions required from them before contacting VCs are described. The chapter is finished by the discussion of the purpose of VC firms and evaluation criteria of VC firm's performance.

2.1 Venture Capital definition and classification

Venture Capital (VC) has emerged as the dominant source of finance for entrepreneurial and early stage businesses. Outstanding venture capital industry is a cornerstone of America's leadership in the commercialization of technological innovation (Bottazzi & Da Rin 2002). Lample (1989) stated that American Research and Development (ARD) company was the first modern venture capital firm formed in 1946. Its goal was to finance commercial applications of technologies that were developed during the World War II, and the focus was on adding value to companies, not just supplying money. Thus, ARD's staff under the supervision of Georges Doriot, Harvard Business School professor and "father of venture capital", provided industry expertise and management experience to the backed companies in order to increase their chances of ultimate success. (Gompers 1994; Bottazzi & Da Rin 2002.)

The venture capital includes some specific characteristics and purposes. Venture capital can be described as financing of young, unlisted dynamic ventures through equity or equity-like instruments by limited partnerships of professional investors who raise funds from wealthy and/or institutional investors (Bottazzi & Da Rin 2002). The venture capital investors provide risk

capital to companies that offer high potential returns, they try to add value through direct participation in management and usually specialize in a certain industry and use their network of key employees, suppliers, and develop customer relations of the funded firms (Barry et al. 1990). Wright and Robbie (1998) define venture capital as long-term and risk equity finance of professional investors in new ventures for eventual capital gain through Initial Public Offerings (IPO) or trade sales (Wüstenhagen & Teppo 2006). Thus, venture capital is the form of equity financing that is suitable for young high-tech companies, as venture capitalists typically monitor the firms they fund closely and have effective tools to overcome information and agency problems partially (Carpenter & Petersen 2002).

The particularities of VC in cleantech industry are studied by the researchers from different facets. Ghosh and Nanda (2010) focus on the problem of too much technology risk, and at the same time requirement of too much funding until maturity of cleantech ventures, typically facing the so called “Valley of Death” (Migendt 2017). Randjelovic, O'Rourke and Orsato (2003) introduced the term “green venture capital” that is high-risk financial capital for eco-innovative ventures, which offers the potential for financial returns at the same time contributing to sustainable development (Randjelovic et al. 2003). The payback period of green innovation projects is longer than common technological innovation projects, accordingly, the payback period will be gradually extended for green venture capital firms (Wei, Yuguo & Jiaping 2015). Marcus, Malen and Ellis (2013) refer to timelines of up to 10 years between raising money and exiting whereas ‘clean’ or sustainable investments are often stretched beyond this (Bocken 2015).

Abovementioned definitions clarify the main characteristics of green venture capital firms which can be formulated as the following ones:

- orientation for longer-term returns (three to ten years after investing),
- risk private equity funding,
- financial intermediation (e.g., between pension funds and insurance companies, and entrepreneurs),
- expertise in industry and management,

- exit opportunities through Initial Public Offerings (IPO) or trade sales.

Venture capital firms can be differed by several criteria - venture stage of interest, the amount of assistance provided by the VCs, the VC's size, and geographic region where they are located (Elango, Fried, Hisrich & Polonchek 1995). VC investments can be divided in early stage investments (seed and startup) and expansion stage investments (Figure 1.1), when a company with established product in the marketplace needs additional financial resources to fund its growth and internationalization, as well as further R&D (Jeng & Wells 2000). A lot of publications are devoted to comparing the corporate venture capital firms and the independent (or private, traditional) venture capital organizations (Chesbrough 2000; Gompers & Lerner 2000; Maula, Autio & Murray 2005; Dushnitsky & Shapira 2010).

Clarifying the definition of Venture Capital, it is worth to mention that it has a different usage in the US and Europe. In Europe this term is wider and comprises all the types of private equity, while in the US Venture Capital is one of the types of private equity investing on a par with management buyouts and leveraged buyouts (Jeng & Wells 2000). However, buyout investors and venture capitalists invest in different kinds of firms: buyout specialists usually invest in mature companies with predictable cash flows, whereas venture capitalists focus on young and high-risk entrepreneurial ventures (Barry, Muscarella, Peavy Iii & Vetsuypens 1990). Our specific interest lays down in the area of narrow understanding of Venture Capital as a type of private equity funding because we focus on entrepreneurial ventures in their expansion stage, and venture capitalists are more actively than buyout specialists involved in managing their portfolio companies and provide firms with expert advice (Barry et al. 1990; Sahlman 1990).

2.2 Venture Capital approaching

VCs-entrepreneurs relationship has been investigated from various perspectives and incorporated the great amount of knowledge on the following topics:

- motivation and incentives for venture financing (Gompers 1996);

- evaluation criteria for VC investing (MacMillan, Siegel & Narasimha1985; Fried & Hisrich 1994; Randjelovic et al. 2003);
- value added by VCs (MacMillan, Kulow & Khoylian 1989; Barry et al. 1990; Jeng & Wells 2000; Hellmann and Puri 2002).

VCs investment behavior, due diligence and various issues related to decision-making have always attracted a great interest to the researchers. Tyebjee and Bruno (1984) proposed a five stages VC process model:

- 1) deal origination - identifying potential firm;
- 2) deal screening - reviewing proposals particularly in technology, product and scope of market;
- 3) deal evaluation – assessment of a business plan (risk and return);
- 4) deal structuring – negotiating and mutually establishing VC agreement and
- 5) post-investment activities – providing value-added activities. (Tyebjee & Bruno 1984.)

Understanding of VCs screening and evaluation criteria is essential for entrepreneurs to apply for and get funds. That is why the key influential factors in VCs' decision-making process have been studied for several decades. Preparation of an entrepreneurial firm for VC approaching is rather specific in every case, as VCs' evaluation criteria differs with different ventures based on the type of industry, geographic location, stage and size of investment (Sharma 2015; Sorenson & Stuart 2001).

The key influential factors in VCs' decision-making process have been studied for several decades (MacMillan, Siegel & Narasimha1985; Fried & Hisrich 1994; Randjelovic et al. 2003; Mrkajic, Murtinu & Scalera 2017). VCs follow multi-criteria perspective of the decision-making giving importance to the entrepreneur's characteristics, as well as to financial and marketing terms. The quality of the entrepreneur (the entrepreneur's experience and personality), with the emphasis on the business plan, ultimately determine the funding decision (MacMillan et al. 1985).

Hisrich and Jankowicz (1990) identified three basic constructs taking into consideration by VCs in decision-making process:

- a concept comprising four components - significant potential for earnings growth, business idea (new product, service, or retail concept), competitive advantage and reasonable overall capital requirements;
- management with such attributes as personal integrity and excellent performance, leadership capabilities and general management experience; and
- returns with three following subconstructs - the exit opportunity, the potential for a high rate of return in the 30-70% range and the potential for a high absolute return by large investments. (Fried & Hisrich 1994.)

Hence, the basic categories discussed in academic literature are entrepreneur's characteristics, product, competitive strategies, market size and growth, but they are weighted differently in every case (Sharma 2015). The opinion exists that a better business model can beat a better idea or technology (Chesbrough 2007). The proprietary protection as trademarks and patents appears to be one of the most important product characteristic for investors in innovative technology (MacMillan et al. 1985; Popov & Roosenboom 2012; Block, De Vries, Schumann & Sandner 2014). Another research confirms that the effects of patents are positive and significant on the likelihood of VC fundraising as VCs follow patent signals to invest in companies with commercially viable know-how (Lahr & Mina 2016). Shane and Stuart (2002) state that the firms with direct or indirect social ties to investors are more likely to get VC investment (Beckman, Burton & O'Reilly 2007). The access to different networks and contacts in the industry and financial community are positively associated with a firm's VC attraction and achieving IPO (Higgins & Gulati 2006). Thus, entrepreneurial teams with more founding experience and diversified affiliation have a higher likelihood of VC funding via a direct social tie (Hsu 2007; Beckman et al. 2007). At the same time, the empirical data indicates that alliances and intellectual property have a similar effect on attracting VC investment (Baum and Silverman 2004).

Another specific criterion of VC investing is balancing financial with social and environmental returns. Global Impact Investing Network (2013) specifies impact investments, which are made with the intention to generate measurable social and environmental impact alongside a financial return. Rockefeller Philanthropy Advisors (2009) highlight that in the sustainability area an investment thesis

(vision of what fits the portfolio) refers to how a specific investment will create impact. Sustainable venture capitalists concentrate on the businesses, which have the potential to generate economic returns accompanied by the positive environmental and social impacts. (Bocken 2015.)

Other determinants of successful VC raising discussed in the scientific literature are generating any revenues at the time of financing (Kaplan & Strömberg 2004), getting investments in previous rounds (Lerner 1994; Rowley 2017) or implementation of crowdfunding (Mollick 2014; Strausz 2017). The empirical data suggests that venture capitalists make investments in the late rounds of promising firms, even if the financial returns are low (Lerner 1994). Crowdfunding can be used to demonstrate demand for a proposed product, which can lead to funding from VC firms afterwards (Mollick 2014). After the successful implementation of crowdfunding an entrepreneur initially rejected for VC funding may then return to the VC firm to obtain the fund (Strausz 2017).

Very few studies are concerned with the influential factors in the cleantech industry. Randjelovic et al. (2003) state that a prerequisite for green VC approaching is a preparation of a 'good' business plan with such essential data as expected revenues and without redundant or irrelevant data, i.e. overemphasis on world environmental problems. In addition, eco-entrepreneurs should possess business skills, such as marketing, management or financial competences, to run their businesses and succeed in market terms (Randjelovic et al. 2003). One publication presents three contingencies that moderate the association between green business propositions and the likelihood to get VC, namely the technical/scientific education of the founder(s), the origin of the firm as academic spin-out, and the presence of corporate shareholders in the venture's equity (Mrkajic et al. 2017).

We summarize the regarded issues which are evaluated by the VC firms and identify the following primary actions that should be taken before VC application by the growth ventures in cleantech industry specifically:

- propose innovative product or service,
- develop sustainable business model,
- prepare strong business plan,

- have social ties and network with VC firm,
- have revenue records,
- have patents or trademark,
- present environmental or social impact,
- succeed in previous investment rounds,
- implement crowdfunding.

2.3 VC firm's purpose and productivity criteria

Venture capitalists are actively involved in the governance of the companies they fund through board membership, management recruiting, and the provision of management incentives (Chen, Gompers, Kovner & Lerner 2010). They maintain a close relationship by sitting on the boards of directors, performing some key corporate functions for the firm, such as running the corporate finance department and working with suppliers and customers (Jeng & Wells 2000). Apart from providing capital, VCs use their specific industrial knowledge, expertise, and contacts to assist their portfolio ventures in various areas such as strategic and operational planning, personnel and supplier selection, marketing, and financing (Rajan 2010). Venture capital investment is a wonderful way to accelerate the growth of a company as it allows to grow faster than with cash flow, get expertise and contacts, create more value, share the risk, fund structural changes, and professionalize the board (Paaomasijoittajat 2018). Private equity investors add value to portfolio companies with a greater focus on increasing growth than on reducing costs (Gompers, Kaplan & Mukharlyamov 2016). The VCs enlarge the company and increase its value by providing help with board work, recruitment and internationalization (Paaomasijoittajat 2018). The VCs grow the company and increase its value by providing help with board work, recruitment and internationalization (Paaomasijoittajat 2018). Thus, distinct areas of VCs' involvement were identified: development and operations, management selection, personnel management, and financial participation, and correlations between VCs' interference with venture performance were indicated (MacMillan et al. 1989).

Academic literature reveals that VC funded companies show superior performance to non VC funded companies. However, concerns about selection

effect exist (Sørensen 2007) as VCs screen and select only the best investment opportunities. The question is, whether the inherent characteristics of the firm result in superior performance, or VCs contribute to the performance of a portfolio company after their involvement. The inter-relationship between VC funding and portfolio firm performance is debated in academia and practice. The performance implications of VC-specific factors (e.g., syndication, reputation, experience, exit conditions, etc.) in the VC-backed firms have been studied thoroughly (Nahata 2008). Most empirical literature indicates that the value addition effect dominates the selection effect in respect of the superior performance of VC-backed companies (Gorman & Sahlman 1989; MacMillan et al. 1989; Brander, Amit & Antweiler 2002; Hellmann & Puri 2002; Rajan 2010). Thus, the evidence strongly points to the overall performance of a VC-backed firm as a criterion of a VC firm's productivity.

VC fund productivity can be measured by the proportion of investments that are successfully exited through an initial public offering (IPO) or a sale to another company (Hochberg, Ljungqvist & Lu 2007). Another measure of VC firm's performance is its IPO capitalization share, which is based on cumulative market capitalization of IPOs backed by the VC firm (Nahata 2008). The VCs grow the company and increase its value by providing help with board work, recruitment and internationalization (Paaomasijoittajat 2018). The returns on venture capital investments depend on the market value of a new company via IPO or acquisition (Zysman & Huberty 2013), thus we can presume that capitalization of a VC-backed firm is one of the determinants of a VC firm's performance.

Abundance of research is devoted to the impact of VCs on internationalization (Fernhaber & McDougall-Covin 2009) and managerial input (MacMillan et al. 1989, Jeng & Wells 2000). We are interested whether the VC firm's performance can be measured by the international growth of VC-backed ventures and the business model changes in their portfolio companies. In other words, do VCs truly add incremental value in BMI and international growth of their portfolio companies as the final purposes of their managerial input?

3 Cleantech

In this chapter the theoretical framework of cleantech is presented. The chapter begins with explaining the phenomenon of clean technology, its definition and categories. Based on the different academic publications the characteristics of clean technology and cleantech company are then elaborated. At the end of the chapter some inherent characteristics of the cleantech ecosystem in Finland are described.

3.1 Cleantech definition and categories

The concept of cleantech industry has no uniformity in understanding and usually associated with a certain sector, such as renewable energy, or interrelated with some other industries. Parker and O'Rourke (2006) define "cleantech" as *any knowledge based product or service that improves operational performance, productivity or efficiency while reducing cost, inputs, energy consumption, waste or pollution*. Thus, clean technologies are not limited to specific sectors of industry or technology, but have a common purpose to develop and commercialize products decreasing the negative footprint of mankind's impact on the environment (Torkkeli, Uzhegova, Salojärvi & Saarenketo 2017).

The term "cleantech" was created by the investment community and is widely regarded as an investment category. The cleantech investment category responds to the need for innovative technologies to combat the impact of global environmental, climate and resource trends (Georgeson et al. 2014). It includes investments in companies mitigating and adapting to climate change and encompasses several industry sectors. It was advocated by founders of the Cleantech Venture Network (now Cleantech Group) in 2002 as a term to describe the "green and clean" technologies, especially including solar, biofuels, fuel cells, water remediation, and renewable power generation, that venture capital investors were turning to as the next trend in technology investing. The ecological need for investments in renewable energies and clean technologies underpin the appearance of cleantech category as a response to climate change. Hence, now the cleantech industry comprises companies that focus on

green and sustainable technologies with product, process or service offerings decreasing the amount of greenhouse gas emissions. (Migendt 2017.)

Green ventures are high-tech ventures using green technologies in their businesses or offering green products/services (Mrkajic et al. 2017). Therefore, cleantech is a science-based and high-tech industry like biotechnology or nanotechnology that offers the potential of high growth, but is fraught with risk (Lo & Pisano 2016). Research-intensive fields involve massive R&D investments, extended lags before investments bear fruit, and high risks of failure. VC funding is one of the major drivers of innovation and technology commercialization especially during initial stages of cleantech company (Samila & Sorenson 2010). From the first sight, it seems that clean technologies are suited to early-stage venture capital (VC) investment. However, traditional venture capital-entrepreneurial model was not designed to deal with the costs, risks, and slow payout (Lo & Pisano 2016). VC firms have shown the impact of stimulating innovation in a wide range of technology settings, but in the science-based settings long-term, high-risk and capital-intensive investments are required (Lo & Pisano 2016). Cleantech has almost the opposite to ICT set of characteristics - high upfront costs and medium level returns over the long term (Bocken 2015). However, it should be noted that huge investments have been made in the cleantech sectors already, and they continue to grow (Sworder, Salge & Van Soest 2017).

In the time frame of 2004 - 2006 financial and capital markets greatly succeeded in the solar, wind, and ethanol sectors. That was driven by changes in policy incentives, fuels standards and pension legislation in the U.S. and Europe. For example, changes in regulation of the pension funds, which are the main investors in VC funds in Europe, required the pension funds to disclose information about ecological, ethical and social characteristics in their investments, thus inducing investors to fund eco-oriented companies (Randjelovic et al. 2003). Other major drivers were rising energy and commodity prices, increased consumer awareness of sustainability issues, and the start of the Kyoto Protocol based carbon trading mechanisms. The combination of these events began to attract significant amounts of capital and awareness to the cleantech industry. Hence, its origin stems from the increased consumer,

regulatory, and industry interest in clean forms of energy generation—specifically the rise in awareness of global warming, climate change, and the impact on the natural environment from the burning of fossil fuels. (Dikeman 2018.)

Figure 3.1 outlines global Venture and Growth Equity Investment in cleantech companies in the time frame of 2010 – 2016 with the specification of main cleantech categories.

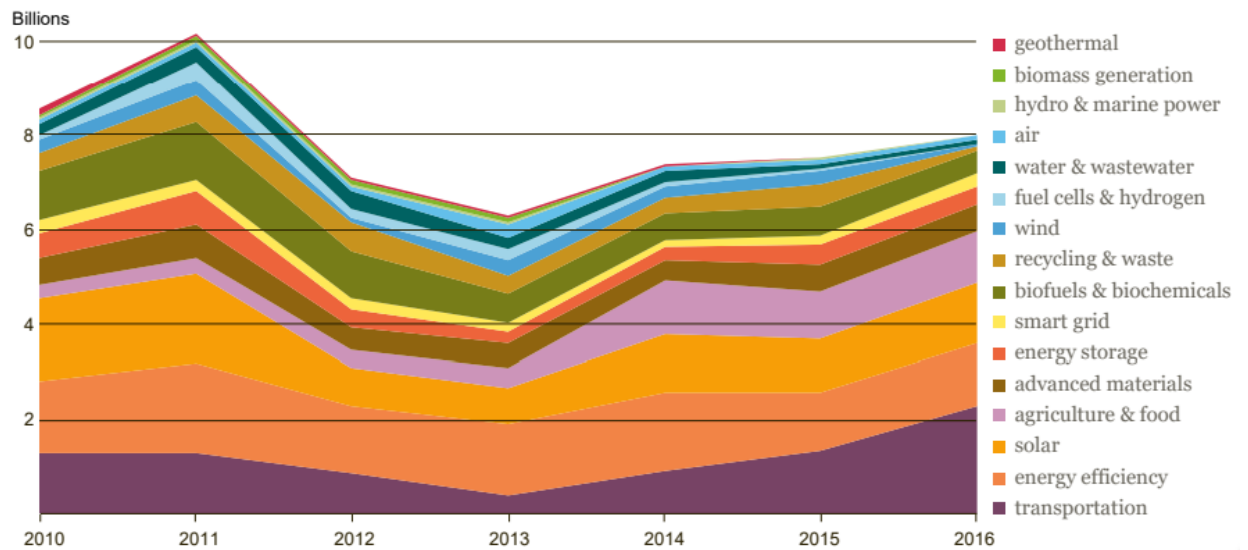


Figure 3.1. Global Venture and Growth Equity Investment in cleantech companies, 2010 – 2016 (Sworder et al. 2017).

Figure 3.2 depicts eight major categories of cleantech innovations representing great investment opportunities (Kachan& Fugere 2013).



Figure 3.2. Major categories of clean technologies (Kachan & Fugere 2013).

Cleantech Group defined cleantech as an innovative technology and related business models offering competitive returns for investors and customers while providing solutions to global challenges. Cleantech represents a diverse range of products, services, and processes, all intended to provide *superior performance at lower costs*, while greatly *reducing or eliminating negative ecological impact* and improving *the productive and responsible use of natural resources* (Dikeman 2018.)

Hence, we can conclude that the term “cleantech” refers to products, services and processes providing the sustainable use of natural resources while reducing the harmful effects of industrial processes on the environment. Cleantech is a cross-sectoral technology for the promotion of resources and energy efficiency, renewable energy, water and material recycling, and environmental management. Cleantech implies products or services that improve operational performance, productivity, or efficiency while reducing costs, inputs, energy consumption, waste, or environmental pollution.

3.2 Characteristics of clean technology and cleantech company

When judging, whether a financial vehicle can support a certain innovation or a company, the question is whether this cleantech company and its market have the characteristics necessary to meet a set of criteria. The key factors for a venture capital investment can be reduced to three interdependent criteria — rapidly growing markets, scalable technologies and business models, and large and rapid pay-offs. The high growth rates of markets and relatively low costs of scaling-up typically differentiate the industries attracting venture capital. When these criteria are not sufficiently satisfied, then those clean technologies are unlikely to receive venture capital. (Zysman & Huberty 2013.)

The scope of Cleantech encompasses a broad range of technology categories, including renewable energy, energy efficiency, green building, transportation, smart power, smart grid and energy storage, and air, water, and waste. Wüstenhagen and Menichetti (2012) specified that cleantech companies primary focus on developing and commercializing resource-efficient and low-impact technologies and processes (Georgeson et al. 2014). Dangelico and Pontrandolfo (2010) describe characteristics associated with the 'green' nature of a product (Mrkajic et al. 2017), among which are resource efficiency and sustainability of resource use, energy efficiency and minimization of the environmental impact, etc. (Dangelico & Pontrandolfo 2010). It is also noted that modern technologies in energy sector must meet very limited cost, quality, and reliability expectations to serve the mass market (Zysman & Huberty 2013).

Summarizing the definitions of clean technology and assessing the requirements for VC investment we can identify the following characteristics of clean technologies favorable for VC funding: energy and resource efficiency, sustainability as reduction of harm on environment, cost savings, reducing waste or pollution, low capex and scalability.

Cleantech companies are usually represented by small, innovative, and entrepreneurial companies introducing technologies such as cleantech (Hockerts & Wüstenhagen 2010). They are commonly financed by venture capitalists (VCs), as they lack the resources for rapid growth and access to

traditional financial institutions with debt financing (Carpenter & Petersen 2002; De Bettignies & Brander 2007). Eco-entrepreneurial cleantech companies are often product-based and the product cycle is longer than service-oriented innovations such as 'dotcoms' (Randjelovic et al. 2003).

The Global Cleantech 100 program represents the most innovative and promising companies selected by corporate experts and financial investors. The latter stress the track records and strength of a team as the main criteria of selection, while breakthrough technology, long-term market potential and competitive cost structure are highlighted by all panelists (Chen, Suzuki & Lackner 2016).

The raise in service-orientation and attraction of ICT by its low capital investment, quick exits and high returns (de Lange 2016) resulted in appearance of immense variety of studies devoted to environmentally sustainable information services. Some of them focus on various environmental reporting and measurement (Isenmann, Bey & Walter 2007), others – on taking into consideration the environment when designing products and services (Chowdhury 2012). Sustainable information systems are designed to perform a variety of transactions such as online operation, monitoring, control, and management of specific equipment and machineries, as well as online supply chain management (Chowdhury 2012). All of them demonstrate Software-as-a-Service (SaaS) business model, which can be applicable in the cleantech industry as well.

The importance of partnering and maintaining network through cooperative strong ties is stressed by de Lange (2016). The networks are built over the lifetimes of collaborative projects and often represented by the private sector partners engaged in public-private partnerships (PPPs). Partners in cleantech industry work together over the long term because many years are required for multidisciplinary product development and integration of it into existing markets (de Lange 2016). Hence, social capabilities and ties over long term are appreciated much in cleantech industry and we assume that they play a significant role in VC raising.

To summarize, the capabilities which are looked for to invest in we can highlight the following ones: scalable BM, Software-as-a-Service (SaaS), sustainable value proposition, strong management team, innovative profit formula, and social capabilities and ties.

3.3 Cleantech ecosystem in Finland

Enterprises and entrepreneurs being an engine of economic growth stimulate innovation, productivity growth, and new jobs. Entrepreneurs exist in the context of their particular geography, and represent the entrepreneurship ‘ecosystem’, which is the mix of infrastructure, resources and attitudes in a country. The Global Entrepreneurship Index is an annual index that measures the health of the entrepreneurship ecosystems in each of 137 countries. It then ranks the performance of these against each other. This provides a picture of how each country performs in both the domestic and international context. (The GEDI 2018.)

Finland is ranked 12th by its Global Entrepreneurship Index (The GEDI 2018), 5th on the Global Innovation Index and the 2nd in Global Cleantech Innovation Index in 2017 (Table 3.1) (Cleantech Group 2018b).

2017 Rank	2014 Rank	Country	2017 Score
1	5	Denmark	4.07
2	2	Finland	3.96
3	4	Sweden	3.86
4	7	Canada	3.76
5	3	United States	3.59
6	1	Israel	3.56
7	6	United Kingdom	3.37
8	9	Germany	3.33
9	14	Norway	2.90
10	8	Switzerland	2.89

Table 3.1. Global Cleantech Innovation Index - Country Rank (Cleantech Group 2018b).

Finland reaffirms its reputation as a cleantech leader, holding position in top three and scoring above the mean for all metrics (Figure 3.3). Finland takes the second place for cleantech-specific drivers, with strong performances for its cleantech R&D governmental budget and the number of cleantech funds which

allow access to private finance. However, Finland is not attractive for investments in renewable energy, where only Indonesia, Russia and Greece score lower. Emerging cleantech is Finland's strong point, with strong performances across all indicators (Figure 3.4): early-stage private investment, abundance of high impact companies and the number of environmental patents granted to Finnish cleantech companies. For the evidence of commercialized cleantech innovation, Finland shows a strong performance for M&A activity and renewable energy jobs, but relatively low – for the cleantech imports and exports. (Cleantech Group 2018a.)



Figure 3.3. Finland's metrics in cleantech drivers (Cleantech Group 2018a).

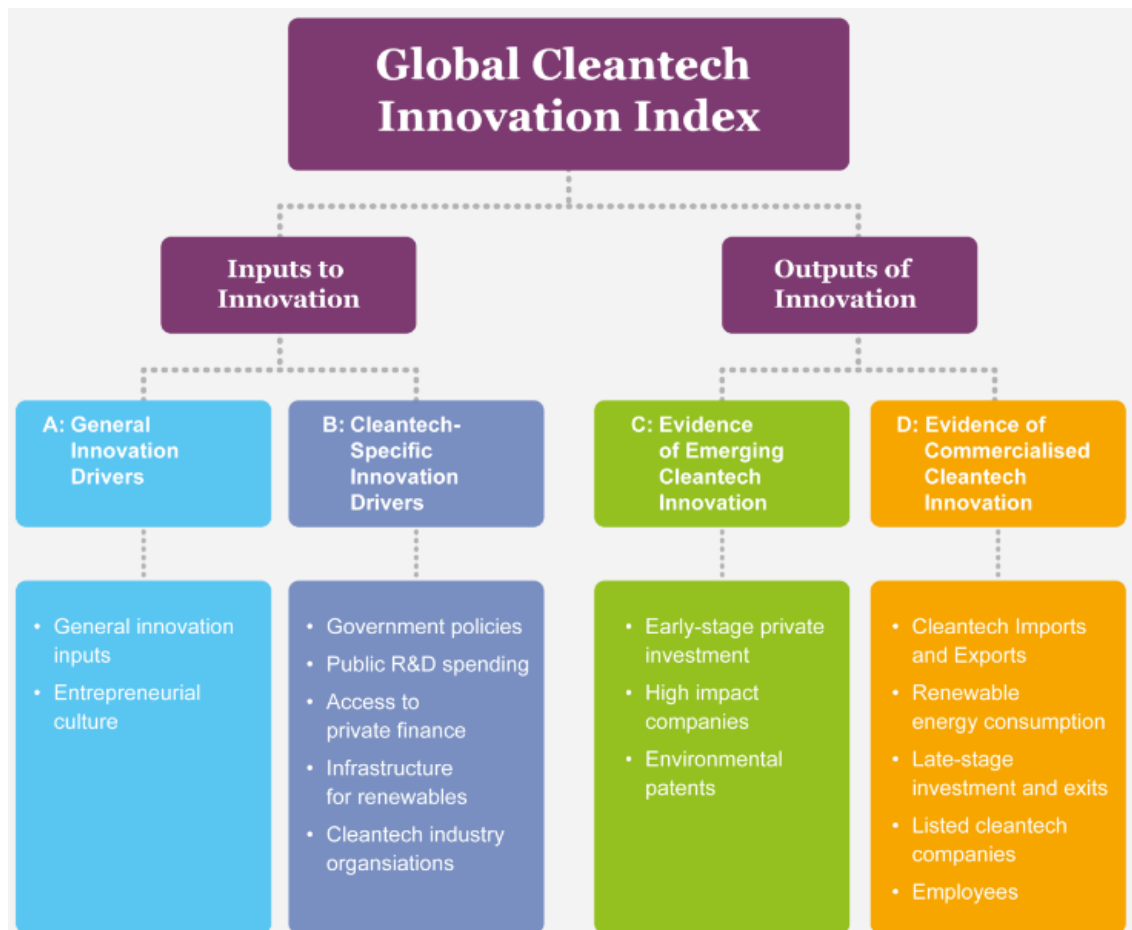


Figure 3.4. Indicators of Global Cleantech Innovation Index (Cleantech Group 2018c).

Figure 3.5 illustrates the Finnish cleantech clusters and areas of expertise (Tekes 2013). The special Finnish strengths in cleantech business activities include resource efficiency in industrial processes – i.e. energy, materials and water efficiency – as well as bioenergy and bio-based products (Ministry of employment and the economy 2014).

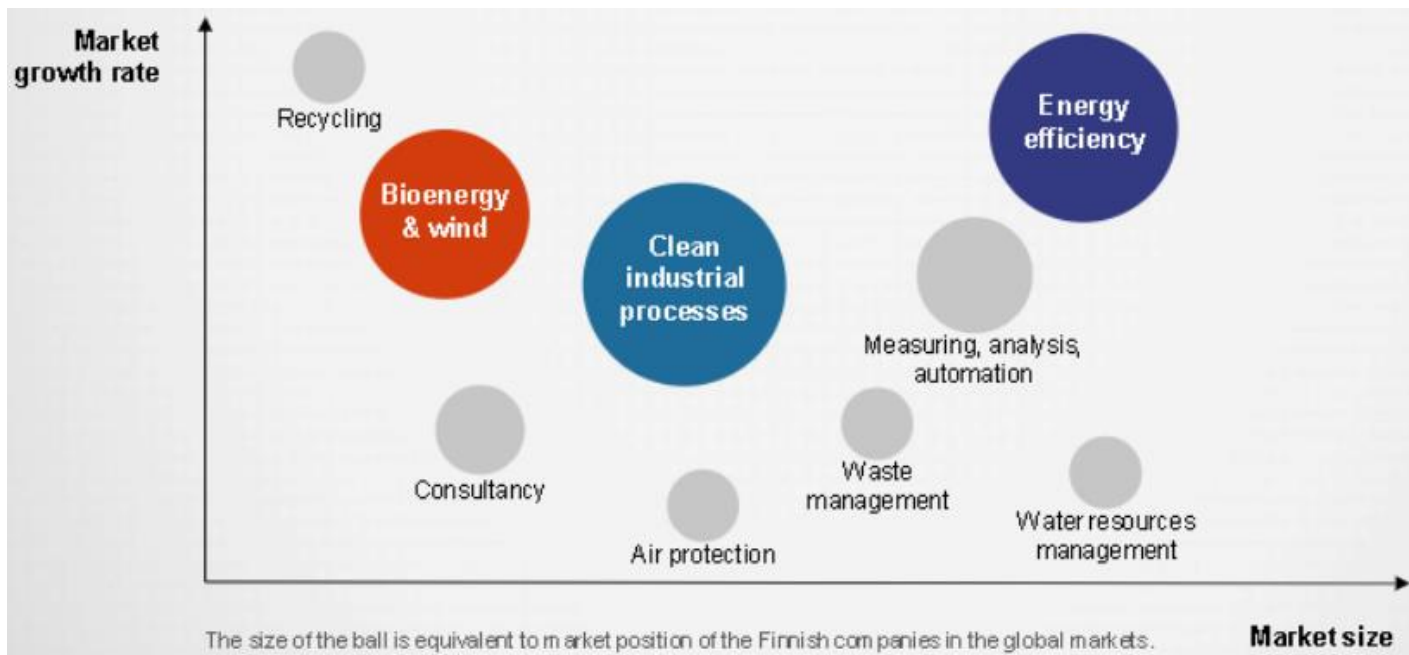


Figure 3.5. Finnish cleantech clusters and areas of expertise (Tekes 2013).

Finland has about 3000 cleantech companies (Ministry of employment and the economy 2015) with the majority of the SMEs and micro companies (70%), while large and giant companies comprise less than third of the whole (Cleantech Finland 2018b). The growth of Finnish SMEs generally requires internationalization, which is especially emphasized in the cleantech sector, because cleantech innovations usually have strong international potential (Business Finland 2018). In 2016 the turnover from Finland's environmental goods and services sector was EUR 36 billion with EUR seven billion of exports and 130,000 persons employed (Statistics Finland 2017). The Finnish cleantech sector comprises a variety of different industries and enterprises, and such organizations as Business Finland (former Tekes) and Cleantech Finland play a significant role in building up the consortiums and the necessary cooperation (Business Finland 2018).

Business Finland (former Tekes) is the Finnish funding Agency for Technology and Innovation under the Ministry of Employment and the Economy. It is non-profit and takes no equity or ownership on intellectual property funding for innovative R&D and business in a form of grant or loan. It supports the creation of new know-how in cooperation with companies and research organizations, match Finnish

industry actors with domestic and international investors, and build business ecosystems. (Business Finland 2018a.)

Cleantech Finland is a Finnish network and association created to boost the internationalization of Finnish cleantech companies. The main criteria for becoming a member is a strategic commitment to developing cleantech operations internationally and having a solution to a significant environmental challenge. Cleantech Finland provides such benefits as access to a strong network of cleantech experts, international visibility and business opportunities from joint marketing and communication efforts, and the right to use to the Cleantech Finland® brand, which represents Finland's leading cleantech actors. (Cleantech Finland 2018a.)

Policymakers in Finland have targeted SMEs and start-ups during the past 30 years. The cleantech business based on energy and environmental technology is one of the focal areas of Finland's business policy. In 2013, the Finnish Government adopted a resolution concerning the promotion of new and sustainable environmental and energy solutions in public procurement. In Finland, the necessity for utilizing the best available technology is included in the Water Act, Air Pollution Control Act, Waste Act and Sea Protection Act. In addition, the producer responsibility principle in waste management has increased reuse and recycling, offering new business opportunities. Finland's Council of State approved the national Cleantech Strategy in May 2014, which points the way for Finland to develop into the one of the world's leading countries in clean technology up to 2020. (Export.gov 2017.)

Finland supports an innovation and entrepreneur ecosystem by identifying, nurturing and accelerating cleantech innovators and entrepreneurs providing them with financial opportunities. In 2015, there were 13 venture capital management companies in Finland, while in 2018 the Finnish Venture Capital Association joins more than 100 members which are VC funds, corporate investors and buy-out firms. The amount of venture capital investments and number of companies receiving the investments for various stages of companies, have grown significantly. FiBAN, a non-profit Finnish Business Angels Network, is one of the largest associations of business angels in

Europe, consisting of approved investor members actively seeking new growth companies. Promotion of VC into cleantech sectors is implemented through incubation and coaching programmes (e.g., VIGO accelerators), competitions (e.g., Nordic Cleantech Open), events (e.g., Cleantech Venture Day). Thus, Finnish cleantech ecosystem is designed to support innovation in cleantech sectors and allow an access to funding, and has the all necessary elements of entrepreneurial ecosystem which are illustrated in Figure 3.6 (Mazzarol 2014) encompassing all core active players as policy makers and public agencies, universities and research centers, incubators and accelerators, existing large corporations, investors and entrepreneurs inspired to solve global environmental challenges. (Nordic Innovation 2017.)

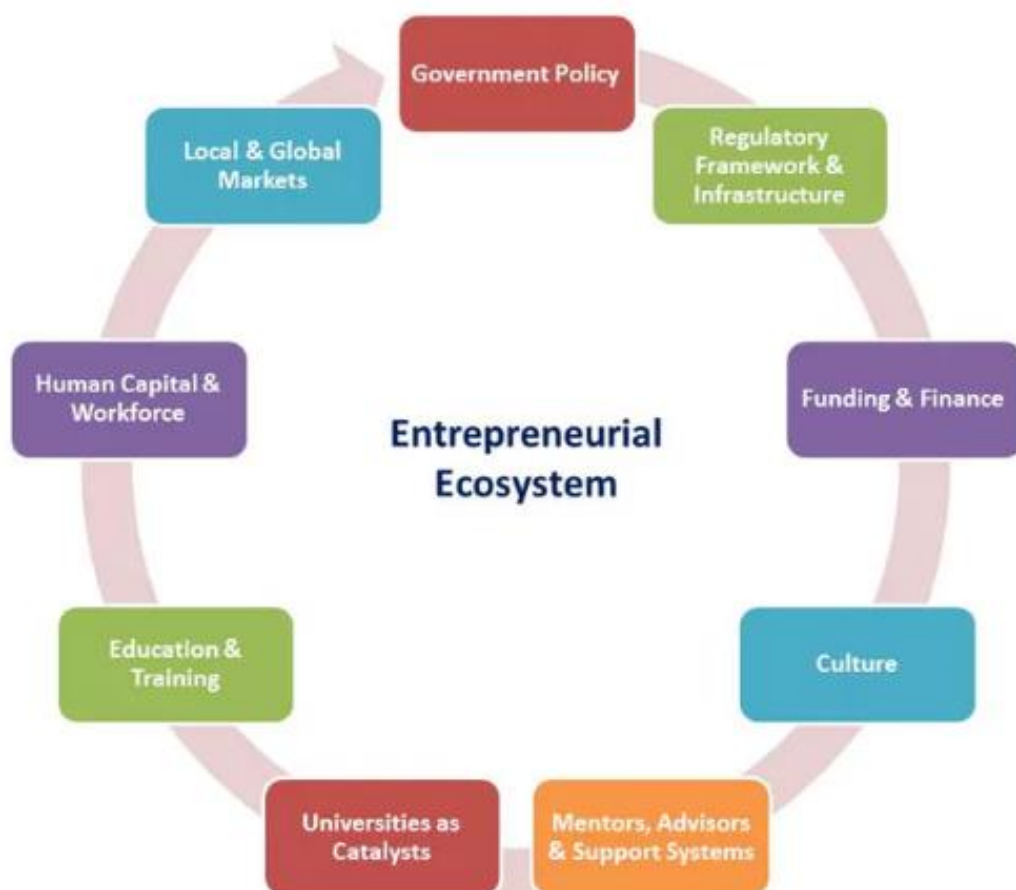


Figure 3.6. Entrepreneurial ecosystem (Mazzarol 2014).

4 Business model innovation

Business model (BM) is acknowledged as a crucial aspect of entrepreneurial and managerial sustainability activities. The concept of business model can be used by two different approaches: static, examining BM components, and transformational approach with focus on BM innovation (Demil & Lecocq 2010). Both concepts, business model and business model innovation (BMI), have been much discussed in the academic literature. However, the subject of BMI shows a trend of increasing popularity among scholars. Some of the highly discussed research problems include: the relationship between BM and Performance, BM and Technology, BM adaptation and BM learning approaches (BM creation), BMI and Sustainability, and some other relevant topics (Saur-Amaral, Soares & Proença 2016).

While business model is a mechanism for turning ideas into revenue at reasonable cost, business model innovation (BMI) can be defined as commercialization of knowledge-based assets. The asset or resource base and activity profile of the firm is integrally tied to its business model, and the success of a business model in generating profit depends on the accumulation within the organization of strategically important resources. (Gambardella & McGahan 2010.)

Having a differentiated (and hard-to-imitate) - but at the same time effective and efficient - architecture for an enterprise's business model is important to the establishment of competitive advantage. The various elements of business model need to be cospecialized to each other, and work together well as a system. (Teece 2010.)

Each of the business model's elements is a subject to renewal. Companies need to regularly assess strengths and weaknesses of their business model's components and react to opportunities and threats by reshaping their BMs (Bucherer, Eisert & Gassmann 2012; Osterwalder & Pigneur 2010). Constructing and rebuilding Business Models entrepreneurs should consider outside forces such as the economy and market conditions. Four external forces: competitive pressures, customer demands, industry trends and

macroeconomic conditions, require constant analysis and assessment of a current BM. Only regularly reassessing its business models' current viability and future promise a company can stay healthy and competitive. Shortening product lives mean that even great technologies no longer can be relied upon to earn a satisfactory profit before they become commoditized (Chesbrough 2007). Technological innovation is important for firms, but it might not be sufficient to guarantee the firm's success; besides embedding technology in attractive products and services, a firm needs to design a unique business model to fully realize its commercial potential (Zott, Amit & Massa 2011). However, the most successful business models are vulnerable to obsolescence. Thus, proactive companies regularly innovate by revising their existing business models and pursuing BM changes in value proposition, creation, delivery and capture. (Osterwalder & Pigneur 2010.)

4.1 Business Model concept and its components

It is worth to be noted that the exact and generally accepted definition of the business model does not exist. Further on, we provide the literature review of the definitions offered by the authors which are rather heterogeneous. The concept of business model can be explained as a way how a company generates revenues using its value chain and interaction with the industry value system (Feng, Froud, Johan, Halsma & Williams 2001; Fisker & Rutherford 2002). A definition of the business model can be defined as a manner by which an enterprise delivers value to customers, entices customers to pay for value, and converts those payments to profit (Teece 2010). Baden-Fuller, MacMillan, Demil and Lecocq (2008) explain the business model as the logic of the firm, the way it operates and how it creates value for its stakeholders (Casadesus-Masanell & Ricart 2010). For the purpose of this study a business model is understood as *the rationale of how an organization creates, delivers, and captures value* (Osterwalder & Pigneur 2010).

The authors structure the elements of a business model in numerous ways, but all of them have the fundamental components: value proposition, value creation, value delivery and value capture. Voelpel, Leibold and Tekie (2004) also included external factors such as technology, economics, and legal issues, as a

part of business model (Clauss 2016). Another classification of the business model elements through factors include factors related to offering, market factors, internal capability factors, competitive strategy factors, economic factors, and growth/exit factors (Morris, Schindehutte & Allen 2005).

Business Model Canvas (Figure 4.1) is the design of business model which is the most often used in academia and practice. It consists of nine elements and depicts all the facets of the firm's operations. It delivers a framework for focused brainstorming and entrepreneurs' inspiration for BM generation. (Osterwalder & Pigneur 2010; Osterwalder, Pigneur, Bernarda & Smith 2014.)

Key partners	Key activities	Value proposition	Customer relationships	Customer segments
	Key resources		Channels	
Cost structure			Revenue streams	

Figure 4.1. Business Model Canvas (Osterwalder & Pigneur 2010).

At the same time the term business model can be described as a system of interconnected and interdependent activities that determines the way the company “does business” with its customers, partners and suppliers. The activity system of an organization consists of the following design elements:

- 1) content – a set of activities performed by a company,
- 2) structure – the links between the activities and sequence of them, and
- 3) governance – a distribution of activities between the partners. (Amit & Zott 2012.)

A business model integrates customers, competitors, offering, activities, resources, suppliers, and longitudinal cognitive and social constraints that managers should cope with (Hedman & Kalling 2003). Another business model scheme distinguishes the growth component that should be considered at the very beginning and includes such components as customer value proposition, market segments, capabilities (resources and capabilities as a “glue” inside), revenue model and growth model (Afuah 2014).

Nenonen & Storbacka (2010) construct business model as the configuration of 12 interrelated elements, covering market, offering, operational, and

management viewpoints. The effectiveness of a business model in value co-creation is defined by the internal configurational fit between all business model elements, and the external configurational fit between provider's and customers' business models (Nenonen & Storbacka 2010). The various elements need to be cospecialized to each other, and work together well as a system (Teece 2010).

The typology of service-based business concepts includes the following parameters: ownership during phase of use, ownership after phase of use, responsibility for production personnel, responsibility for maintenance personnel, payment model, number of customers, location of operation (Lay, Schroeter & Biege 2009). Some authors define four key components: customer value proposition, key resources, key processes, and profit formula (Johnson, Christensen & Kagermann 2008). Another view to the BM design includes such three core elements as technology, market offering and network architecture (Mason & Spring 2011).

The business model of a technology firm comprises the following functions to utilize the technology profitably:

- articulation of the *value proposition*, that is, the value created for users by the offering based on the technology;
- identifying a *market segment*, that is, the users to whom the technology is useful and for what purpose;
- defining the structure of the *value chain* within the firm required to create and distribute the offering, and determining the complementary assets needed to support the firm's position in this value chain;
- estimating the *cost structure and profit potential* of producing the offering, as well as specifying the revenue generation mechanisms;
- describing the position of the firm within the *value network* linking suppliers and customers, including identification of potential partners and competitors;
- formulating the *competitive strategy* by which the innovating firm will gain and hold advantage over rivals. (Chesbrough & Rosenbloom 2002; Chesbrough 2010.)

Table 4.1 depicts the main elements of a business model covered in academic literature.

Authors	Year	No.	Elements
Clauss	2016	10	Capabilities, technologies/equipment, processes/structures, partnerships, offerings, customers/markets, channels, customer relationships, revenue models, cost structures
Osterwalder & Pigneur	2010	9	Value proposition, customer segments, customer relationships, channels, key resources, key activities, key partners, cost structure, revenue streams
Chesbrough & Rosenbloom	2002	6	Value proposition, market segment, value chain structure, cost structure and profit potential, value network, competitive strategy
Teece	2010	5	Technologies embedded into products and services, customer benefits, market segments, revenue streams, ways of capturing value
Amit & Zott	2012	3	Content, structure and governance of activities' system
Demil & Lecocq	2010	3	Resources and competences, organizational structure, value delivery
Casadesus-Masanell & Ricart	2010	2	Choices (policies, assets and governance structures), e.g., compensation practices, procurement contracts, location of facilities, assets employed, extent of vertical integration, sales and marketing initiatives, etc.; Consequences
Hedman & Kalling	2003	7	Customers, competitors, offering, activities, resources, suppliers, and longitudinal cognitive and social constraints
Morris, Schindehutte & Allen	2005	6	Offering-related factors, market factors, internal capability factors, competitive strategy factors, economic factors, and personal/investor (growth/exit) factors
Nenonen & Storbacka	2010	12	Design principles, resources and capabilities related to market, offering, operations, and management
Lay, Schroeter & Biege	2009	7	Ownership during phase of use, ownership after phase of use, responsibility for production personnel, responsibility for maintenance personnel, payment model, number of customers, location of operation
Afuah	2014	5	Customer value proposition, market segments, capabilities (resources and capabilities), revenue model and growth model
Mason & Spring	2011	3	Technology, market offering and network architecture
Johnson, Christensen & Kagermann	2008	4	Customer value proposition, key resources, key processes, and profit formula

Table 4.1. Literature review on Business model elements.

Concerning the topic of our study - the role of VC firm and its impact - we consider one more significant factor as a part of business model – company's ownership structure. VC firms are an example of external owners, which play a vital role in the strategic decisions taken by the supported ventures, and contribute to the funding that is needed for international expansion (Zahra, Ireland & Hitt 2000; George, Wiklund & Zahra 2005). The data from 889 Swedish SMEs reveals that internal owners (CEOs and other senior executives) tend to be risk averse and have a lower proclivity to increase scale and the scope of internationalization than external owners (venture capitalists and institutional investors). The results of the study suggest that higher levels of VC ownership are conducive to a larger scale of internationalization (the percentage share of a firm's business activities conducted internationally), but are negatively related to the scope of internationalization (the number of countries in which a firm has direct export relationships). Davila, Foster and Gupta (2003) assert that the heterogeneity in ownership structures influences among other things the nature of the firm's products, and the funding requirements for growth. (George, Wiklund & Zahra 2005.)

Regarding the clean technology no one business model conceptualization was done up to date. We consider sustainable business model as an appropriate theoretical underpinning, and highlight the crucial meaning of sustainable value proposition – the offering based on the clean technology – as a component of BM. Growing demand for sustainable offerings is considered to be strategic imperative and a potential source of competitive advantage (Patala, Jalkala, Keränen, Väisänen, Tuominen, & Soukka 2016). Therefore, many companies develop clean technology products and services as their sustainable value proposition, and create “niche markets” for their clean technologies (Asemokha 2016).

Sustainable value proposition can be defined as *a promise on the economic, environmental and social benefits that a firm's offering delivers to customers and society at large, considering both short-term profits and long-term sustainability* (Patala et al. 2016). This definition corresponds to the triple bottom line approach of Corporate Sustainability (CS) - economic,

environmental and social benefits: Profit as a superior value for stakeholders, Planet – positive impact for the environment, and People – positive impact for common interests of society. Wempe and Kaptein (2002) determined Corporate Sustainability (CS) as an ultimate goal, with Corporate Social Responsibility (CSR) as an intermediate stage where companies try to balance the Triple Bottom Line of “3P” (Figure 4.2) (Van Marrewijk 2003).

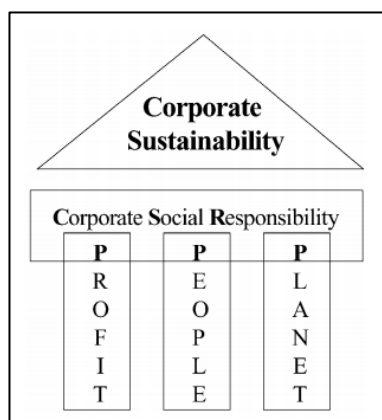


Figure 4.2. Relationship between 3P, CSR and CS (Wempe & Kaptein 2002).

Corporate sustainability and CSR form environmental orientation of a firm that positively influences in international entrepreneurial growth in particular to the performance of a firm (Torkkeli, Uzhegova, Salojärvi & Saarenketo 2017). The previous research also supports that natural environmental orientation combining CSR, entrepreneurship, and commitment to the natural environment has a positive impact on profitability and market share of a firm (Menguc & Ozanne 2005).

Sustainable business models seek to go beyond delivering economic value and include a consideration of other forms of value for a broader range of stakeholders. Stubbs and Cocklin (2008) affirm that sustainable business models are built on the triple bottom line approach to define the firm’s purpose and measure performance, and include a wide range of stakeholders – in particular, environment and society. (Bocken et al. 2013).

Sustainable BMs are achieved through innovation of technologies, products or services proposing sustainable value (Figure 4.3), and through business model innovation by the development of trust-based and mutually beneficial

relationships with key internal and external stakeholders (Evans, Vladimirova, Holgado, Van Fossen, Yang, Silva & Barlow 2017).

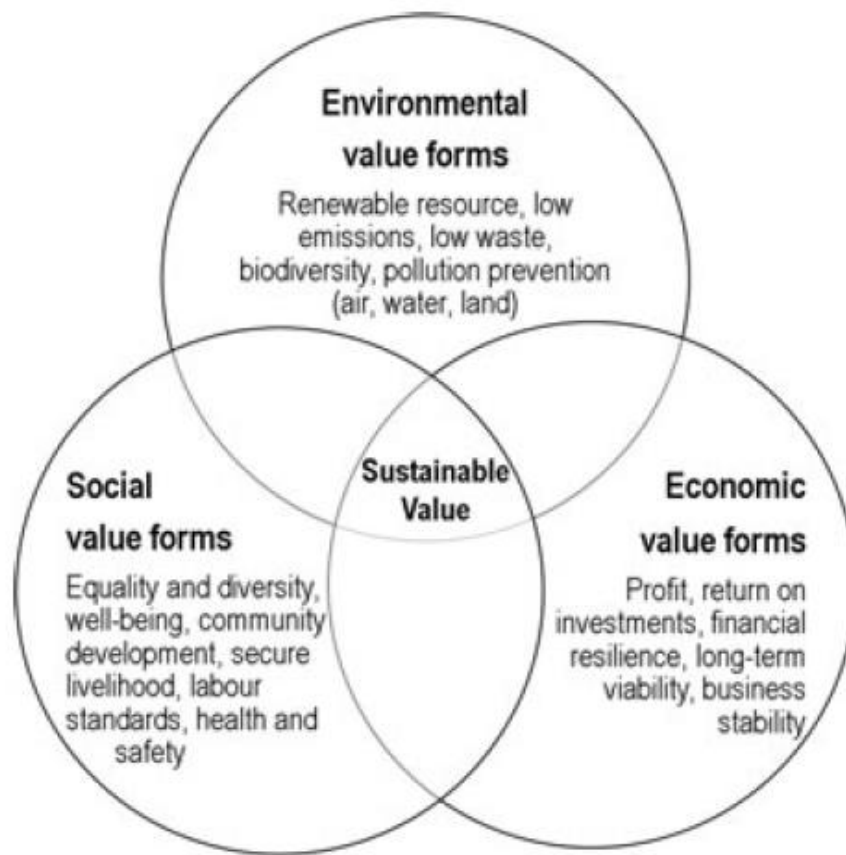


Figure 4.3. Sustainable value (Evans et al. 2017).

Finally, one must acknowledge that policy and regulation direct human and financial capital towards cleantech (Zysman & Huberty 2013), and support distinct types of cleantech innovations in the form of subsidies and grants (Business Finland 2018). However, institutional arrangements in subsidizing clean solutions differ from country to country and regulation does not support transition to cleantech industry in some markets, which leads to imbalance in international opportunities (Carlsson 2006). According to Bartholomew (1997), institutions and governmental policy form a system that either supports or impedes the innovation system of a country (Carlsson 2006), thus being an important part of internationalization. According to McDougall (1989), international new ventures compete in industries that exhibit significantly higher levels of governmental protection and regulations (Zahra & George 2002).

Research suggests that institutional factors as policy and regulation affect the availability and cost of equity financing for the development of entrepreneurship and growth of high-tech sector (Carpenter & Petersen 2002). “Green” business models require support from a broad range of actors with effective regulations and policies as a regulatory framework which forces organizations to adopt sustainable measures (Nair & Paulose 2014). New regulation should encourage conventional energy firms to strive for sustainable new business models (Richter 2013).

As the framework for our study we combine all above-mentioned publications and their findings and elaborate BM design in cleantech industry with its components and elements as smaller structural units (Table 4.2).

BM components	BM elements
Sustainable value proposition	Clean technology type
	Auxiliary Services
	Differentiation of offering
Value delivery	Customer segments
	Market conditions
	Marketing strategy
	Delivery channels
	Location of offices and operations
Value creation	Company's ownership structure
	Financial Resources
	Human Resources
	Knowledge and know-how (patents)
	Network (partners)
Value capture	Financial model (revenue and cost structure)
Regulatory framework	Policy (Visions, Plans, Memorandums of Understanding)
	Regulation (taxation and incentives) in the target markets
	Subsidies and grants

Table 4.2. Business model components and their elements in cleantech industry

4.2 The concept of business model innovation

Business model innovation has become an increasingly vital topic in strategic management research. Business management is a dynamic ongoing process where changes are constantly happening. The companies struggle to gain and maintain a competitive advantage in the face of technological innovation, globalization, and an increasingly knowledge-intensive economy (Afuah 2014).

They regularly revise their business models in terms of how to create, deliver, and capture value in order to achieve growth, otherwise they are left behind. Thus, the concept of business model innovation illustrates the dynamic nature of business operations and can be explained as a value creation mechanism, based on identifying customer needs, realigning resources, processes and profit formula, and creating a new value proposition.

Much of the recent research about business model innovation examines the alignment between the value proposition and customer needs (Osterwalder, Pigneur, Bernarda & Smith 2014), as well as alignment between the value proposition and strategic partners (Nielsen & Lund 2018). Companies are required to know customer needs, optimize their value propositions and collaborate with the partners for the maximum benefits. In addition, the ultimate goal of entrepreneurs and their investors is achieving profitable growth.

The definition of business model innovation remains largely unspecified in the current academic literature. Given the definition of business model, business model innovation occurs when a firm adopts a novel approach to commercializing its underlying assets. BMI can be understood as a strategic renewal mechanism for organizations facing changes in their external environment (Sosna, Trevinyo-Rodriguez & Velamuri 2010).

While business model is a system of activities that configure a firm's business, Business Model Innovation (BMI) implies performing changes in the element or in a group of elements of this system in order to increase the value created by a firm. For example, switching from being a supplier of products to becoming a service provider is a change in the "content" of activity system. Linking activities in a novel way refers to "structure" changes. Shifting to franchising is an

example of “governance” changes implemented in introducing professional management and local adaptation. (Amit & Zott 2012.)

Designing new business models is closer to an art than to a science (Casadesus-Masanell & Ricart 2010). Some authors also stress that BMI is more a matter of trial and error with ex-post adaptation than foresight (Chesbrough 2010; Sosna et al. 2010). Business model experimentation and effectuation are discussed as the forms of BMI to achieve an economically attractive business model (Chesbrough 2010; McGrath & Macmillan 1995). *At root, business model innovation refers to the search for... new ways to create and capture value for its stakeholders* (Casadesus-Masanell & Zhu 2013).

In the present study BMI is understood as the development of new organizational forms for the creation, delivery, and capture of sustainable value (Richter 2013).

4.3 Scalable and internationally viable business model

The data suggests that scalability is the most substantial characteristics of a business model in terms of profitable growth. It is usually associated with internationalization and economies of scale, however, attaining business model scalability is going beyond of achieving economies of scale or creating economies of scope through differentiation. It involves accelerating returns on input and is a top priority in business model innovation. (Nielsen & Lund 2018.)

The term scalability refers to a system’s ability to expand output on demand when resources are added. Linking to business models it means profitability of the business potential and enough flexibility to grow while facing the external forces, such as new competitors, altered regulation, or macroeconomic pressures. Consequently, a scalable business model is one that is flexible and where the addition of new investments brings accelerating returns. (Nielsen & Lund 2018.)

Having scalable business model implies aiming toward a one billion dollars market capitalization. It is quite possible in case of thinking globally since the first day. To achieve a set goal, it is fundamental to get the necessary resources

for internationalization, from technical and managerial talents to the financial resources required for fast growth. (Cannone 2015.)

In business literature, the scalability means increasingly positive returns to scale and is specific for high-tech fields dominated by R&D costs. Successful scalability has a strong connection to productivity growth and improved value creation. For instance, a scalable business model can help to strengthen partnerships, which in turn contribute to networking competences. (Roolant 2017.)

Business model scalability can be achieved by market expansion, where the costs of entry grow slower than the returns from a more extensive market presence (Roolant 2017). Simply put, scalability implies that the value of a company (and its international growth) is exponentially larger than its capital requirements to achieve that growth (Zysman & Huberty 2013). Thus, scalability is a prerequisite of successful international viability and a dominant feature of internationally viable business model.

Five patterns by which companies can reach scalability are:

- 1) adding new distribution channels,
- 2) removing traditional capacity constraints (such as labor shortages, machine capacity, cash liquidity, or storage capacity),
- 3) shifting capital requirements to partners,
- 4) having customers and partners assuming multiple roles in the business model,
- 5) establishing platform models in which even competitors may become customers. (Nielsen & Lund 2018.)

Thus, we can conclude that the purpose of obtaining scalable and internationally viable business model is the dominant one in the business model innovation and can be implemented through the certain changes of existing business model.

4.4 Characteristics of Business Model changes

Business model is a collection of highly dependent elements and a dynamic system (Osterwalder & Pigneur 2010; Bucherer et al. 2012). Two main types of BM dynamics are determined in the academic literature: “business model innovation” (BMI) and “business model adaptation” (BMA) (Saebi, Lien & Foss 2016). Another classification is aligned to this one, where changing the business model more incrementally over time can be seen as an alternative to more dramatic BM changes (Achtenhagen, Melin & Naldi 2013). Markides (2006) argues that business model innovations tend to be radical or disruptive in general, while Mitchell and Coles (2004) consider both radical and incremental business model innovations (Bucherer et al. 2012).

Key differences between the concepts of BMI and BMA, according to Saebi et al. (2016), are:

- 1) BMI requires the concept of novelty, whereas BMA can be non-innovative;
- 2) BMA occurs due external triggers whereas BMI can be driven by both external and internal factors;
- 3) the motivation in BMA is to keep the balance with the environment whereas BMI is to disrupt the environment (Munther 2017).

Business model changes can be triggered by one of four catalysts – or a combination of them:

- 1) a decision to make greater use of underutilized assets,
- 2) a new offer to customers,
- 3) a change in customer service, or
- 4) a finance-related innovation (Osterwalder & Pigneur 2010).

Authors have different perspectives on the compulsory number of concurrently changed elements to capture BMI. One point of view stands for the fact that significant changes are required in all the components of the current business model (Johnson, Christensen & Kagermann 2008; Clauss 2016). Another view states that BMI requires a reinvention of two or more elements of the existing model (Wirtz 2011). Demil and Lecocq (2010) define *substantial* business model change which implies simultaneous changes in the multiple components

requiring the consistency across and within components after the implementation of changes (Gerasymenko, De Clercq & Sapienza 2015).

A combination of the business model innovation, strategic orientation and the organizational change perspectives provide us with the theoretical framework for addressing the sub question of the research about the characteristics of BM changes. We aim to study the common types of organizational changes, as well as BM changes covered in the academic publications. Linking strategic orientations to BMs we consider the difference between the concepts and understand under the strategy - *basic long-term goals of an enterprise, and the adoption of courses of action and the allocation of resources necessary for carrying out these goals* (Chandler 1962). The main objective of the strategy is sustainable competitive advantage of a company, while BM is a form of implementing a strategy.

Classifying the BM changes by their radicalness and degree of innovativeness we have decided to utilize the thoroughly discussed in academia typology of BMI and BMA. Hence, our theoretical investigation aims to determine the main characteristics of BM changes for BMI and BMA.

Zott and Amit (2007) specified novelty-centered and efficiency-centered business models (Zott & Amit 2010; Zott et al. 2011; Amit & Zott 2012). Novelty-centered business model innovation reflects the extent to how a focal firm's business model is different from an average firm within the same industry (Guo, Pang & Li 2017). Efficiency-centered business model is built on transaction cost perspective and refers to the measures that firms may take to achieve transaction efficiency with the only focus on the reduction of transaction costs (Zott & Amit 2007).

Evolutionary (gradual) and revolutionary (simultaneous shift in strategy, structure, people, and culture) changes were described in the literature (Tushman & O'Reilly III 1996). Since the topic of internationalization has a central position in our research, we aim to divide the changes into simultaneous and gradual in different markets.

Degree of innovativeness was studied by several authors (Bucherer, Eisert & Gassmann 2012; Cavalcante, Kesting & Ulhøi, 2011). McDermott and O'Connor (2002) introduced "radical" or "disruptive" innovation, which implies the change of existing processes (Cavalcante et al. 2011). Incremental innovations are based on the existing processes only with addition of some new process (Bucherer et al. 2012). This typology of changes was originally introduced by Miller & Friesen (1982) in the context of organizational (structural) change and had definitions of quantum (rapid, dramatic) versus piecemeal-incremental changes (Miller & Friesen 1982).

Hannan and Freeman (1984) identify core and peripheral dimensions of changes, where core features define the purpose of the organization, give institutional reality to insiders and outsiders, and determine the distribution of resources, and peripheral changes, in contrast, involve operating decisions undertaken to align the organization to its environment (Nicholls-Nixon, Cooper & Woo 2000). Core changes assume product scope and partnership status, while peripheral changes have emphasis on competition and time allocation, and it is stressed that peripheral changes are more likely to be the focus of adaptation efforts (Nicholls-Nixon et al. 2000). Attempts to change peripheral features do not raise questions about organizational identity and do not disrupt organizational operations (Kelly & Amburgey 1991).

When confronted with decision-making situations involving uncertainty, the firms typically adopt one of the strategic postures: a bold and aggressive posture in order to maximize the probability of exploiting potential opportunities, or a cautious and 'wait-and-see' posture in order to minimize the probability of making costly decisions (Covin & Slevin 1989; Covin, Slevin & Covin 1990). Khandwalla (1977) noticed that entrepreneurial firms often initiate actions (to which their competitors then respond) and they are frequently first to market with new products; they are also bold and aggressive in pursuing opportunities (Robertson & Chetty 2000). VC funded companies pursue more aggressive market strategies than non VC-backed firms, and aim at more radical innovations (Hellmann & Puri 2000). Thus, we assume that the same

characteristics of boldness and aggressiveness, as well as cautiousness can be applicable to the BM changes regarding BMI and BMA, correspondently.

Covin & Slevin (1988) supported an entrepreneurial-conservative dichotomy to establish a firm's strategic orientation (Robertson & Chetty 2000). Conservative firms are defined as having risk-adverse, non-innovative, and passive, or reactive management style, while entrepreneurial firms are defined as risk-taking, innovative, and proactive, willing to take on high risk projects for the chance of very high returns (Covin et al. 1990; Robertson & Chetty 2000). The research also suggests that VC ownership of a firm influences managers' risk-taking propensity (Eisenhardt 1989; George, Wiklund & Zahra 2005). Basing on the strategic literature we adopt this classification of high-risk and innovative, and, conversely, low-risk and conservative BM changes in regard to BMI and BMA, respectively.

Based on the materials of literature review we present developed characteristics of BM changes in Table 4.3.

Theoretical underpinning of typology	Business model innovation characteristics	Business model adaptation characteristics
Zott & Amit (2007) Zott, Amit & Massa (2011) Amit & Zott (2012) Guo, Pang & Li (2017)	Novelty-oriented	Efficiency-oriented
Tushman & O'Reilly III (1996)	Simultaneous in different markets	Gradual in different markets
Miller & Friesen (1982) Cavalcante, Kesting & Ulhøi (2011) Bucherer, Eisert & Gassmann (2012)	Radical within a particular component	Incremental within a particular component
Hannan and Freeman (1984) Kelly & Amburgey (1991) Nicholls-Nixon, Cooper & Woo (2000)	Involve Core aspects of the firm's strategy	Involve Peripheral aspects of the firm's strategy
Khandwalla (1977) Covin & Slevin (1989) Robertson & Chetty (2000)	Bold and aggressive in order to maximize the probability of exploiting potential opportunities	Cautious in order to minimize the probability of making costly decisions
Covin, Slevin & Covin (1990) Robertson & Chetty (2000)	High-risk and innovative	Low-risk and conservative

Table 4.3. Characteristics of business model changes.

5 Internationalization

While the term globalization means a growing economic interconnectedness among countries worldwide, the concept of internationalization implies a *systematic increase in international business activities* (Cavusgil, Knight & Riesenberger 2014). Internationalization is the process of adapting a firm's operations (resources, structure and strategy) to international environments (Calof & Beamish 1995). A broad concept of internationalization can be viewed *as the process of increasing involvement in international operations* (Welch & Luostarinen 1988). Figure 5.1. illustrates the conceptual model of the international business schools of thought, which explain different ways of internationalization (Mtigwe 2006).

In this chapter we seek to overview the internationalization theories relevant to the context of our study: incremental theory, network approach and international entrepreneurship theory (Born globals theory). The incremental theory generally claims that firms internationalize incrementally, i.e. certain stages follow a gradual sequence and a linear trajectory (Coviello & McAuley 1999; Hall & Cook 2009). The network theory challenges the incremental theory assumption that a company must overcome the barriers in the international environment before engaging in the international operations. The network theory presumes that the internationalization activities happen through creating relationships between a firm and the other stakeholders in the marketplace (Johanson & Mattsson 2015; Johanson & Vahlne 2003). The international entrepreneurship theory postulates that some exceptional entrepreneurial characteristics make some firms to enter the international market at the early stages of inception (born globals) in a contrary to a gradual process. The international entrepreneurship is especially significant for our study as both entrepreneurs and venture capitalists are characterized by risk-taking capabilities and aim for a rapid internationalization.

In the following sub-chapters, the abovementioned theories will be described to illustrate the phenomenon of internationalization. Firstly, the Uppsala-Model (Johanson & Vahlne 1977) will be explained to underlie the further theories. Secondly, network theory of internationalization (Johanson & Mattsson 1988) will be overviewed to explain the role of business networks in internationalization.

Finally, the international entrepreneurship theory (Oviatt & McDougall, 1994) will be presented.

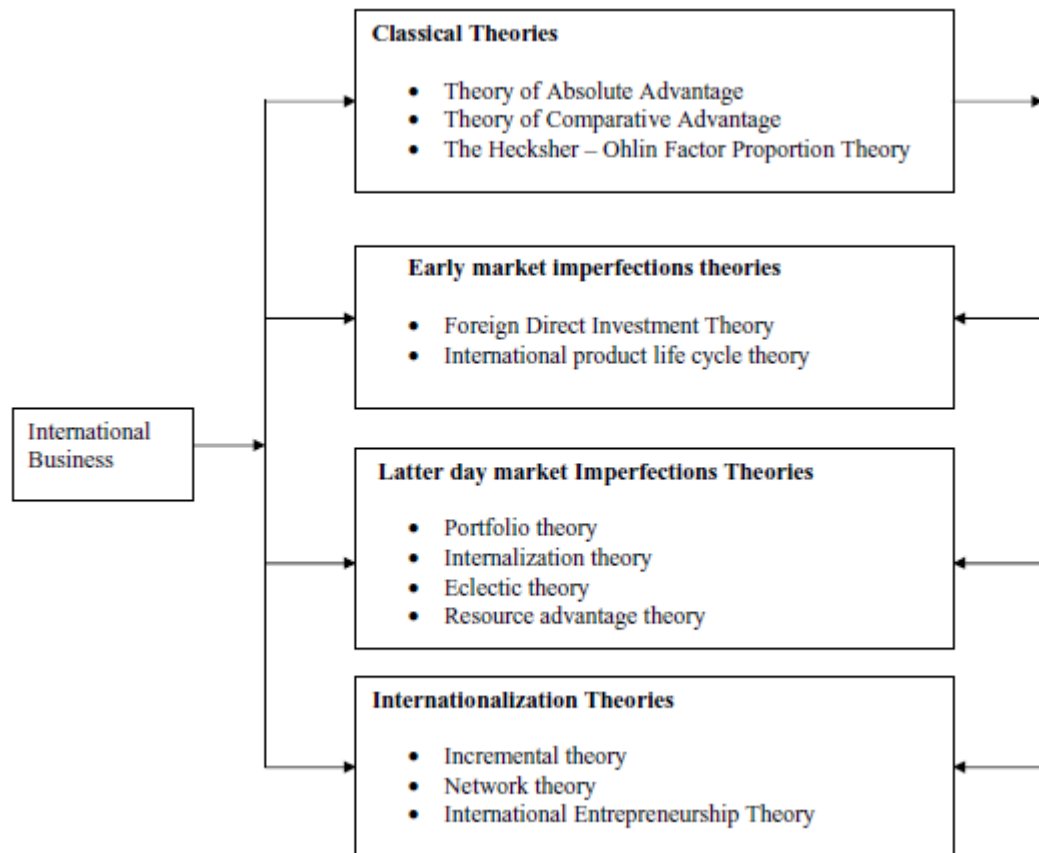


Figure 5.1. Conceptual model of the international business schools of thought (Mtigwe 2006).

5.1 Incremental theory

Johanson and Wiedersheim-Paul (1975) identified four stages of the internationalization process that followed sequentially: export via independent representatives (agents), establishment of a sales subsidiary, and production/manufacturing (Johanson & Vahlne 1977). Based on this empirical study Johanson and Vahlne (1977) introduced the Uppsala-Model (incremental or stage theory). It is often called the "rings in the water" model to stress the sequential character of internationalization process of firms (Madsen & Servais 1997). The enterprises increase their involvement stage by small steps selecting their target markets incrementally based on the psychic distance to keep the level of risk as low as possible. The rationale of the Uppsala-model is

explained by the fact that the uncertainty and risk come from the lack of market knowledge, and the level of knowledge about a particular market determines the commitment to the foreign operations (Johanson & Vahlne 1977). Revisiting this model, the authors switched from market knowledge to relationships as the main influential factor in internationalization process facilitating opportunities to learn, build trust and commitment (Johanson & Vahlne 2009).

5.2 Network theory

Network approach of internationalization states the importance of the intra and inter-organizational networks for successful internationalization process. There are a wide range of publications on network theory and they relate to various aspects of business. The study of internationalizing SMEs shows that they expend their activities, select the market and the entry mode depending strongly on established network relationships (Coviello & Munro 1997). The internationalization process is an interaction of formal and informal networks to put a product on the foreign market (Mtigwe 2006). The internationalization of a company begins with engaging in a network, initially through domestic partners which may introduce the firm to an international network, thus increasing involvement in international operations developing more relationships in other countries (Johanson & Mattson 1998). Thus, the process of internationalization is assumed to be incremental and require time and commitment to building the network. By building financial, technological and market relationships with other members of the networks, the enterprise extends its connection with other enterprises and slowly increases its activities across national borders until they become international (Bose 2016).

The term “network” has different definitions and one of them implies a junction of relationships (Cook & Emerson 1978). Network is a basic concept of Relational View – one of the metatheories of strategic management. The Relational View states that interfirm cooperation is a source of relational rents (Dyer & Singh 1998; Lavie 2006). The Relational View considers the network as the unit of analysis and the source of profit without the ownership of the rent-generating resources (Dyer & Singh 1998). Usually companies use a network for cost optimization, finding new business opportunities and gaining market

influence by pooling of resources with partners within alliances (Dyer & Singh 1998). Coviello and Munro (1997) argue that the degree as well as the form of internationalization is influenced by different types of relationships that are developed in the networks (Bose 2016). In the framework of entrepreneurial relationships, we exploit the following definition: *networking is a socioeconomic business activity by which businesspeople and entrepreneurs meet to form business relationships and to recognize, create, or act upon business opportunities, share information and seek potential partners for ventures* (Österle, Fleisch & Alt 2011). The crucial role of networking has been confirmed by many studies (Andersson & Wictor 2003; Freeman 2006; Kaur & Sandhu 2014). The ability to create partnerships and receive extra value from lasting relationships is inherent to born global firms and help them to overcome limited resources (Gabrielsson & Kirpalani, 2004). In general network helps to create sustainable competitive advantage, which is the main purpose of any strategy and strategic management.

5.3 International entrepreneurship theory (Born Global theory)

The concept of international entrepreneurship is primarily understood as international activities by newly established enterprises (Ruzzier et al., 2006). In contrast to the incremental theory, this approach concentrates more on rapid internationalization. The international entrepreneurship theory is an integrative framework for explanation of such phenomenon as born global firms. It is based on metatheories of strategic management – Resource-Based View (RBV) and Dynamic Capability View (DCV), and combines such concepts as international new ventures, global start-ups, and born global firms (Oviatt & McDougall 1994; Knight & Cavusgil 2004; Allen 2016). Adapted and extended from Zucchella and Sciabini (2007) Figure 5.2 represents international entrepreneurship as a consolidation of three fields: international business, entrepreneurship and strategic management (Wach & Wehrman 2014).



Figure 5.2. International entrepreneurship as the amalgamation of three fields (Wach & Wehrman2014).

The main questions of strategic management research are concerned with achievement of sustainable competitive advantage and the factors of superior performance. Competitive advantage is a firm's ability to earn superior economic returns, often measured by a higher return on investment than in the industry average. Sustainable competitive advantage implies the persistence of above-average performance. Competitive advantage is based on market imperfection. In conditions of perfect competition, no firm has competitive advantage. Porter (1985) has identified 2 basic types of competitive advantage: cost advantage (similar product at lower price) and differentiation advantage (price premium from unique product). Using "value" as a core concept a firm can position itself against its competitors given its relative cost structure of the value chain to compete on price, or differentiation of its products/services to specific customer segments (Porter 1985).

Different theories are developed to discover factors driving competitive advantage and superior performance. External industry-specific factors are

explained by the Market-Based view (Porter's five forces). Internal firm-specific factors are discussed by Resource-based view (RBV) and dynamic RBV (Dynamic Capability View).

The RBV explains that valuable, rare, imperfectly imitable and non-substitutable (VRIN) resources create competitive advantage (Barney 1991). Sustainable competitive advantage can be achieved if these characteristics of internal resources of a firm simultaneously exist (Peteraf 1993).

The DCV highlights that the ability to react adequately and timely to rapidly changing business conditions requires a combination of multiple capabilities. Organizational capabilities underpin companies' competitive advantages, as well as their ability to respond to internal and external changes. Organizational capabilities can be determined as a set of routines for individual tasks and for task coordination, and can be classified as operational or dynamic (Helfat & Peteraf 2003). Operational capability refers to performing a repeated, reliable activity, such as manufacturing a particular product, utilizing organizational resources. The dynamic capabilities are defined as @ (Teece, Pisano & Shuen 1997). Thus, the dynamic capabilities emphasize the managerial ability to orchestrate a firm's assets so that to avoid harmful inertia in a rapidly changing environment (Teece et al. 1997). They mention that attributes such as network relationships, entrepreneurial orientation, marketing orientation, research and development (R&D), product diversification, customer orientation, and access to resources such as knowledge and learning are considered important firm level dynamic capabilities (Kuivalainen et al., 2010).

A central concept in the RBV and the DCV is path dependency. The impact of path dependency on firm resources and capabilities is significant. *Performance of a firm does not depend simply on the industry structure within which a firm finds itself at a particular point in time, but also on the path a firm followed through history to arrive where it is* (Barney 1991). A firms' ability to acquire and exploit resources depends upon its place in time and space and is associated with path dependency. Thus, path dependency is a reason of resource heterogeneity (Teece et al. 1997).

Dynamic managerial capabilities are determined as the capabilities with which managers build, integrate, and reconfigure organizational resources (Adner & Helfat 2003). The foundations of dynamic managerial capabilities are the following:

- Managerial cognition - mental models and beliefs (knowledge structures), managerial cognitive capabilities and emotions;
 - Managerial social capital - goodwill derived from relationships, informal and formal relations within and across companies;
 - Managerial human capital - knowledge, skills, education and experience.
- Managers differ in their impact on strategic change and performance of the firm that results in differences in managerial cognition, social capital, and human capital and leads to different outcomes. (Helfat & Martin 2015.)

Regarding the internationalization process, resources, competencies and capabilities are the determining factors of successful internationalization. To recognize and capture the opportunities in the international markets, the entrepreneurial resources, i.e. the financial and technological resources of the entrepreneur, are critical (Dhanaraj & Beamish 2003). It is generally confirmed that the internationalization process requires the mobilization of resources and competences in a company (Ruzzier, Hisrich & Antoncic 2006). The knowledge-based organizational capabilities are found to contribute most to the performance of internationalizing SMEs (Kuivalainen, Puumalainen, Sintonen & Kyläheiko 2010). In addition, financial capabilities are a significant indicator of the degree of internationalization: investment expertise, connections with venture capitalists and excellent financial management, are all valuable capabilities for a small firm with high international growth orientation (Kuivalainen et al. 2010).

Oviatt and McDougall (2000) define international entrepreneurship as *a combination of a, and risk-seeking behavior that crosses national borders and is intended to create value in organizations* (Oviatt & McDougall 2005). While the entrepreneurship is the creation of organizations, two approaches argue what differentiates entrepreneurs from non-entrepreneurs. In behavioral approach entrepreneurship is seen as a complex of actions involved in organization

creation, while in the trait approach an entrepreneur is a set of personality traits and characteristics (Gartner 1988). In any way, the main dimensions of entrepreneurial orientation - proactivity, risk taking and innovativeness (Naldi, Nordqvist, Sjöberg & Wiklund 2007) - can be applied to the organizational level (Hisrich 2009).

New international ventures, global start-ups, and born globals are similar concepts with some differences regarding the scope of their international operations (Allen 2016). These terms refer to firms that are global from inception or develop global operations very close to it (Oviatt & McDougall 1994; Knight & Cavusgil 2004; Allen 2016).

Oviatt and McDougall (1994) focus on newly started firms and they define an International New Venture (INV) as a business organization that, from inception, seeks to gain a significant competitive advantage from the use of resources and from the sale of outputs in multiple countries. A global start-up is *the most radical manifestation of the international new venture* which is international at inception (Oviatt & McDougall 1994; Oviatt, McDougall & Loper 1995). According to Knight and Cavusgil (2004), a born-global can be defined as a firm that has a share of foreign sales of at least 25% after having started export activities within three years of its inception.

Born globals are often small, innovative, and technologically advanced firms with knowledge which enables them to internationalize at an earlier stage than traditional firms (Knight & Cavusgil 2004). Moreover, it is assured that the innovative nature of born globals enable them to develop specific traits and knowledge which allow them to succeed in early internationalization. They are driven by the entrepreneurial orientation and international mindset of the manager to maximize the international growth and performance (Knight & Cavusgil 2004). Born global firms generally find the niche on the global market and internationalize in the focused markets (Knight & Cavusgil 2009). Thus, they are specialized on niche markets and seek to differentiate their products from competing products more than the firms that internationalize on later stages (Aspelund & Moen 2005).

According to the international entrepreneurship theory, the born globals employ export as the main entry mode because of limited resources due to their small size and newness (Knight & Cavusgil 2004; Oviatt & McDougall 1994). However, dealing with the uncertainty inherited to internationalization process, born globals are more flexible and dynamic because of their small size (Knight & Cavusgil 2004). The main aspect of the born global firms is that they are knowledge-driven (Knight & Cavusgil 2004; Oviatt & McDougall 1994). They learn and acquire knowledge through early international operations rather than incremental steps (Knight & Cavusgil 2004). Moreover, on every stage of internationalization they expose different traits (Chetty & Campbell-Hunt 2004). For instance, the initial international operations of the firms are more likely to be similar to that of traditional ones, i.e. they expand to the markets close to their home market. In later internationalization, they start focusing on entering multiple markets quickly, which is a characteristic trait of born global firms (Chetty & Campbell-Hunt 2004).

To conclude, we must acknowledge that many basic assumptions underlying the internationalization of Born Global firms do not necessarily differ from what is outlined in the original Uppsala-Model. Johanson and Vahlne (1977) explain the slow and incremental character of internationalization by the fact that a firm attempts to keep risk at a low-level striving for growth and long-term profit. This assumption may still be valid for BG firms choosing the nearest location for the first market entry (Madsen & Servais 1997). However, the entrepreneurial characteristics of founders and market conditions are different and they predetermine the differentiation of Born Globals from incrementally internationalizing firms (Madsen & Servais 1997). The globalization of markets and the technological development are the antecedents of born global firms' appearance as they help new companies to serve cross-country niche markets. Globalization with less trade barriers and developed communications capabilities foster the growth of born globals (Knight & Cavusgil 2004).

5.4 Influential factors on internationalization

5.4.1 Failure factors of internationalization

The literature in the field of internationalization covers different barriers and failure factors. Different authors mention internal barriers of the firm (e.g., lack of knowledge) and external ones, such as the emerging market (Johanson & Vahlne 1977; Dunning 1988).

The empirical study on the renewable energy technology reveals that renewable energy is not as profitable as fossil fuels, and consequently not cost-competitive as a substitute of the traditional sources of energy (Owen 2006). Thus, competitive alternative solutions to clean technologies is a challenge in the internationalization path.

The institutional barriers to internationalization of technology-based companies can be in the form of split regulatory incentives. For example, institutional arrangements in subsidizing clean solutions in one market lead to the disadvantage for firms in other markets, where regulation does not support transition to cleantech industry (Carlsson 2006). Furthermore, the economic factors as higher returns on alternative investments, and low energy costs are the most affecting SMEs in the energy-efficiency sector in their development towards the international growth (Nijkamp, Rodenburg & Verhoef 2001; Trianni, Cagno & Farné 2016).

Problems with financing of the geographical expansion are faced by many entrepreneurial firms due to their limited financial resources (Coviello & McAuley 1999). Scarcity of financial capital has been confirmed as a barrier for internationalization (Beck, Demirgüç-Kunt, Laeven & Maksimovic 2006).

The internationalization theory or Transaction cost theory stands for the fact that internationalizing companies choose the lowest cost location for each activity they perform (Buckley 1988). This theory fails to provide an appropriate explanation for INVs (McDougall, Shane & Oviatt 1994). INVs act contrary to this axiom and choose locations using their business and personal networks, usually encountering high transaction costs. Among the transaction costs are

the additional communication costs, the cost of operating in an unfamiliar environment, the cost of overcoming political and social preferences for domestically owned firms and the administrative cost of managing an internal market (Venkateswaran 2012).

Perceived technical risk is the most critical failure factor for energy-efficiency technologies because of inadequate information about pay-back time and vague advantages of the environmental solutions (Andersson & Newell 2004). Business risk associated with local suppliers switching to competitors, refusal to pay or product returns and last-minute cancellations are confirmed to be significant constraint for early and rapid foreign market entry (Freeman et al. 2006).

Another challenge for early internationalizing firms is lack of trust. It has been historically confirmed that the level of trust is decreased when uncertainty and risk are high, and this situation is usual in unfamiliar locations (Welch & Luostarinen 1988). Trust or the lack of it is usually identified as one of the “make-or-break” factors in partnerships (Blomqvist, Hurmelinna-Laukkanen, Nummela & Saarenketo 2008). The greatest obstacle in establishing local-supplier relationships is the lack of trust with local firms (Chen 2003).

We have identified factors of failure of rapid internationalization discussed in academic literature and attributed to the context of cleantech industry, and provide the conceptual framework in Figure 5.3.

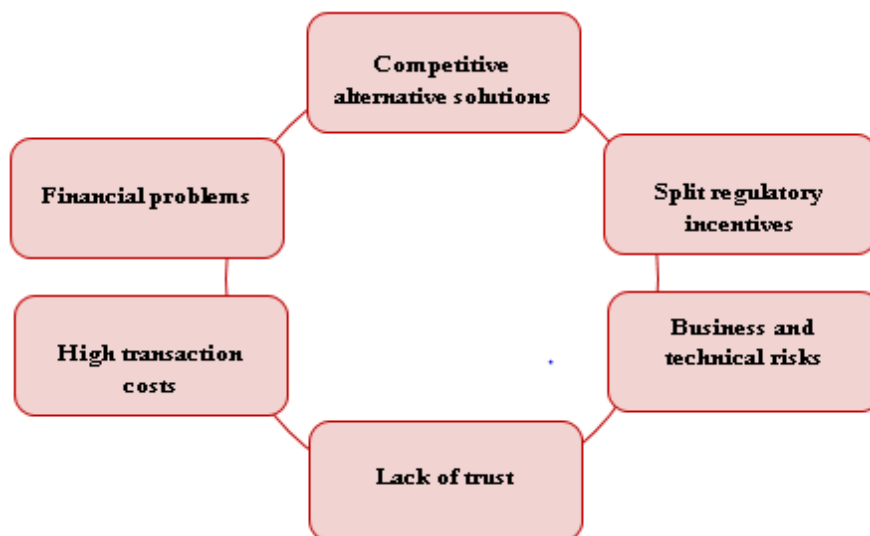


Figure 5.3. Failure factors of internationalization in cleantech industry

5.4.2 Business model specific success factors of internationalization

The term “critical success factors” was proposed by Rockart (1979) for helping senior executives describe the vital information they needed for successful management of their organization (Rockart 1979). It is now applied to the key factors for achieving success in any operation.

The researchers divide success factors in different types and propose their own theoretical frameworks for explaining the successful expansion to foreign markets. Oviatt and McDougall (1995) identify seven successful characteristics of Born Globals; global vision from inception which is supported by Persinger, Civi and Vostina (2007), managers with international experience developed further by Andersson and Evangelista (2006), international business network, exploited pre-emptive technology and marketing, unique intangible asset, closely linked product or service extension and closely coordinated worldwide organizations (Andersson, Danilovic & Hanjun 2015). Knight and Cavusgil (2004) emphasize such critical influential factors as innovation culture, foreign market knowledge and organizational capability (Knight & Cavusgil 2004). Five drivers of early internationalization for high-tech companies are identified in the conceptual study: innovativeness of a product or service; high-tech/niche-based market; industry’s uncertainty and dynamism; access to business network; and previous experience in the same market/segment (Baronchelli & Cassia 2008).

A meta-analysis of findings in 31 studies identifies the 24 most widely researched success factors for new technology ventures (Song, Podoynitsyna, Van Der Bij & Halman 2008). The homogeneous positive significant success factors correlated to the venture’s performance are supply chain integration; the market scope; a firm’s age; the size of founding team; financial resources; founders’ marketing experience; founders’ industry experience; and existence of patent protection. While five factors which are not significant are: founders’ research and development (R&D) experience; founders’ experience with start-ups; environmental dynamism; environmental heterogeneity; and competition intensity. The remaining 11 success factors appear to be heterogeneous. (Song, Podoynitsyna, Van Der Bij & Halman 2008).

We concentrate on the business model specific (BM-specific) factors enabling successful internationalization omitting the role of strategic management with entrepreneurial, learning and international growth orientation (Jantunen, Nummela, Puumalainen & Saarenketo 2008), business environment characteristics (Zahra and Bogner 2000), opportunity-based approach (Oviatt & McDougall 2005; Zahra, Korri & Yu 2005), entrepreneurial team background and characteristics (Bloodgood, Sapienza & Almeida 1996), and some other approaches to classification of success factors.

The role of technology is appreciated by many researchers (Freeman, Edwards & Schroder 2006). Due to the shortened product life cycle and fast innovation intensity the innovative offering is a key competitive factor for the success of a born global firm (Knight & Cavusgil 2004). The early and rapid internationalization of a firm is positively associated with the innovatory uniqueness of the firm's products (Gassmann & Keupp 2007).

According to Porter (1980) born-global firms tend to offer improved, different, distinctive or innovative products, thus emphasizing a differentiation strategy (Hoti 2015). The BGs typically develop new product or services to find opportunities in niche markets (Cavusgil & Knight 2009). Empirical analysis suggests that product differentiation is important for rapid internationalization (Oviatt & McDougall 1995).

The empirical analysis suggests that the main strengths of studied American born global companies lay in superior product quality, differentiation and customer focus, enabling these companies to serve their customers better than large multinational companies (Knight, Koed Madsen & Servais 2004). Niche customer segments are typically served by a company through a specific product and a unique marketing strategy (Freeman & Cavusgil 2007). The attributed success factors of a firm are found to be the product differentiation, targeting the global niche segments, and maintaining close relationships with international customers (Evers 2011).

Market conditions are considered to be a prerequisite for the success of born global firms (Madsen & Servais 1997; Lee, Lee & Pennings 2001). Strategic

orientation expressed in a marketing strategy and distribution channels is emphasized less by the international new ventures than domestic ventures (McDougall 1989). The same finding is relevant for geographical location of operations: it is not significant for BGs. Those companies whose competitive advantage is location-bound are likely to proceed slower in their internationalization path (Gassmann & Keupp 2007).

External owners such as VCs are found to be important initiating the force of rapid internationalization (Zahra, Ireland & Hitt 2000; George, Wiklund & Zahra 2005). Linkages to venture capital companies have shown very strong effects on the performance of technological start-ups (Lee, Lee & Pennings 2001). Instead of focusing on entrepreneurial team characteristics we propose such business model's specific factor as Human resources as one of the essential one in the success of internationalization process. A study of 1102 Spanish firms suggests that human capital as well as organisational resources, have the strongest influence on internationalisation speed (Rialp & Rialp 2007). The firms' human capital determines the propensity to export abroad (Westhead, Wright & Ucbasaran 2001). Another intangible resource - Knowledge and Know-how (patents) - supports the appearance of BGFs. According to Oviatt and McDougall (1994) the main asset of a firm is its unique knowledge how to create value in several different countries (Oviatt & McDougall 1994). Patented or secret knowledge that needs little local adaptation may be embedded in the technology of the product and transferred to multiple locations at a low marginal cost (McDougall & Oviatt 1996). The early and rapid internationalization of a firm is positively associated with the firm's scope of intellectual property rights protection (Gassmann & Keupp 2007).

The impact of capital requirements (financial resources) on the likelihood of a new venture entry has been examined by entrepreneurship scholars thoroughly (Robinson & McDougall 2001). The empirical research on the internationalisation of smaller firms suggests that these companies are more likely to face resource scarcity in terms of financial and human resources (Coviello & McAuley 1999). Lack of resources (financial and knowledge) is one of the key constraints that smaller born-global firms face entering new markets,

it can, however, be overcome by using advanced technology and networking competencies to create collaborative partnerships (Freeman et al. 2006). The empirical study confirms the importance of technological capabilities and financial capital invested during a venture's development period (Lee, Lee & Pennings 2001).

Many scholars highlight that networks play a crucial role in the internationalization of BG firms. Because of limited resources high-tech start-ups govern their sales and marketing activities through a network of partners who complement their own competences (Jolly, Alahuhta, & Jeannet 1992). The high importance for new firms to relate with customers, suppliers and other partners is stressed by Oviatt and McDougall (1995). Different modes of cooperation such as exporting, licensing, strategic alliances, and joint ventures are used in the value chain of international new ventures (Oviatt & McDougall 1994). Networks and alliances are ascertained to be enablers of internationalization of SMEs as Majocchi, Bacchiocchi and Mayrhofer (2005) confirm that the network of partners and customers enhance the firms' overall international competitiveness, and Doole, Grimes and Demack (2006) verify that foreign market connections are the main factor increasing export-related performance in general (Torkkeli, Puumalainen, Saarenketo & Kuivalainen 2012).

In the previous chapter 4 we have argued that the policy and regulation with subsidies and grants may play a significant role in the support of international new ventures (Carlsson 2006; Zahra & George 2002; Carpenter & Petersen 2002). However, the Bavarian entrepreneurship study of Brüderl and Preisendörfer (2000) does not show strong 'state support' effects on start-up growth (Lee, Lee & Pennings 2001).

Based on the systematic integration of the business model elements, which have been justified to be appropriate for the context of cleantech industry in the chapter 4, and success factors of BG firms, proven to be important in previous studies, the conceptual framework illustrated in Table 5.1 has been developed. In our empirical part we aim to examine which of these BM-specific success factors cleantech growth companies should consider first in order to have the strongest track record of global success. It should, however, be mentioned that

the factors deducted in this study are not the only ones responsible for the high performance of BGs, since several perspectives do exist on how the successful internationalization path can be analysed.

BM components	Factors	Authors
Sustainable value proposition	Technology type	Knight & Cavusgil (2004); Freeman et al. (2006); Gassmann & Keupp (2007)
	Auxiliary Services	Oviatt & McDougall (1995)
	Differentiation of offering	Porter (1980), Oviatt & McDougall (1995); Cavusgil & Knight (2009)
Value delivery	Customer segments	Evers (2011);
	Market conditions (growth rate, competitors)	Madsen & Servais (1997); Lee, Lee & Pennings (2001)
	Marketing strategy	McDougall (1989)
	Delivery channels	McDougall (1989)
	Location of offices and operations	Gassmann & Keupp (2007)
Value creation	Company's ownership structure	Zahra, Ireland & Hitt (2000); George, Wiklund & Zahra (2005)
	Financial Resources	Robinson & McDougall (2001); Lee, Lee & Pennings (2001)
	Human Resources	Rialp & Rialp (2007); Westhead, Wright & Ucbasaran (2001)
	Knowledge and know-how (patents)	McDougall & Oviatt (1996); Gassmann & Keupp (2007)
	Network (partners)	Jolly, Alahuhta, & Jeannet (1992); Oviatt & McDougall (1994); Freeman et al. (2006);
Value capture	Financial model (revenue stream and cost structure)	Low-cost strategy by Bloodgood, Sapienza & Almeida (1996)
External regulatory forces	Policies (Visions, Plans, Memorandums of Understanding)	Carpenter & Petersen (2002)
	Regulation (taxation and incentives) in the target markets	McDougall (1989); Carpenter & Petersen (2002); Zahra & George (2002)
	Subsidies and grants	Carlsson (2006)

Table 5.1. Business model specific factors enabling internationalization

6 Research Methodology

This chapter introduces and explains the empirical methodology adopted in this research. We explain the methodological choices and argue the appropriateness of them. The research approach of the thesis is described in the beginning, followed by the research design. The research method is explained afterwards. Further on, we present the data collection process which reveals how informants were selected, data gathered, and the theoretical framework was incorporated in this process. The following sub-chapter provides information on how the analysis process was implemented. Finally, the evaluation of validity and reliability of the research concludes this chapter about the empirical methodology.

6.1 Research approach

The research approach identifies how the researcher relates to the theory and the process of the research. The main approaches are the deductive, inductive and abductive approach which have different purposes. The inductive approach starts with empirical data and results in the development of theory. A researcher analyzes the empirical data and comes to the conclusions developing a theory. An inductive approach is the most appropriate if the field of research is new with a few studies and information. (Saunders *et al.* 2009.)

The deductive approach is suitable when the theory exists and it can be utilized and tested by the researcher (Saunders *et al.* 2009). The objective and question of the research are adapted to the specific theory and the research is focused on testing available theory by collecting data. A deductive approach is usually preferred when there is a lot of research in a topic and hypotheses can be drawn (Saunders *et al.* 2009). Thus, theoretical concepts are derived from the literature and have a specific impact to the research process, before the empirical data is collected and analyzed (Patton 2002).

The abductive approach is a mix of inductive and deductive approach. In abduction, a researcher observes a surprising fact about reality, and uses the existing theory to guide the study in trying to explain this fact (Saunders *et al.* 2009). This approach is often utilized to generate a new theory or modify the

existing ones. Qualitative data analysis procedures may include both inductive approach based on empirical findings and deductive approach with the development of hypotheses, their testing and accepting or rejecting (Sharma 2008). The abductive approach is preferred when the topic is thoroughly researched but now studied in a new context (Saunders *et al.* 2009).

Taking into consideration that this study is derived from both theory and reality, an abductive approach has been regarded to be the most suitable. First, the author of this thesis discovered that Finland was one of the most technologically advanced countries regarding cleantech, and that firms supported by the VCs outperformed others. However, not all Finnish cleantech companies succeed in raising VC. Therefore, the problem was thought to be in the particularities of the industry or business models of approaching companies. Moreover, albeit managerial input of VC firms is confirmed by a wide range of studies, the evaluation effect of the VC-backed companies' successful internationalization still may occur. Therefore, it was supposed to be appropriate to explore the impact of VC firms on business model innovation and internationalization in the context of Finnish cleantech industry. Furthermore, the author of this thesis tried to reveal internationalization success factors concerned with the business model, as well as internationalization failure factors specific to the cleantech industry, which is in line with how data is usually utilized within an inductive approach (Saunders *et al.* 2009).

6.2 Research design

The research design is the general plan of how the research question can be answered, therefore it must match the purpose of the study (Saunders *et al.* 2009). The purpose of the research can be explorative, explanatory, descriptive or evaluative, or combine several forms of it. Robson (2002) ascertains that an exploratory study helps to find out *what is happening; to seek new insights; to ask questions and to assess phenomena in a new light* (Saunders *et al.* 2009). The explorative studies commonly answer the questions "How" and "What" (Saunders *et al.* 2009). Such studies are used to increase the understanding of a specific and focus on determining what and how something is happening.

Furthermore, the research design enables to choose an appropriate research strategy. A qualitative research proposes a variety of research strategies: experiment, survey, archival analysis, history and case study (Yin 2009). This list can be added by action research, grounded theory and ethnography (Saunders et al. 2009). Such strategy as a survey is more usually associated with deductive approach and quantitative research, however, strategies can be combined (Saunders et al. 2009). Wester (1995, 2000) specifies three main strategies of qualitative research: case study, ethnography and qualitative survey, where the latter is an application of grounded theory with theoretical sampling and constant comparison, involving iteration of analysis and data collection (Jansen 2010). The survey strategy is the most frequently used to answer 'who', 'what', 'where', 'how much' and 'how many' questions, therefore it tends to be used for exploratory and descriptive research (Saunders et al. 2009; Yin 2009).

The case study strategy usually aims to evaluate a specific process (Yin 2009). Robson (2002) defines case study as *a strategy for doing research which involves an empirical investigation of a particular contemporary phenomenon within its real-life context*. According to Morris and Wood (1991), the case study strategy is of particular interest for gaining a rich understanding of the context of the research and the processes being enacted. This strategy generates answers to the questions 'why', 'what' and 'how', though 'what' and 'how' questions tend to be more appropriate for the survey strategy. Thus, the case study strategy is most often used in explanatory and exploratory research. Yin (2003) distinguishes single case and multiple case studies. The rationale for utilizing multiple cases lays in the need to establish whether the findings of the first case occur in other cases and, as a consequence, the need to generalize from these findings. For this reason, multiple case studies are preferable to a single case study. (Saunders et al. 2009.)

Since this thesis aims to explore VC-entrepreneur relationships and internationalization process in a new context, a multiple case study is considered to be the most appropriate research strategy. Since there is a need

to answer several 'what' sub questions, and the research question targets to answer 'how does the phenomenon influence...?' question, we use the qualitative survey strategy as well. Our multiple case study aims to provide the thorough understanding of the relationship between VC firms and cleantech companies, as well as the impact of VC firms on business model innovation and the internationalization process of Finnish cleantech growth companies. The purpose of every case study is to get knowledge on the studied phenomena from various perspectives. The cross-case analysis and comparison of the results can give the findings for theoretical summarization and managerial implications.

An archival research strategy makes use of administrative records and companies' documents as the principal source of data. It allows to answer the research questions which focus upon the past and changes over time, and are exploratory, descriptive or explanatory (Saunders et al. 2009). We presume that archival materials will contribute to gaining more insights on our research question.

Due to the limited amount of time for data collection, a cross-sectional time horizon with the data collected at one point in time is applied. It is opposite to longitudinal study when data is collected over time (Creswell 2009). A cross-sectional time horizon enables us to create an understanding on the specific situation at a given time. Thus, our research collects data at a given time, and is therefore affected by the stage in where the case-companies are at the time of the data collection.

6.3 Research method

The research methodology of the study is qualitative multiple case study and survey-based exploration. A qualitative method was chosen because of the focus on the phenomenon - the impact of venture capital firms in business model innovation and internationalization of cleantech growth companies. The aim of the study is *to improve knowledge on how venture capital firms influence Finnish entrepreneurial cleantech companies in the field of business model innovation and internationalization*. A qualitative approach is relevant when the

research question is “how” and the aim is to describe certain case studies (Yin 2009). The goal of the qualitative research method is to enhance the understanding of phenomena with emphasis on the meanings, experiences and views of all participants (Neergaard & Ulhøi 2007). Qualitative research allows to gain comprehensive understanding of the studied phenomenon. It focuses on understanding phenomenon in context-specific setting and results in findings that are not statistical or quantifiable (Strauss & Corbin 1990). Thus, meanings are expressed through words (Saunders et al. 2009).

Qualitative research methodology is widely used for the investigation of organizational phenomenon. This kind of research method is concerned with particular cases and therefore any type of qualitative methodology might be appropriate. One of the primary issues of this method is the number of cases necessary to generalize findings and conclusions. Cases usually give understanding of the meaning of human actions and what is done and how. Therefore, qualitative research method places more emphasis on words than numbers. (Thorpe & Holt 2008; Schwandt 2007).

Qualitative research lifts the veil on the complex picture of a problem or issue under the study. This involves reporting multiple perspectives, identifying the many factors involved in a situation, and generally sketching the larger picture that emerges. A visual model of many facets of a central phenomenon aids to establish this holistic picture. (Creswell 2009.)

Traditional qualitative techniques for data generation are case study research, the study of archival data, formal and informal interviews, ethnographic observation, naturalistic and narrative inquiry (Thorpe & Holt 2008). Six ways that are suitable for collecting data in the case studies are documentation, archival records, interviews, direct observations, participant observation, and physical artifacts (Yin 2009). However, a qualitative survey is also a viable form of data collection, as qualitative research implies any form of information collection that is meant to describe, but not predict, as in the case of quantitative research (Jansen 2010; SurveyMonkey 2018). Qualitative surveys can be open (inductive) or pre-structured (deductive); open-ended questions allow the respondents to provide a unique answer, while multiple-choice

questions provide a list of predetermined responses to select from (Jansen 2010). To summarize, the qualitative survey aims to describe the diversity (not distribution) in the participants' meanings or practices (Jansen 2010). Qualitative survey strategy is a less structured research methodology than a quantitative survey as it is used to gain in-depth information about respondents' underlying reasoning and motivations. The end goal is to develop a deep understanding of a topic, issue, or a problem from an individual perspective.

Although the wide variety of “handbooks” are devoted to the versatility and usefulness of the qualitative research method, there are still no universal answers how it can be appropriately utilized. Nesbary (2000), as well as Sue and Ritter (2007), emphasize that the data collection may involve creating a Web-based or Internet survey administered online (Creswell 2009). Therefore, the core of our data is taken from digital survey composed by open and multiple-choice questions and distributed among venture capitalists and cleantech entrepreneurs in the period from January 2018 to February 2018. All our potential respondents had active investment experience in cleantech industry, thus we probably had knowledgeable sample.

The main limitation of the chosen and applied research method is that the questionnaire as the instrument of data collection is not a usual tool in the qualitative study. It has certain weaknesses, although some benefits can be indicated as well.

Digital survey as a tool for data collection was chosen due to several challenges. The main of them is no personal contact of the researcher to the respondents before the study. Usually, interviewees are selected from the close surrounding network of the researcher or recommended by common friends or relatives, and have trust to the author of the study. People are more likely to take part in an interview if they speak the common language or have had a personal face-to-face contact before. The author of this thesis had made several attempts to contact potential interviewees by phone and asked for giving a short interview, but all of them refused to take part in the interview due to the lack of time and mentioned that the form of digital survey was more convenient for them. Thus, the decision to prepare a thorough questionnaire

with the availability to give detailed answers to the open questions was made by the author of this thesis. The rationale for this form of data collection is based on the availability and preferences of informants, and time constraints of the research.

Implementing case-based research and stating the research question as “How does phenomenon influence...?” we elaborated digital survey with appropriate questions starting with the words “how”, “what”, “who”. All the questions were open-ended and asked to choose a suitable answer from the provided variants, and give a full detailed answer in the field “Other”. Most of the respondents used the option of a text box “Other”, and we consider that dominantly filling in the questionnaire by the respondents had a form of open sharing of experience. This approach gave respondents a freedom to say exactly what they felt about the topic, and it provided an exploratory data that revealed unforeseen issues and quotes.

The advantage of digital qualitative survey is the prevention of tension and hints from the researcher’s side which can be unconsciously used during interviews (Ekanen 2007). The interview may be seemed as not an objective source of evidence (Qu & Dumay 2011), while the results of our approach are not influenced by the researcher’s experience and interpretation. However, some difficulties of understanding the meaning of a question could arise and in this case the researcher did not have an opportunity to rephrase the question or formulate it differently to avoid misunderstanding. To eliminate ambiguity in understanding the survey’s style we attach the questionnaire in Appendices 1 and 2 for the VC firms and cleantech companies, correspondently. The presented list of questions gives a possibility to repeat the research and contributes to the reliability of the study.

The important advantages of adopted research strategy are that:

- 1) it attempts to overcome some of the limitations of the quantitative approach such as failing to consider the heterogeneity of the phenomenon;
- 2) it provides enough detachment to prevent “going native” and guarantees objectivity of researcher’s conclusions (Ekanen 2007); and

3) it increases the reliability of the study and internal validity of the research findings as the transcribing of the gathered data and ensuring its accuracy are not required as in the case of interviews (Given 2008).

The weakness of this cross-case study and the applied research method is its methodological limitation - the extent to which it can be generalized to a wider range of growth companies in cleantech industry (Ekanen 2007). Moreover, we recognize that a qualitative survey has its own limitations, which could be overcome by further interviews.

Figure 6.1 represents the research design of this study adopted from Saunders et al. (2009).

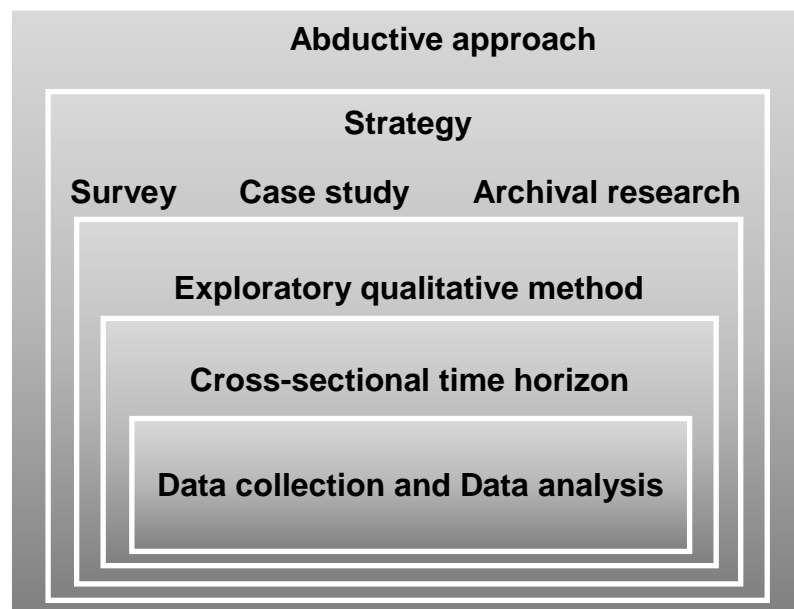


Figure 6.1. Research design of this study adopted from Saunders et al. 2009.

6.4 Data collection

Data collection implies collection of information from various sources of data (Eisenhardt 1989; Saunders et al. 2009). We used primary and secondary data in the study. Survey responses of the key persons in the case-companies are the source of the primary data. Secondary data was retrieved from other sources like webpages, archives and databases. It is necessary to note that using several data sources establishes various evidences of the phenomenon and improves construct validity of the study (Yin 2009). Thus, multiple sources of evidence help to find explanations for the multifaceted phenomenon, get its

deep understanding and increase the validity of the research (Thorpe & Holt 2008).

The initial and primary data was collected through a structured questionnaire with open-ended questions and a possibility to give a detailed answer, share the experience, personal attitude and perception. Five of the ten respondents are representatives of separate cleantech ventures, and other five ones are the specialists and investors of VC firms. All informants deal with VC funding and take part in making managerial decisions regarding investments and their further exploitation. Five cleantech case-companies and five venture capitalists represent the same phenomenon, but the context of capabilities and practices differ. The experience and expertise of respondents have allowed to get data from various facets and both perspectives of investor-entrepreneur relationship.

The secondary sources of evidence used in this study are web-sites of case-companies (Guercini 2014), as well as documents available in the internet which help to have a general view on the cases. The questiones in the survey themes – network and partners, financing and investments, internationalization process and foreign markets – are well reflected in companies' media publications, reports or general info about the ventures. Hence, we have got more evidence and visual picture of the studied themes. Table 6.1 represents a summary of the sources of data collection utilized in the study.

Type of data	Sources of data collection
Primary data	Survey responses of key persons in the case companies: CEO, founder, investment manager
Secondary data	Cleantech Finland, Finpro, case-companies' webpages, NordicGreen Cleantech Start-ups website, Finnish Venture Capital Association website
Archival materials	Reports, presentations, brochures, companies' annual reports
Other materials	Amadeus database, Statistics Finland

Table 6.1. Summary of the sources of data collection

To achieve the reliability of the study we describe the process of database selection and data collection in details. The list of potential participants from the

side of cleantech firms was prepared based on the NordicGreen Cleantech Start-ups website's dataset (Nordic Green 2018), and venture capital firms were chosen by the researcher with the help of list of Finnish Venture Capital Association's members. We provide information how many invitation letters were sent, how many of them were replied and ignored.

The initial list of venture capital investors was formed with the help of database of Finnish Venture Capital Association's members, which is available on the web-side of association and consists of 119 firms (Paaomasijoittajat 2018c). By the analysis of the introduction data on the website of Finnish Venture Capital Association, and individual websites of VC firms, the limited list of potential respondents specializing in cleantech investments, or having at least one cleantech company in their portfolio, resulted in total of 25 VC firms.

Firstly, the companies were contacted by personal email addresses of Managing partners, Regular partners, Investment directors or Investment managers. The introductory electronic letter was comprised of several parts and included the short presentation of the researcher, the topic and the roots of increased interest to this field of knowledge, the main objective of the study and research question. The link to the digital survey was presented at the end of the letter and was accompanied by the mentioning of the approximate time required to fill out the questionnaire, and confidentiality of all gathered data.

The first reminder was sent automatically in two weeks after the initial contact by email, but the second one was done after reaching the relevant persons by phone number and asking for their availability and actuality of this study for their companies.

As the result, the response rate is 20% with 5 respondents out of 25 firms. Four investors refused to take part in the survey because of no interest or time, and four other ones explained they were not applicable to the research by one of the following reasons:

- no direct contact with CT firms making investments through other VC funds,
- no PE investments since 2016,

- being not a VC firm, or
- being a buy-out firm.

The sample of cleantech ventures was based on the data published on the web-site nordicgreen.net – portal where general info, news and deals among Cleantech Startups, Innovators and Investors in the Nordic, the Baltic and the Arctic regions are presented (Nordic Green 2018). This database includes 42 Finnish cleantech firms. After the exploration of these companies with the help of their web-sites, search engines and database Amadeus we explore that three of 42 firms were dissolved or bankrupted, and 14 firms used other forms of financing than PE investing (e.g., loans, guarantees or export credits). Thus, we have got an initial list of 25 Finnish cleantech ventures. While the sample is too small in total numbers, it provides a very good coverage of the cleantech entrepreneurs in Finland acquired VC during their expansion stage. Thus, the quality of the sample is underlined by the experience of the responding cleantech firms. The link to the digital survey was sent by email to Managing Directors or Founders of our target companies, and we received 5 responses with 20% response rate for this group.

The open-ended questions for the survey and multiple-choice options for the answers were generated based on the theoretical framework. The survey was designed especially for this research utilizing the main concepts discussed in the literature with adaptation to the specific context of the study. The used questions were devoted to the general info about a firm and specified the explored themes of the topic. The questionnaire prepared for VC firms asked for general information about the firm, such as the areas of investments, and VC-backed companies' characteristics of particular interest. The VCs were also asked about the priority of evaluation criteria in the process of investment decision-making, success and failure factors of internationalization of cleantech companies and how they assess the performance of their activities. The CT firms were asked to complete a questionnaire about the difficulties to acquire VC funding, managerial input of VC firm, characteristics of business model changes under the management of VC firm, success and failure factors of internationalization of cleantech ventures. Since the questionnaires asked for

assessment on certain variables, they therefore dealt with judgements, estimates and expectations of respondents providing a qualitative data (Nardo 2003).

6.5 Data analysis

We put an effort in documentation of the analysis process and describe it carefully. Data analysis approach is provided by the content analysis. Data analysis involves collecting open-ended data, based on asking open-ended questions, and developing an analysis from the information supplied by participants (Creswell 2009). Thus, data analysis includes the evaluation of words, definitions and experience of informants. It is deemed that the analysis in the qualitative research is closely connected with the researcher's experience and occurs to be an interpretation of his own understanding (Mills 1959). However, the form of quantitative survey allows to avoid subjective conclusions, as we illustrate cross case analysis with citations of the respondents in the text, as well as comparison matrix of the case-companies.

One key study construct – business model specific success factors of internationalization - was measured consistently using 7-point Likert scales. A primary reason for this selection is explained by Dau (1991), who stresses that these scales communicate interval scale properties to respondents, and thus permit more rigid data analysis, at a parametric level (Robertson & Chetty 2000). Another reason for choosing the 7-point Likert scale is that it has been used successfully by other researchers for similar parameters (Covin & Slevin 1989; Naman & Slevin 1993; Robertson & Chetty 2000). We utilize a comparison matrix to evaluate success factors of internationalization. For each component of a business model (i.e., sustainable value proposition, value creation, value delivery, value capture and regulatory framework), specific elements are evaluated by the grades from 1 to 7. However, it is considered that each element of each component attributes equally to the effect of the whole component on the internationalization of the cleantech case-companies.

In our analysis, we investigate the influence of venture capital on business model innovation (managerial input) and internationalization in cleantech

industry as it is reflected in the experience and perceptions of the responded entrepreneurs and VC investors. To organize and analyze the large amount of information, we utilized Excel tables forming separate databases for cleantech and VC case-companies. Figure 6.2 depicts the part of the organized database of cleantech case-companies.

No	Question	Type of answer	Cleantech companies				
Q1	Name of the Company	Text	CT-1	CT-2	CT-3	CT-4	CT-5
Q2	Your position in the company	Multiple-Selected Choice	Managing director	CEO, Founder	Founder	Managing director	Managing director
Q3	Number of employees	Selected Choice	< 10	< 10	< 10	< 50	< 50
Q4	Turnover in euros	Selected Choice	≤ € 2 m	≤ € 2 m	≤ € 2 m	≤ € 2 m	≤ € 2 m
Q5	Year of first international activities	Text	2014	2017	2014	2013	2008
Q6	What was the first country you had international activity in?	Text	Netherlands	Sweden	Sweden	Germany	Germany

Figure 6.2. Database scheme showing variables and outcomes.

Data from the questionnaires was organized into various categories and the linkages between categories were analysed. A survey frame was planned to cover several factors influencing VC-entrepreneur relationship in the field of BMI and internationalization – cleantech industry related factors, business model innovation specific factors and internationalization related factors. These factors formed themes, which were divided into sub-themes.

We state the goal of the study - to achieve abstraction and produce analysis at the general level not at the case level. We recognize that the greater number of the informants could give more generalized data about the studied phenomenon. However, we suppose that the number of respondents is sufficient as the purpose of the thesis is not to generalize and obtain statistical data, but to receive deep understanding of the researched specific topic at the general level.

It is worth to mention that our study has all the weaknesses of a self-report study. It is possible that respondents could be influenced by their perception of what is a desirable response, or a response that is seen as appropriate to their position as representatives of the venture capital community, rather than the criteria they actually use. There is also a danger that some respondents may not actually use the criteria in the ways that they think they do. Given these

limitations, the results reported below need to be interpreted with some circumspection. (MacMillan et al. 1985.)

6.6 Validity and reliability

To conclude the chapter related to research methodology, we summarize and assess the reliability and validity of the study, as these both constructs allow to evaluate the quality of the research (Patton 2002).

Reliability implies description of the data collection process in such a way that the operations can be repeated with the same results. Holistic documentation of all processes and procedures enhance the reliability of the research by enabling to repeat the study again.

Validity evaluates whether the research is measuring what it targeted to measure. Construct validity means to establish correct measures for the concepts being researched. Internal validity of a study is the extent to which it is free from systematic error or bias. External validity is *establishing the domain to which a study's findings can be generalized*. However, in a qualitative study the purpose is to increase understanding but not to measure anything. For this reason, the validity of a qualitative study depends on the research objective. (Yin 2009.)

As it was mentioned before, due to sufficient description of the process of sample selection and data collection process, as well as the attachment of the questionnaire to this paper the reliability of the research is very high. Construct validity is justified by the multiple relevant sources, non-forcing survey method, and external verification from the university's supervisors. External validity is supported by using multiple-case method with various cleantech case-companies and VC specialists.

In this study the construct validity is supported by the usage of different approaches. Empirical data has been collected from the representatives of the phenomenon and other multiple sources. Because of the chosen data collection method (digital survey), informants had a possibility to freely and anonymously share their thoughts and experience regarding the studied topic. The survey did

not have a risk of forcing specific answers and gave a freedom to express opinions. Moreover, several supervisors from the university evaluated the progress of data collection and validity of the chosen method.

The internal validity of the findings is secured by the careful selection of the databases of case-companies, high expertise of informants at the executive level (CEOs, founders, and investment managers) and uniformity of the questionnaire. The survey explored the history of cleantech companies, their business models and internationalization processes, as well as the investment decision-making process and motivations of VC specialists.

Since our study is focused on a certain geographical area – Finland – its external validity is rather limited. The results of this research cannot be directly extended to other markets due to the market-specific factors. Moreover, making conclusions we have no possibility to attain statistical generalization through the analyzed case studies. Gibbs (2007) states that the intent of qualitative research is not to generalize findings, but to describe the themes developed in the context of a specific site (Creswell 2009). According to Greene and Caracelli (1997) particularity rather than generalizability, is the hallmark of qualitative research (Creswell 2009). However, Yin (2003) believes that qualitative case study results can be generalized to some broader theory (Creswell 2009). Thus, external validity of our study is added by multi-case method. Furthermore, the aim of this study is to implement analysis at the general level rather than a case level.

7 Findings and Analysis

In this chapter, the gathered data is summarized and analyzed on the basis of theoretical framework. The analysis part is structured according to the theoretical framework and it is a try to find answers for the research question and sub questions by comparing the findings in the empirical study with the theories. The findings illustrate the points of view of our respondents and it should be taken into consideration that they are limited by the drawbacks of the survey as a data collection tool.

This chapter is started by the case companies' description – both VC and CT firms. Characteristics of clean technology and capabilities of cleantech company which have an effect on VC funding, as well as preparation actions before VC approaching are discussed further on. Thereafter, the type of BM changes after VC firm's involvement is deliberated. Then failure and specific success factors of business model influencing internationalization in cleantech industry are discussed. Finally, we analyze the purpose of VC firms and their productivity criteria.

7.1 Case companies' description

7.1.1 Venture capital firms

Table 7.1 combines the general information about the VC case-companies: the position of the informants, the areas of investments and sectors of cleantech industry which are of particular interest to the VC firms. The data is gathered from the survey and will be further detailed in the description of the VC case-companies based on the secondary sources as web-sites and media sources. Three of five VC firms are 100% private VC funds, while one of five has a share of public sector (40%), and another one – 10% of corporate investors (Table 7.2).

Name	VC-1	VC-2	VC-3	VC-4	VC-5
Position	Board Member, Partner	Chairman, Partner	Investment Director	Managing Director, Partner	Chairman, Partner
Areas of investments	Nordic countries including Finland	Nordic countries including Finland, Other European countries	Europe (excluding Nordic countries), South and Central America, Middle East, Asia	Nordic countries including Finland	Nordic countries including Finland
Sectors of cleantech industry	Cleanweb & IoT, Energy & resource efficiency, Renewables & smart grid, Smart transport & logistics	Cleanweb & IoT, Energy & resource efficiency, Renewables & smart grid, Smart transport & logistics	Renewables & smart grid, Waste-to-value, Waste Management	Cleanweb & IoT, Renewables & smart grid	Air quality, Bioproducts & Materials, Clean Water technologies, Cleanweb & IoT, Energy & resource efficiency, Renewables & smart grid, Smart transport & logistics, Waste-to-value, Waste Management, Other

Table 7.1. VC firms' description

Name	VC-1	VC-2	VC-3	VC-4	VC-5
Private equity investors	100	100	100	60	90
Corporate investors	-	-	-	-	10
Public sector	-	-	-	40	-

Table 7.2. The ownership of VC firms allocated between the groups (% of shares)

VC-1 invests mainly in early-stage technology companies that already have evidence of demand for a product or service and international roadmap. Technology areas are not limited to specific industries and include cleantech. Scalable BM, Software-as-a-Service (SaaS) BM and Strong management team are the essential capabilities of a potential portfolio company. The experienced

team of VC-1 aims to help in business growth and internationalization of portfolio companies providing post-closing support with network and contacts. The informant is Board Member and Partner of VC-1 with Master's Degrees in law and economics, and MBA education, having the working background in major industrial and financial organizations.

VC-2 is one of the first venture capital companies in Europe to invest in clean technologies, renewable energy, electronic systems and energy-saving technology companies. The innovations in which different forms of energy are converted into electricity, such as wind and solar power, wave power and biomass, are of particular interest. Also, energy-saving applications, such as electric drive trains as well as smart grids, Cleantech related IT and new processing technologies are in its focus. VC-2 recognizes the UN Principles of Responsible Investment (UNPRI) and believes that companies aligning to the Environment, Social and Corporate Governance Principles (ESG Principles) in their corporate responsibility work will be more attractive investments than other companies in the long run. Regarding the evaluation process VC-2 appreciates Scalable BM, Software-as-a-Service (SaaS) BM, Sustainable value proposition, Innovative profit formula and Strong management team. Its focus areas are the Nordic countries and German-speaking Europe. VC-2 offers equity financing (€1-10M) for technology companies operating in the above-mentioned areas. In addition to financing, it provides knowledge in technology, markets and business models assuming an active role in the company's board. The range of its essential services includes the evaluation of technology and development of business ideas, as well as the identification of winning business models and ensuring an access to the sales networks of its partners. The respondent is Chairman and Partner with experience of 22 years in the electrical engineering industry.

VC-3 focuses on international renewable energy investments and the Finnish growth companies making use of the opportunities offered by digitalization. The key criterion of the investments is "steady cash-flow potential (mainly infrastructure)". VC-3 provides solutions for boosting corporate growth and increasing customer wealth. Our respondent serves as Investment Director, a

cleantech and private equity professional, who has over 25 years of experience in Venture Capital, start-ups, industrial management, cleantech and ICT.

VC-4 invests in early stage businesses with unique technology and global ambition to become winners in their industry categories. Its core expertise lies in designing the optimal business models, go-to-market plans and scaling strategies that unleash the potential of innovative technologies and engineering expertise. It looks for the brightest ideas, strongest expertise and greatest teams in Nordic and Baltic countries. It is technology centric and business focused: looks for protectable technologies and platforms that enable the creation of novel industry categories or taking over existing ones. VC-4 values niche solutions for a specific global market over more general offerings with limited geographical reach. The main criteria for investment decision is Scalable BM and Strong management team. It can be also interested in:

- Large international market opportunity,
- compelling value proposition,
- disruptive technology and sustainable competitive advantage,
- ability of VC-4 to add value to business design and execution.

In contrast, it is not interested in ventures with lower ambition levels, limited scalability and regional or local target markets. VCs are very closely involved with their portfolio companies and actively syndicate with leading international VCs to ensure speed of growth. Our informant is a Managing Partner with 18 years of technology financing experience and specialization in wireless technology, component industry, telecom, and start-ups.

VC-5 is an early growth VC-fund aiming to open the international markets to ambitious companies in knowledge intensive related businesses. It has “no specific limitation and invests in early growth high IPR content technologies for B2B”. VC-5 has a very disciplined selection and evaluation process of potential portfolio companies. It has a risk averse approach with no interest in unproven technologies/markets. It looks for Scalable BM, Software-as-a-Service (SaaS) BM, Innovative profit formula, Strong management team, as well as “high entry barrier for competition, big enough market potential and exit opportunity”. Team members of VC-5 have experience ranging from working with high growth firms

and businesses expanding into international markets, capital raising, valuing and structuring private placement deals and arranging listings. VC-5 has an ability to support portfolio companies through financing, strategy advice and providing access to network of advisors - leading Finnish entrepreneurs and business executives. The Chairman and Partner, our respondent on behalf of VC-5, has over 30 years of entrepreneurial experience creating successful business from an idea, multiple successful exits, numerous board memberships and international business experience in Nordic, Baltics and Russia.

Table 7.3 introduces the main assessment criteria in decision-making process of potential investment among our VC case-companies.

Name	VC-1	VC-2	VC-3	VC-4	VC-5
Assessment criteria	Scalable BM, Software-as-a-Service (SaaS), Strong management team	Scalable BM, SaaS, Sustainable value proposition, Innovative profit formula, Strong management team	Steady cash-flow potential (mainly infrastructure)	Scalable BM, Strong management team	Scalable BM, SaaS, Innovative profit formula, Strong management team, Market potential

Table 7.3. Assessment criteria of potential portfolio companies

7.1.2 Cleantech companies

The cleantech case-companies represent different sectors of cleantech industry: Energy & resource efficiency, Bioenergy & biofuels, Energy production & distribution, Clean water technology, Marine & shipping and Smart transport & logistics. The cleantech case-companies were incorporated from 2008 till 2013 and started their international activities in the first year of incorporation, or in two or four years after their foundation. Thus, we suppose they can be referred to the born globals or International New Ventures as they are defined by Oviatt and McDougall (1994). All case companies are micro enterprises in accordance with classification of SMEs of the European Commission. However, all of them have already developed their products, established sales channel and have a steady turnover, and that is why we consider them as the growth companies in consistence with Feimster (2016). Two of the companies have internationalized to Sweden as the first country of entrance which supports the opinion of Madsen and Servais (1997) about the propensity of born globals to have the

elements of Uppsala-Model. Other three firms have expanded their operations to other European countries Netherlands and Germany, with the help of their network connections which correlates with Network theory (Coviello & Munro 1997, Johanson & Mattson 1998, Mtigwe 2006).

Table 7.4. represents the general information about the cleantech case-companies collected from the respondents in the questionnaire and in the secondary sources as web-sites and Amadeus database. As our case-companies are VC-backed firms the ownership of their equity is allocated between the founders/directors and private or corporate investors, and in two cases - public share of ownership comprises 20% (Table 7.5).

Name	CT-1	CT-2	CT-3	CT-4	CT-5
Position	Managing director	CEO, Founder	Founder	Managing director	Managing director
Year of incorporation	2012	2013	2012	2013	2008
Sectors of cleantech industry	Energy & resource efficiency, Marine & shipping, Wind energy, Smart transport & logistics	Energy & resource efficiency	Clean water technology	Combined heat and power (CHP) & District heating and cooling (DHC), Energy production & distribution	Bioenergy & biofuels
Turnover in euros (th EUR in 2016)	≤ € 2 m (99)	≤ € 2 m (26)	≤ € 2 m (140)	≤ € 2 m (131)	≤ € 2 m (1812)
Number of employees	< 10	< 10	< 10	< 50	< 50
Year of first international activities	2014	2017	2014	2013	2008
The first country of internationalization	Netherlands	Sweden	Sweden	Germany	Germany
Share of international sales in turnover (%)	98	0	70	0	50
Type of sales (Products/Services in %)	98/2	40/60	100/0	100/0	50/50
Type of exports	Direct exporting	Representatives (Agents or Distributers)	Representatives (Agents or Distributers)	Direct exporting, Licensing or franchising, Contract manufacturing	Direct exporting

Table 7.4. Cleantech companies' description

Name	CT-1	CT-2	CT-3	CT-4	CT-5
Founders/directors	20	77	90	30	15
Private investors	20	23	5	70	-
Corporate investors	40	-	5	-	65
Public sector	20	-	-	-	20

Table 7.5. The ownership of CT firms allocated between the groups (% of shares)

CT-1 is a Finnish clean technology and engineering company pioneering modern auxiliary wind propulsion for the global maritime industry. Its technology is software operated, and fuel saving, supporting the decarbonisation of the shipping industry. The company offers economical solutions to the global maritime market, which enable significant reduction of both fuel costs and greenhouse gas emissions of the ships. It uses updated technology, advanced materials and a high-tech control system to maximize cargo ship fuel efficiency.

The technology is around ten times more efficient than a conventional sail, because more lift is produced with a much smaller sail area. Fuel costs can be reduced typically by 5% to 20% without lowering the operating speed of the vessel. Due to its simplicity, it requires no reefing or crew attention when in operation. It is "push button wind propulsion" from the bridge. The customers are shipping companies, whose vessels are cruising on routes with favourable wind conditions. Typically, such vessels are Ro-Ro ships, tankers, bulk carriers and passenger vessels.

The vision of CT-1 is to be the global market leader in auxiliary wind propulsion systems. The core values of the company are protecting the health and safety of its employees, customers and the natural environment. The key markets are Europe, Asia and North America. In addition, the main partners in internationalization process are VC investors, export agents and governmental agencies providing financial support, as well as suppliers.

Since its establishment in 2012, CT-1 has gathered more than \$10 million USD of funding, which has enabled development, piloting and commercialisation of the technology. The main investors are governmental agencies and VC firms having a pivotal role in the commercialization of the technology. In 2016 the company received €2.6M funding to develop the world's largest auxiliary wind

propulsion system awarded by both Tekes, the Finnish Government's funding agency for Innovation, and the European Commission under its Horizon 2020 Framework Programme for Research and Innovation. These financial resources supported manufacturing, assembling, land testing, fine tuning, and piloting of the technology.

Our respondent is the managing director of CT-1, a serial entrepreneur with educational background in physics and economics, and experience of developing the business from inception to a publicly listed company.

CT-2 is a Finnish start-up based on a solution for saving energy in water radiators heated buildings. It has a B2B SaaS (Software as a Service) business model for buildings and district heating networks. The core is a cloud-based software utilizing patented big data algorithms. Heating of the building is operated with electronic wireless TRVs (Thermostatic radiator valve) and gateways, compatible with other IoT (Internet of Things) devices and building automation. The installation is fast, premises can be in normal use during the installation, and the heating is not cut off. After installation, the Service works automatically, enabling a remote access for Maintenance and the Tenant.

The company creates a better quality of heating, saves energy, and reduces emissions by lower consumption and demand-side management. Its solution consumes 10-35% less heating energy by adjusting the temperature of each room at the right time – resulting in savings in the whole energy network. The Service works fully automatically at room level accuracy in any size of building, including commercial and residential. All parties from tenants, professional building owners, real estate maintenance & ESCO to energy companies can benefit from this solution.

The company is privately held. It closed private funding rounds among VC firms and business angels, and received TEKES funding. Financing enabled CT-2 to start business operations in Finland and Scandinavia with Sweden to be the first country of internationalization. CT-2 closed A-round in 2H/2017 raising €2M for expansion in Nordics, sales and business development, strengthening the team and R&D. Expansion countries in 2018-2021 are planned to be the EU, China

and ex-CiS countries including Russia taking the benefits of close collaboration with established partners.

CT-2 has a cross-functional team with experience in international business development, product development and management, marketing and sales, and execution in large international companies. Our informant is the founder and CEO of the company, serial entrepreneur with educational background in electrical Engineering and 20+ years of business and product creation in wireless network software, hardware and consumer business.

CT-3 is a Finnish growth oriented start-up company, founded in 2012. It developed technological applications for water treatment systems that are more efficient with reduced costs. Its innovative products offer solutions with minimal energy consumption, energy efficiency, and more controlled solids separation. Total estimated investing and life cycle running costs can be reduced by more than 50%, depending of the site / facility and when compared to existing type systems. Its solutions prove to be more modular and thus grant better possibilities for variations than other systems in the market. Modularity, in turn, means cost savings in the investment phase as the customer process needs can be better tailored and secured, which also affects running costs. Thus, CT-3 brings cost-effective solutions, quality improvement, and genuine added value to its customers. Key customer segments are urban and industrial water facilities, drinking water production, fish farming, agriculture irrigation, as well as Pulp & Paper and packaging industry.

CT-3 is currently preparing to be listed in suitable stock market for the planned expanding of the company and brand. The share of private and corporate investors is relatively small – 10% in total, while the internationalization process is financed purely by VC funding. The main markets are Finland, Nordic countries, Europe, Arabia including Gulf area, SE Asia and East Asia. CT-3 collaborates with the agents to enter international markets. CT-3 is a part of the Finnish Cleantech Cluster and utilize the services of governmental agencies providing support in building network.

CT-3 has a qualified service personnel and our respondent, Managing Director, has several business degrees and strong experience from a large variety of start-up companies. The team of CT-3 believes that environmentally friendly products can also be efficient and economical.

CT-4 is a Finnish manufacturer of the most efficient small gas turbines in the world. The technology has been developed in Lappeenranta University of Technology, Finland, and successfully commercialised. The pedigree of this technology has been established over 30 years of Research and Development in high speed technology and fluid dynamics. The company has extensive immaterial rights on the core technology and continue to develop a portfolio of IP protection around the product and its application.

Its head office and manufacturing facilities are in Finland. It has also offices in Germany and in the United Kingdom. CT-4 has brought its advanced technology to the growing combined heat and power market in North America through the partnership with distributor and authorized integrator. Market potential for this high efficiency technology is growing as the need for a clean and efficient power system exists. The strategy of the company has been to have a world class product with high reliability and high efficiency achieved with modular components. CT-4 retains the core expertise and employs industrial, world-class partners to ensure component scalability and ease of integration into a company's own technology.

BM is based on partnerships with contract manufacturers and distributors via marketing cooperation and business development agreements. With Germany being the first country of internationalization, CT-4 has embarked upon market development in the UK, the Czech Republic, Slovakia, Russia, Mexico and the USA.

The company is privately held and it is financed by the private investors. CT-4 was one of the first companies in Europe to receive financing from the EU H2020-program and has also received funding from different financing bodies owned by the local authorities and/or Finnish government. It has received funding from European Regional Development Fund for application engineering

development and for manufacturing facility ramp up. The company has also received R&D funding from Tekes and funding for a market feasibility study from Nopef. It closed several seed rounds just after inception. Afterwards, the team managed to raise 1.700 k€ Pre-A round and two Series A investments in total of 5.000 k€. Up to the end of 2016 CT-4 got 2.7 M€ of equity capital and 1.7 M€ grants & soft loans. In 2018 the company has secured 3.7 M€ in new equity investment to provide working capital to fulfil existing orders for the first gas turbine, expand into new markets, and start the development of the next larger size turbine. The first turbines are planned to be delivered in 2018.

CT-5 is a Finnish growth company founded in 2008 which develops and markets novel and disruptive enzymatic products that enable significant efficiency improvements in the pulp and paper and biofuels industries, as well as removal of toxic micro-pollutants from waste water. It provides enzymes that dramatically save energy at the refining step in the pulp and paper industry. In the advanced biofuel sector, it enables production of low cost lingo-cellulosic sugars. Its competitive advantage is the ability to tailor or adapt enzymes to meet each customer's segment specific needs. Offering customized projects to meet customer's specific needs, CT-5 has already achieved successful industrial trials with sector leaders in the forest and renewable chemicals. Value-added partnerships with leaders in such industries as Pulp and Paper, Renewable chemicals, Biofuels&Energy and Biomaterials enables CT-5 to accelerate market growth through the global introduction of its innovative and sustainable solutions in various business segments.

The products of CT-5 are protected by international patents. Together with its proprietary technology, it offers significant advantages over existing approaches in terms of selectivity, productivity, and the eventual costs of the industrial enzymes or microorganisms that are produced. The technology is highly versatile and applicable to a range of enzyme and industrial applications. It solves critical energy efficiency issues related to industrial processes, enhances productivity and lowers the overall level of environmental impact. Its bio-based products succeed, not only thank to a demand for environmentally friendly

alternatives, but being as good as the petrol-based products but cheaper, or the same price but better.

CT-5 is a widely recognized supplier of industrial enzymes, significantly contributing to the economics and sustainability of process industries such as pulp & paper, biofuels and biochemicals. It gained international recognition very fast participating in several sustainable EU projects. It made a name for itself via participation in EU Horizon 2020 projects. Moreover, it had industrial trials with several European partners and marketed its solutions in Europe (Scandinavia, Germany, France) and the US signing a joint technology development agreement with the US-based renewable biochemical producer. CT-5 is currently takes part in the Innovative bioproducts growth program of Business Finland which intends to network Finnish companies with Finnish or international investors and create an international growth capital network. This programme helps companies participating in the program to enter new international markets of such target countries as Netherlands, Belgium, Germany, USA, UK, Sweden, Russia and Japan.

CT-5 closed several financial rounds with €2.2M in 2013 and €3.7M total (as of 05/2017) with the participation of major VC funds of Finland, Finnvera and other financial organizations. The funds were intended to be used for the commercial roll-out and development of new products.

CT-5's advantage is in its team experienced in genetic engineering and microbiology. It also strengthened its Board of Directors with an experienced and internationally recognised industry executive in order to build a collaboration network with various industry players. Our respondent is a founder and CEO of CT-5, serial entrepreneur with international experience in biotechnology, pharmaceutical and cleantech industries over 15 years.

Table 7.6 summarizes the unique characteristics of clean technology and/or value proposition of our cleantech case-companies.

Name	CT-1	CT-2	CT-3	CT-4	CT-5
Characteristics of clean technology (value proposition)	Energy efficiency, Cost savings, Sustainability (diminished environmental harm)	Low capex, Scalability, Energy efficiency, Cost savings	Low capex, Scalability, Resource & Energy efficiency, Cost savings, Sustainability	Resource & Energy efficiency	Cost savings

Table 7.6. Characteristics of clean technology (value proposition) of cleantech case-companies

7.2 VC approaching particularities in cleantech industry

As previous research states, the particularities of technology and its market potential are the influential factors in VCs' decision-making process (MacMillan et al. 1985, Fried & Hisrich 1994, Sorenson & Stuart 2001, Sharma 2015), which determine the probability of VC investments in knowledge-based industries. Unique characteristics of clean technology and the capabilities of a potential VC-backed company were asked in the surveys, as one of the research sub-questions addresses this issue. Moreover, we tried to expose the primary actions that should be taken before VC application by the growth ventures in cleantech industry.

The unique characteristics of the clean technologies (value propositions) of the case-companies funded by VC firms are depicted in Figure 7.1.

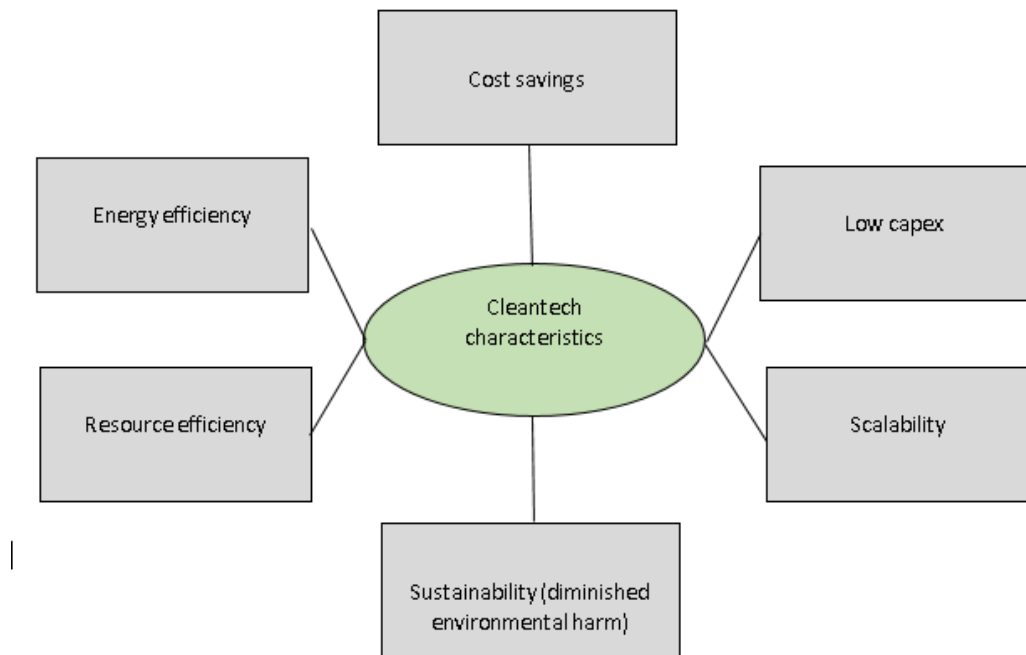


Figure 7.1. Cleantech characteristics in case-companies

Figure 7.2 illustrates business models and capabilities which are looked for by investors in cleantech industry from the point of view of our respondents.

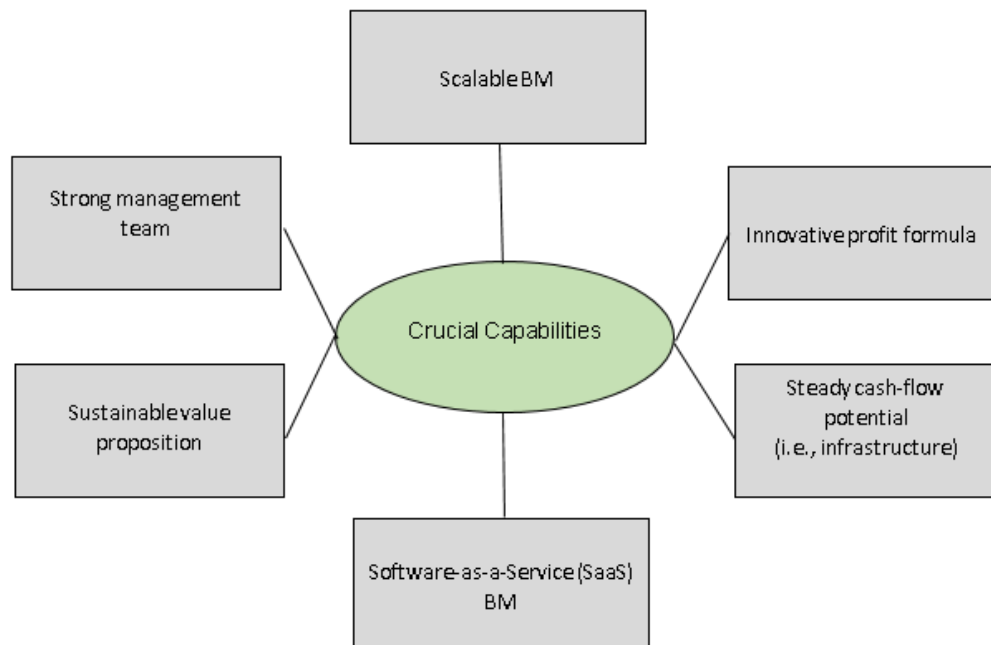


Figure 7.2. BMs and capabilities which are looked for to invest in by VC firms

To determine the primary actions before VC approaching the respondents were asked to rank the order of options by their importance, where “1” was the most important, and “10” - the least important. Placing a certain preparation action on the top list and giving it the minimum number of grades (i.e., “1”) means the highest importance of an option. Thus, Top3 substantial actions before VC approaching appreciated by the VC specialists are Sustainable business model development, Strong business plan and Innovative product or service, which totally corresponds to the perspective of CT entrepreneurs (Table 7.7).

Preparation before VC approaching	CT-1	CT-2	CT-3	CT-4	CT-5	Grades of CT firms	VC-1	VC-2	VC-3	VC-4	VC-5	Grades of VC firms	Total Grades
Propose innovative product or service	1	6	3	6	1	17	1	4	10	4	1	20	37
Develop sustainable Business Model	2	3	2	1	2	10	2	6	2	1	4	15	25
Prepare strong business plan	3	5	1	2	3	14	3	2	3	3	5	16	30
Have social ties and network with VC firm	4	4	4	7	4	23	5	7	6	7	8	33	56
Have revenue records	5	1	6	3	6	21	4	8	4	2	2	20	41
Have patents or trademark	7	7	7	4	5	30	6	5	5	5	3	24	54
Have environmental or social impact	8	8	5	8	8	37	7	3	7	8	6	31	68
Succeed in previous investment rounds	6	2	8	5	7	28	8	9	8	6	7	38	66
Implement crowdfunding	9	9	9	9	9	45	9	10	9	9	9	46	91
Other (Strong team)	10	10	10	10	10	50	10	1	1	10	10	32	82

Table 7.7. Actions before VC approaching

The informant of the VC-2 stressed that “experienced team or a plan for it” is the main assessment criteria, while representative of VC-3 pointed that in their case “steady cash-flow potential (i.e., infrastructure)” plays the key role in the evaluation of applied company. The respondent from behalf of CT-5 highlighted that “strong team is number one”. Considering the opinions of the specialists from both perspectives we can assume that preparation to the VC approaching should be started beforehand and comprise the steps outlined in Figure 7.3 in sequence to descending order of their importance.

- 1 Develop sustainable business model
- 2 Prepare strong business plan
- 3 Propose innovative product or service
- 4 Have revenue records
- 5 Have patents or trademark
- 6 Have social ties and network with VC firm
- 7 Succeed in previous investment rounds
- 8 Have environmental or social impact
- 9 Implement crowdfunding

Figure 7.3. Preparation actions before VC approaching

7.3 Characteristics of Business Model changes after VC firm involvement

As we have presented each of the case-companies and discussed VC approaching particularities in cleantech industry, this section concentrates on the business model changes and their characteristics after VC firm entrance to the business. We analyze each CT company separately and focus on the dimensions of the BM changes earlier derived from the theory. The underlying characteristics of the BM changes are summarized in Table 7.8, and the detailed depiction of the changes in every cleantech case-company follows hereinafter. Such specific areas related to BM changes as certain actions taken, stage when the changes were implemented, opportunities raised after VC funding, outcomes of changes and current challenges of cleantech case-companies are presented in a cross-case analysis at the end of this section.

We have specified six distinct kinds of changes and their characteristics in BM innovation and BM adaptation which are shown in Table 7.8.

Business model innovation characteristics	Business model adaptation characteristics
Novelty-oriented	Efficiency-oriented
Simultaneous in different markets	Gradual in different markets
Radical within a particular component	Incremental within a particular component
Involve Core aspects of the firm's strategy	Involve Peripheral aspects of the firm's strategy
Bold and aggressive in order to maximize the probability of exploiting potential opportunities	Cautious in order to minimize the probability of making costly decisions
High-risk and innovative	Low-risk and conventional

Table 7.8. The kinds of changes and their characteristics in BMI and BMA

The respondents were asked to assess the features of business model changes after VC firm involvement with the option to have a neutral meaning. Table 7.9 indicates the total points of ten respondents standing for both perspectives: VC and CT firms. It shows the prevalence of BMA over BMI only in one grade. Moreover, the number of neutral responses is close to both dimensions and we can interpret this fact as no changes in the regarded characteristics. These results raise the further interest in separate valuation of views of VC and CT firms' representatives.

Number of responses related to BM innovation		Number of responses related to BM adaptation		Number of Neutral responses	Total number of responses
Novelty-oriented	3	Efficiency-oriented	5	2	10
Simultaneous in different markets	1	Gradual in different markets	5	4	10
Radical within a particular component	2	Incremental within a particular component	3	5	10
Involve Core aspects of the firm's strategy	5	Involve Peripheral aspects of the firm's strategy	2	3	10
Bold and aggressive...	4	Cautious...	3	3	10
High-risk and innovative	5	Low-risk and conventional	3	2	10
Results	20		21	19	60

Table 7.9. Total points on the types of changes and their characteristics

VC firms assessed the changes of BM as more innovative than adaptive (Table 7.10), while CT entrepreneurs stressed that BM changes after VC firm's involvement had the characteristics of BMA more than BMI (Table 7.11). Furthermore, the number of neutral responses of the cleantech case-companies exceeds even the total number of points for any kind of changes (Table 7.9) what can be comprehended as the companies had no BM changes after VC entering the business.

Number of responses related to BM innovation		Number of responses related to BM adaptation		Number of Neutral responses	Total number of responses
Novelty-oriented	2	Efficiency-oriented	3	-	5
Simultaneous in different markets	1	Gradual in different markets	3	1	5
Radical within a particular component	2	Incremental within a particular component	2	1	5
Involve Core aspects of the firm's strategy	4	Involve Peripheral aspects of the firm's strategy	1	-	5
Bold and aggressive...	3	Cautious...	1	1	5
High-risk and innovative	4	Low-risk and conventional	1	-	5
Results	16		11	3	30

Table 7.10. Points of VC firms on the types of changes and their characteristics

Number of responses related to BM innovation		Number of responses related to BM adaptation		Number of Neutral responses	Total number of responses
Novelty-oriented	1	Efficiency-oriented	2	2	5
Simultaneous in different markets	-	Gradual in different markets	2	3	5
Radical within a particular component	-	Incremental within a particular component	1	4	5
Involve Core aspects of the firm's strategy	1	Involve Peripheral aspects of the firm's strategy	1	3	5
Bold and aggressive...	1	Cautious...	2	2	5
High-risk and innovative	1	Low-risk and conventional	2	2	5
Results	4		10	16	30

Table 7.11. Points of CT firms on the types of changes and their characteristics

The limitation of the findings is the lack of interconnection between case-companies: the studied VC firms do not have shares in the studied CT companies. Because of that fact we have no possibility to compare the perspectives of entrepreneurs and venture capitalists in the framework of one company. Thus, our conclusions will be made on the basis of perspectives of ten different specialists having experience in VC and CT industries from both sides.

To implement cross-case analysis of the BM changes of the cleantech companies we describe every company's pathway, firstly, and do the comparison afterwards.

CT-1 confirmed that it did not face any BM changes after VC funding by choosing the neutral meaning for all characteristics. It implemented some tuning of the BM before VC application by expanding to new customer segments, building new partnerships and saving manufacturing costs which resulted in cost reduction and international growth. Receiving investments was required for further international growth. Now CT-1 sees the relational challenge for further expansion abroad with the current Business Model, which is concerned with the customer segments, partners and competitors.

CT-2 confirmed that it faced some BM changes after VC funding, however the primary changes were carried out during the start-up stage. CT-2 executed a range of changes starting from the launching new products, integrating services for the long term financial returns and utilizing new distribution channels continuing by building new partnerships, saving manufacturing costs and receiving investments which were required as the “monetary resources” for further international growth. These changes ensured “a wide access to customers”. Figure 7.4 demonstrates the main characteristics of the business model changes after VC firm involvement in the CT-2 which can be characterized as gradual, incremental and low-risk. Organizational challenges for further international growth concerned with resources, skills and capabilities within the company are perceived as the key ones in the context of current BM.

Novelty-oriented	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	Efficiency-oriented
Simultaneous in different markets	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	Gradual in different markets
Radical within a particular component	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	Incremental within a particular component
Involve Core aspects of the firm's strategy	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Involve Peripheral aspects of the firm's strategy
High-risk and innovative	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	Low-risk and conventional
Bold and aggressive in order to maximize the probability of exploiting potential opportunities	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	Cautious in order to minimize the probability of making costly decisions

Figure 7.4. Characteristics of business model changes in case-company CT-2

CT-3 asserted that BM changes were made on the stage of entering new markets rather than after VC funding. The core changes included launching new

products or services, addressing new, unmet customer needs, utilizing new distribution channels and building new partnerships. They resulted in development of the innovative value proposition and attracting VCs. VC financing allowed to see opportunities in new markets, where the relational challenge is still relevant with the existing BM.

Regarding **CT-4** it faced the changes of BM after VC attracting. The first changes were performed in the start-up stage, when the innovativeness of the value proposition was achieved. VC funding generated market related opportunities, and CT-4 was enabled to expand to new markets, strengthen the management team and build new partnerships which led to the international growth of the company. Figure 7.5 shows that the changes after VC funding involve core aspects of the firm's strategy and are more novelty-oriented, high-risk and bold rather than cautious and adaptive. Organizational challenges associated with resources, skills and capabilities within the company are seen as the main obstacles for further internationalization with the present business model.

Novelty-oriented	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Efficiency-oriented
Simultaneous in different markets	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Gradual in different markets
Radical within a particular component	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Incremental within a particular component
Involve Core aspects of the firm's strategy	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Involve Peripheral aspects of the firm's strategy
High-risk and innovative	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Low-risk and conventional
Bold and aggressive in order to maximize the probability of exploiting potential opportunities	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Cautious in order to minimize the probability of making costly decisions

Figure 7.5. Characteristics of business model changes in case-company CT-4

In accordance with the answers of the CT-5's representative, the business model of **CT-5** has changed after VC funding. CT-5 has seen financial (new revenue models) and strategic (new modes of internationalization) opportunities, and in order to change business model it has taken the following actions: expanding to new markets and customer segments, receiving investments and participating in programmes for the grants, as well as developing new revenue opportunities (i.e., additional sales and cross-selling). According to Figure 7.6 showing the main characteristics of Business Model changes after VC firm involvement in the CT-5's equity, the type of BM changes can be confidently defined as business model adaptation. However, the

outcomes of these changes were innovativeness of the value proposition and international growth. The main challenges for further international growth with the Business Model CT-5 has today are the relational challenges concerned with the customer segments, partners and competitors.

Novelty-oriented	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	Efficiency-oriented
Simultaneous in different markets	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	Gradual in different markets
Radical within a particular component	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Incremental within a particular component
Involve Core aspects of the firm's strategy	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Involve Peripheral aspects of the firm's strategy
High-risk and innovative	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	Low-risk and conventional
Bold and aggressive in order to maximize the probability of exploiting potential opportunities	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Cautious in order to minimize the probability of making costly decisions

Figure 7.6. Characteristics of business model changes in case-company CT-5

Considering five cleantech case-companies we should admit that they all have clear similarities and differences. Table 7.12 and Table 7.13 demonstrate the summary of the discussed above issues concerning BM changes: VC impact, outcomes and existing challenges, as well as certain activities to create a sustainable business model.

Two of five ventures had hardly any changes of BM after VCs entering the firm, while two of five had changes with characteristics of BM adaptation. Only one case-company, CT-4, highlighted that its changes were more novelty-oriented, high-risk and innovative, and bold and aggressive (BM innovation), rather than efficiency-oriented, low-risk and conventional, and cautious (BM adaptation). We would like to stress that the type of changes of BM was homogeneous by its nature in all three cases meaning that having the characteristics of BM adaptation in one kind of changes other ones were also adaptive. For example, CT-2 had incremental changes within a particular component of BM and gradual in different markets. At the same time the changes of its BM were characterized by the respondent as efficiency-oriented, low-risk and conventional, and cautious in order to minimize the probability of making costly decisions (BM adaptation).

Table 7.12. describes the pathway of cleantech case-companies regarding the specific areas related to BM changes – the stage of the company when the

changes were implemented, opportunities raised after VC funding, outcomes of BM changes and current challenges of cleantech case-companies.

Name of the Company	CT-1	CT-2	CT-3	CT-4	CT-5
How did your Business Model change over the time (at what stages and what components)?	VC funding (administrative techniques, marketing)	Start-up (value proposition)	Entering new markets (changes in product or service lines)	Start-up, VC funding	VC funding
What opportunities have you seen after VC funding?	-	Monetary resources	Market/Industry related (new markets)	Market/Industry related (new markets)	Financial (new revenue models, price differentiation), Strategic (new modes of internationalization)
What were the outcomes of changes in Business Model?	International growth, Cost reduction	Wide access to customers	Innovativeness	International growth, Innovativeness	International growth, Innovativeness
What challenges do you see for your further international growth with the Business Model(s) you have today?	Relational (customers, partners, competitors)	Organizational (resources, skills and capabilities within the company)	Relational	Organizational	Relational

Table 7.12. BM changes related issues in cleantech case-companies

Our analysis shows that most of the changes were made within Value creation BM component and incorporated increasing of financial resources through investments and building new partnerships. More detailed description of actions taken by the cleantech case-companies to create internationally viable business models is presented in Table 7.13.

Business Model Components	Business Model Changes	CT-1	CT-2	CT-3	CT-4	CT-5	Points	Total points
Regulatory framework	Adapting to regulations							
Sustainable value proposition	Launching new products or services		V	V			2	3
	Addressing new, unmet customer needs			V			1	
Value delivery	Expanding operations to new industry sectors					V	1	7
	Expanding to new markets			V	V		2	
	Expanding to new customer segments	V				V	2	
	Utilizing new distribution channels		V	V			2	
	Strengthening customer relationships and retention							
Value creation	Receiving investments	V	V			V	3	9
	Receiving subsidy or grant					V	1	
	Strengthening management team				V		1	
	Implementing HR training and learning							
	Building new partnerships	V	V	V	V		4	
Value capture	Developing new revenue opportunities (e.g., additional sales, cross-selling)					V	1	4
	Integrating services for long term financial returns (e.g., maintenance contract, leasing)		V				1	
	Utilizing price differentiation strategy							
	Implementing price-quantity strategy							
	Saving manufacturing costs	V	V				2	
	Saving transaction costs							

Table 7.13. Business model changes of cleantech case-companies

7.4 Factors influencing internationalization

The key challenges affecting the success of cleantech firm's internationalization were questioned in the surveys. The respondents were asked to determine three main failure factors (challenges) affecting the viability of internationalization in accordance to their company's specific experience. Table 7.14 illustrates the results of all ten case-companies and allows to detect the

challenges most frequently faced by our case-companies: perceived business and technical risks, high transaction costs and problems with financing.

Factors	CT-1	CT-2	CT-3	CT-4	CT-5	Points of CT firms	VC-1	VC-2	VC-3	VC-4	VC-5	Points of VC firms	Total Points
Competitive alternative solutions							V			V		2	2
Problems with financing		V	V	V		3		V		V		2	5
High transaction costs	V		V		V	3	V		V	V		3	6
Split regulatory incentives	V					1					V	1	2
Perceived business and technical risks	V		V			2	V	V	V		V	4	6
Lack of trust								V	V		V	3	3

Table 7.14. Challenges affecting the viability of cleantech firm's internationalization

One of the questions of the survey asked to rank the main elements of the Business model and other success factors on their importance in internationalization process of a company. They could give a grade from 1 to 7, where ("1"-the least important, "7"-the most important, and "4" has a neutral meaning) for each element. The ranking was not required to be a unique number among others, for example they could assign the grade 7 to more than one item. In addition, the informants could add important items in the end of the list as missed elements. Almost all respondents filled out the full grade list. The total number of respondents is shown in Table 7.15. The first column in Table 7.15 is added to show the related category (component) defined for business model elements in the literature review.

BM components	BM elements	Grades							Total number of responses
		1	2	3	4	5	6	7	
Sustainable value proposition	Clean technology type	0	1	4	1	2	2	0	10
	Auxiliary Services	1	3	1	5	0	0	0	10
	Differentiation of offering	1	1	0	0	4	3	1	10
Value delivery	Customer segments	0	0	0	1	3	4	2	10
	Market conditions (growth rate, competition)	1	0	1	2	2	4	0	10
	Marketing strategy	0	0	1	4	1	4	0	10
	Delivery channels	1	0	0	0	4	4	1	10
	Location of offices and operations	0	3	1	4	1	1	0	10
Value creation	Company's ownership structure	2	3	2	2	1	0	0	10
	Financial Resources	0	0	0	1	3	1	5	10
	Human Resources	0	0	0	1	2	2	5	10
	Knowledge and know-how (patents)	0	0	1	2	3	2	1	9
	Network (partners)	0	0	0	1	2	2	5	10
Value capture	Financial model (revenue and cost structure)	0	0	0	2	5	2	1	10
Regulatory framework	Policies (Visions, Plans, Memorandums of Understanding)	0	2	1	4	2	1	0	10
	Regulation (taxation and incentives) in the target markets	1	1	2	2	2	2	0	10
	Subsidies and grants	0	0	1	2	4	1	2	10

Table 7.15. Grades on the importance of BM elements in internationalization.

Table 7.16 represents calculation of total number of grades on the importance of business model elements in the internationalization process of case-companies.

BM components	BM elements	Grade							Total number of grades
		1	2	3	4	5	6	7	
Sustainable value proposition	Clean technology type	0	2	12	4	10	12	0	40
	Auxiliary Services	1	6	3	20	0	0	0	30
	Differentiation of offering	1	2	0	0	20	18	7	48
Value delivery	Customer segments	0	0	0	4	15	24	14	57
	Market conditions (competition)	1	0	3	8	10	24	0	46
	Marketing strategy	0	0	3	16	5	24	0	48
	Delivery channels	1	0	0	0	20	24	7	52
	Location of offices and operations	0	6	3	16	5	6	0	36
Value creation	Company's ownership structure	2	6	6	8	5	0	0	27
	Financial Resources	0	0	0	4	15	6	35	60
	Human Resources	0	0	0	4	10	12	35	61
	Knowledge and know-how (patents)	0	0	3	8	15	12	7	45
	Network (partners)	0	0	0	4	10	12	35	61
Value capture	Financial model (revenue and cost structure)	0	0	0	8	25	12	7	52
Regulatory framework	Policies (Visions, Plans, Memorandums of Understanding)	0	4	3	16	10	6	0	39
	Regulation (taxation and incentives) in the target markets	1	2	6	8	10	12	0	39
	Subsidies and grants	0	0	3	8	20	6	14	51

Table 7.16. Calculation of total number of grades on the importance of BM elements in internationalization.

The maximum number of grades for every success factor is 70, as the highest grade is “7” and we have 10 respondents in total. Network and Human resources seemed to be the most critical success factors associated with internationalization of Finnish cleantech companies. Both elements of BM refer to Value creation component (Figure 7.7). Calculating in “60” grades, the role of Financial resources is on the second place by its importance, and it belongs to Value creation component (Figure 7.7). Such element of BM as Customer

segments is on the third place with the result of 57 grades and reference to Value proposition component (Figure 7.8). Figure 7.9 outlines Top 7 BM-specific success factors in internationalization of cleantech companies.

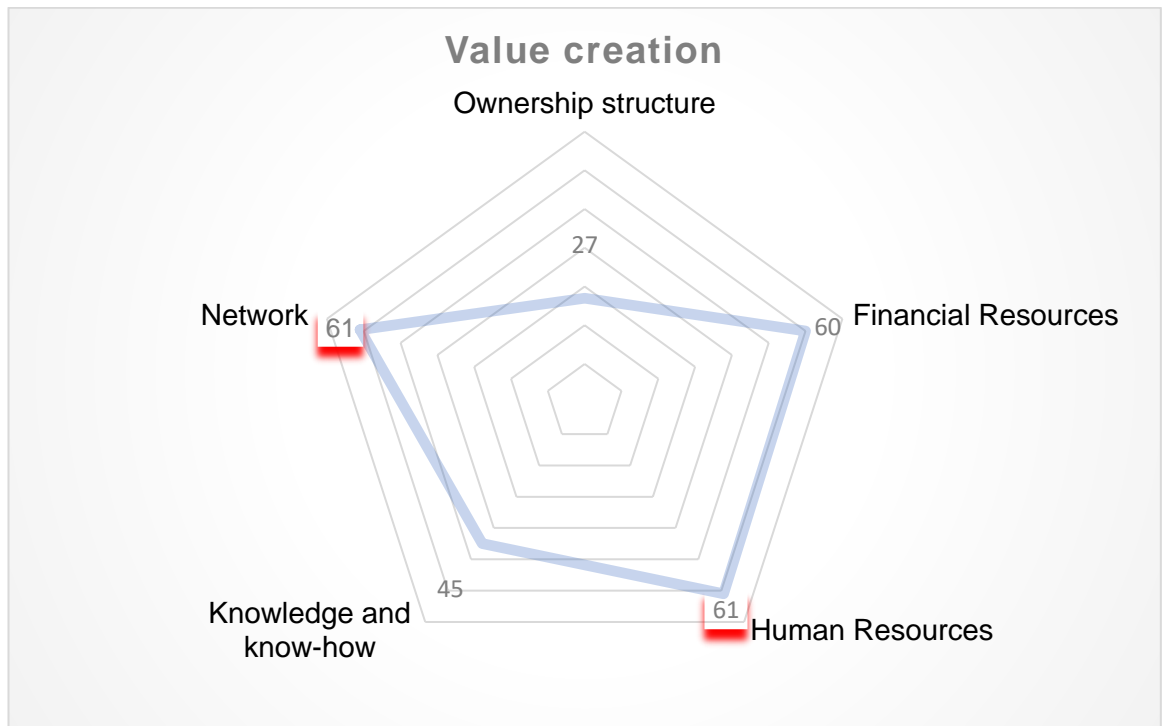


Figure 7.7. Main success factors in value creation of Business Model

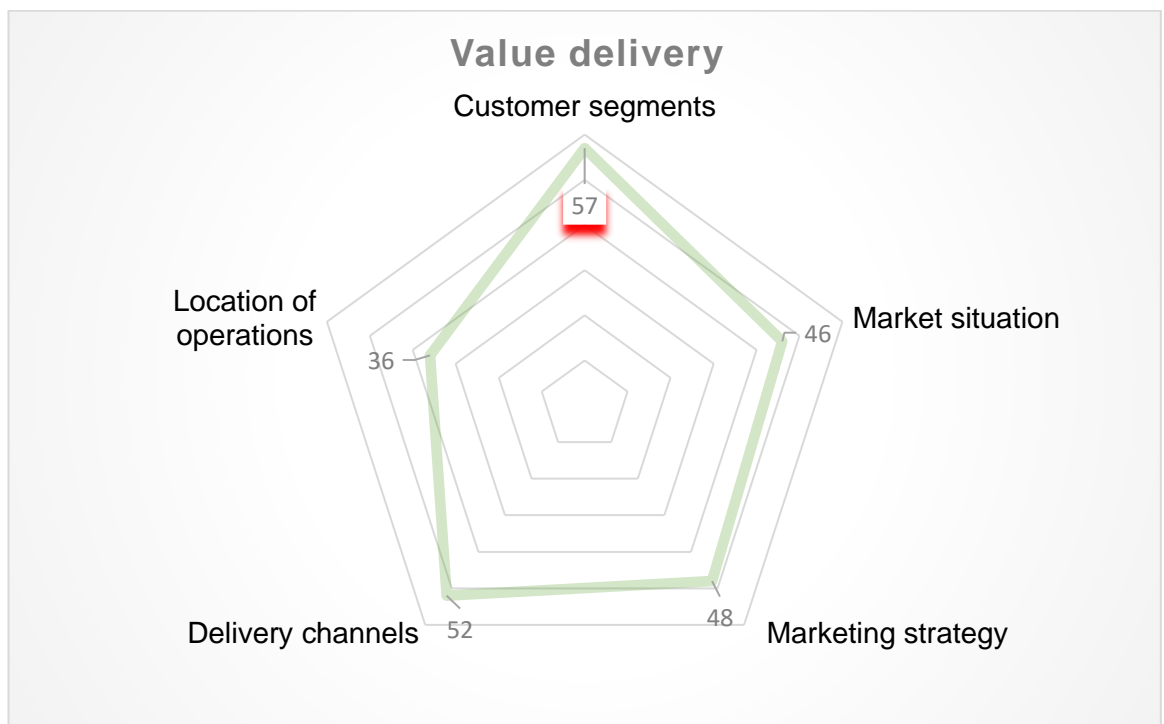


Figure 7.8. Main success factors in value delivery of Business Model

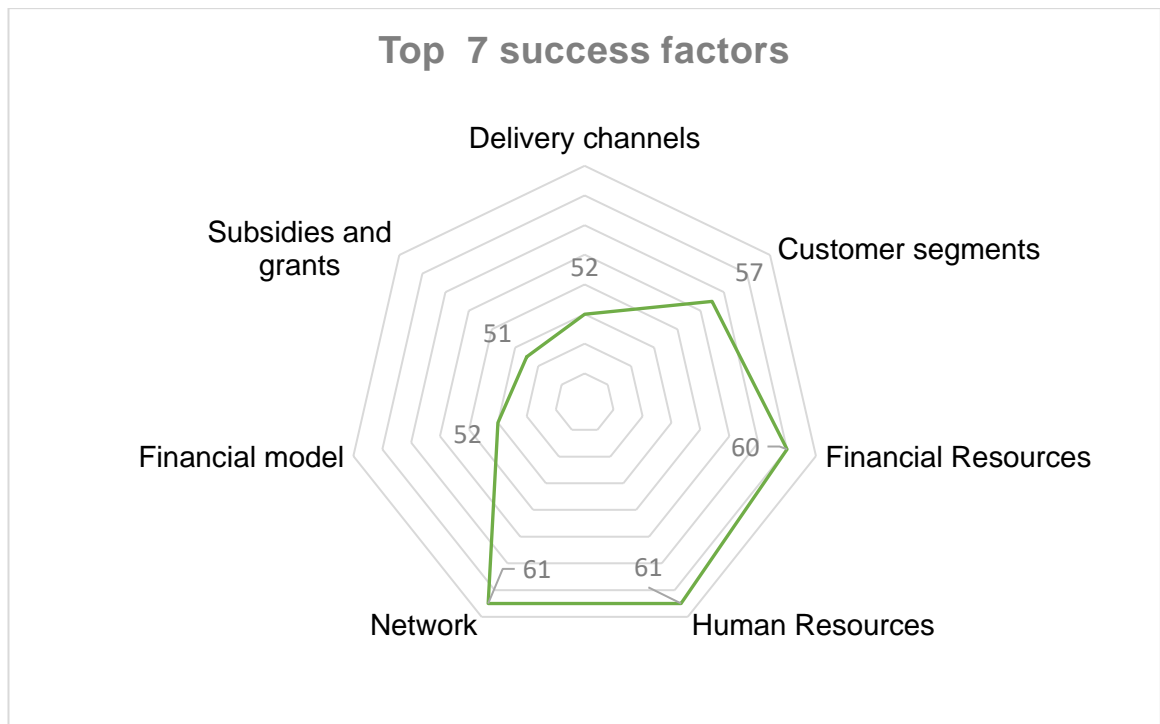


Figure 7.9. Top 7 success factors in internationalization of cleantech companies

According to our respondents, human resources and network are seen as the most important when going international. All cleantech case-companies constantly work to improve their networks, for example, by being a part of the national association – Cleantech Finland, which promotes Finnish cleantech companies and helps to establish partnerships abroad. Moreover, the best experts from both academia and the industry are put together in a strong co-operation that stems from the programmes such as Horizon 2020. The representatives of our case-companies stressed the high value of human resources, i.e. experienced and strong team, as running a business, an entrepreneur may miss some skills which should be acquired within the team to succeed. Financial resources are seen as essential success factor of effective internationalization as an immense amount of capital is required, and all our cleantech case-companies use VC funding to finance their internationalization process. Customer segments are marked as a crucial priority in expanding abroad as well. Delivery channels and financial model are considered to be less significant than above-mentioned factors, but nevertheless they are pointed by our respondents and comprise Top 7 of success factors of internationalization. Subsidies and grants are admitted being an influential factor, however it is rather controversial. From the point of view of our respondents, on one hand,

they facilitate international growth and stimulate the flow of customers, but on another hand, they cause the inequality in competition as the government supports certain sectors primary to others (for example, solar energy primarily to wind energy) which is in agreement with the previous findings (Business Finland 2018). Surprisingly, regulation and policy do not play a key role in cleantech industry. Policy may create a supportive framework as in the cases of energy market liberalization, aggressive energy saving goals for public facilities and energy certification for buildings, or may be a barrier and a hurdle for rapid internationalization as requires localization of products. At the same time, the VC firms' representatives noted that regulation might support international activities in case of preferential tax treatment.

7.5 VC firm's purpose and productivity criteria

The main research question – How do VC firms influence on business model innovation and internationalization process of Finnish cleantech companies? – is addressed by the investigation of VC firms' impact: contributions and raised opportunities after VC funding, as well as criteria of VC firm's productivity and its purposes. We have looked to these facets from different perspectives of VC investors and cleantech entrepreneurs, at the same time integrating their views in a whole picture of cleantech VC category.

Table 7.17 highlights other contributions besides capital provided by the VC case-companies. VC-5's representative separately noted that "Strategy & Exit" was one of the benefits granted by his company. At the same time, four of five respondents highlighted networks as the main contribution to the portfolio firms.

Contributions	VC-1	VC-2	VC-3	VC-4	VC-5	Total points
Expertise in industry		V	V		V	3
Networks	V	V		V	V	4
Managerial input	V			V	V	3
Marketing					V	1
Other (Strategy & Exit)					V	1

Table 7.17. VC firms' contributions besides capital

Table 7.18 summarizes the opportunities appeared after VC funding of CT case-companies. CT-3 and CT-4 stressed market/Industry related opportunities for new markets, while CT-5 pointed on strategic and financial possibilities.

“Monetary resources” are mentioned by CT-2 as the only capability of VC funding. No one of the cleantech case-companies attested the relational and technological/knowledge-based opportunities were concerned with the new customer segments and partners, and new products or services, respectively.

Opportunities	CT-1	CT-2	CT-3	CT-4	CT-5	Total points
Financial (new revenue models, price differentiation)					V	1
Relational (new customer segments, partners)						
Market/Industry related (new markets)			V	V		2
Strategic (new modes of internationalization)					V	1
Technological / knowledge-based (new products or services)						
Other (Monetary resources)		V				1

Table 7.18. Opportunities after VC funding

All the respondents expressed their opinion on the main criteria of VC firm’s productivity (Table 7.19). Performance of the VC-backed company is considered as the primary criteria of VC firms’ productivity followed by the capitalization of portfolio companies and international growth. Only one respondent (CT-3) considers that BM changes could be an appropriate criterion of VC firms’ productivity assessment.

Productivity criteria	CT-1	CT-2	CT-3	CT-4	CT-5	Points of CT firms	VC-1	VC-2	VC-3	VC-4	VC-5	Points of VC firms	Total Points
Business model changes			V			1						-	1
International growth				V		1		V	V			2	3
Performance	V				V	2	V			V	V	3	5
Capitalization		V		V		2	V			V		2	4

Table 7.19. VC firm’s productivity criteria

The respondents were asked to rank the purposes of VC firms by their importance. The results on this assessment are illustrated in Table 7.20.

Purpose	CT-1	CT-2	CT-3	CT-4	CT-5	Grades of CT firms	VC-1	VC-2	VC-3	VC-4	VC-5	Grades of VC firms	Total Grades
Receiving financial resources for exploitation of international opportunities	1	3	4	2	1	11	5	2	3	1	2	13	24
Acceleration and growth	3	1	1	1	2	8	1	3	6	3	1	14	22
Managerial input	7	5	7	5	4	28	3	6	4	2	3	18	46
Expertise in industry	2	6	2	4	3	17	4	1	7	7	8	27	44
Networks	4	2	3	3	5	17	2	5	1	4	4	16	33
Earning above-normal returns	8	7	8	9	6	38	6	7	2	8	5	28	66
Risk-sharing	5	4	5	7	7	28	7	8	5	5	6	31	59
Allocation of control rights	9	8	9	8	8	42	9	9	8	9	7	42	84
Making an impact	6	9	6	6	9	36	8	4	9	6	9	36	72
Other	10	10	10	10	10	50	10	10	10	10	10	50	100

Table 7.20. Purposes of VC firm

By the general opinion of the respondents, VC firms have the main purposes of acceleration and growth, provision of financial resources for internationalization and providing networks. All these functions refer and contribute to internationalization process. Thus, we can come to the conclusion that the impact of VC firms is highly significant for internationalization in cleantech industry, as VCs help to overcome main failure factors and contribute to the BM-specific success factors of internationalization. However, we should mention that respondents have not come to the unanimous opinion regarding managerial input of VC firms. Thus, VC firms stressed their Managerial input, while CT entrepreneurs more highly assessed the role of VC firm as an Expert in industry. This finding is aligned to the previous one that VC firms assess the innovativeness of BM changes more highly than CT entrepreneurs. Hence, the conclusion can be made that the impact of VC firm on BMI is not so meaningful, at least it is not ranked in the Top 3 of VC firm's purposes by the respondents of this study, and changes of BM, if happen, have characteristics of BM adaptation.

8 Summary and Discussion

This chapter summarizes the findings of the empirical study and presents answers to the research question and sub questions. Theoretical contribution is discussed comparing previous research with the present findings. Further on, we provide recommendations for cleantech born global companies seeking VC investment and aiming for rapid internationalization, as well as for VC firms investing in cleantech growth companies. Lastly, limitations of the study and some suggestions for future research finalize the discussion about the results.

8.1 Summary

The objective of the study was to explore the influence of VC firms on business model innovation and internationalization process of Finnish cleantech growth companies. The research question was addressed by answering sub questions in an exploratory way.

Our empirical study has been implemented among five Finnish VC firms investing in cleantech industry and having at list one cleantech company in their portfolio. Another group of our participants has been represented by five Finnish VC-backed cleantech companies on the growth stage, when they have not yet reached the target of 2 M€ turnover per year and are still considered to be start-ups or born global firms. Cleantech case-companies have their similarities and differences. They were incorporated from 2008 till 2013 and started their international activities in the first year of incorporation, or in two or four years after their foundation being born globals or International New Ventures (Oviatt & McDougall 1994). However, they differ by their internationalization stage as two of five ventures still do not have revenue from international markets (as of 02/2018), but have already established strong networks in several international markets planning sales in nearest future. All cleantech case-companies have a unique technological solution allowing for significant energy or/and resource savings in their specific sectors: Energy & resource efficiency, Bioenergy & biofuels, Energy production & distribution, Clean water technology, Marine & shipping and Smart transport & logistics.

Utilizing qualitative multiple case study and survey-based exploration we have investigated the research topic from different facets.

What are the characteristics of “clean technology” and capabilities of a cleantech company which are looked for by VC firms, and what are the preparation actions before VC approaching?

Although cleantech case-companies represent different technologies from various cleantech sectors the certain similarities have been found in the characteristics of their offerings and value propositions. They all focus on resource or/and energy efficiency thereby diminishing environmental harm and decreasing the amount of greenhouse gas emissions (Migendt 2017), and providing superior performance at lower costs (Dikeman 2018). Opposing to other science-based and knowledge-intensive industries such as biotechnology or nanotechnology (Lo & Pisano 2016) clean technologies are cost-efficient and require low capital expenditures, especially in the cases of CT-2 introducing Software-as-a-Service (SaaS) business model based on software utilizing patented big data algorithms. Thus, in controversy to Bocken (2015) environmentally friendly products can also be economical and have characteristics of ICT. Another feature of clean technologies of two of five case-companies is scalability, which is achieved by the modularity of technological solutions and their applicability in different customer segments, thus requiring less investments and enabling cost savings in running operations (e.g., CT-3).

VCs have come to the unanimous view that a scalable BM is an essential prerequisite for VC funding. In this regard we can conclude that despite the focus on sustainable value propositions investors are mostly interested in high returns and this priority guides their decisions in the choice of portfolio companies. Another significant assessment criterion is a strong management team which is appreciated by four of five VC case-companies what is inconsistent with the previous studies (Chen et al. 2016, Randjelovic et al. 2003, Fried & Hisrich 1994). Market size and market potential are discussed in the literature as determining factors of the investment decisions of VCs (Fried & Hisrich 1994, Sharma 2015). This view is reinforced by our study as two of five VC case-firms stressed market and steady cash-flow potential as playing the

crucial role in valuation process of applicants. In cases of VC-2 and VC-5 innovative profit formula is noted as one of the main capabilities of a cleantech company which is looked for by them. As only VC-2 highlights sustainable value proposition as the assessment criteria we are more likely to consider that a better business model beats a better idea or technology (Chesbrough 2007).

This inference agrees with other findings of this study regarding the primary steps before VC approaching. Thus, from both perspectives of cleantech and VC case-companies the first three actions in sequence to descending order of their importance include development of sustainable business model, preparation of strong business plan and proposing of innovative product or service.

What is the type of business model changes after VC firm involvement?

We have assessed the type of business model changes after VC firm's entrance to business on the basis of six kinds of changes derived from the strategic management literature and attributed to BM innovation or BM adaptation. Gerasymenko et al. (2015) have stated that 'substantial' business model changes are supported by VC firms; however, our findings demonstrate the opposite picture of the discussed topic. We should mention that VC firms assessed the changes of BM as more innovative than adaptive, while CT entrepreneurs stressed that BM changes after VC firm involvement had the characteristics of BMA more than BMI. Going through the cross-case analysis of cleantech case-companies we have figured out that two of five ventures had no any changes of BM after VCs entering the firm, while two of five had changes with characteristics of BM adaptation. Only one case-company, CT-4, highlighted that its changes were more novelty-oriented, high-risk and innovative, and bold and aggressive (BM innovation) rather than efficiency-oriented, low-risk and conventional, and cautious (BM adaptation). We would like to stress that the type of changes of BM was homogeneous by its nature in all three cases meaning that having the characteristics of BM adaptation in one kind of changes other ones were also adaptive. For example, CT-2 had incremental changes within a particular component of BM and gradual in different markets. At the same time the changes of its BM were characterized

by the respondent as efficiency-oriented, low-risk and conventional, and cautious in order to minimize the probability of making costly decisions (BM adaptation). This finding contradicts to the position of some researchers claiming that there seems to be a balanced mix of incremental and radical innovations (Bucherer et al. 2012; Mitchell & Coles 2004), and supports the vision that BM innovation is radical by its nature, while BM adaptation is incremental.

We consider that those VC firms that take an effort to provide managerial input have much more impact on business model changes of supported companies. Such venture capitalists usually occupy places in the board of VC-backed firms and are the leading investors during Series A funding. They may concentrate on the business model innovation as it can be translated into a sustainable performance advantage (Amit & Zott 2012).

What are the key failure and success factors influencing internationalization process in cleantech industry?

We have aimed to explore whether there are specific challenges and BM-specific success factors influencing the internationalization of Finnish cleantech growth companies.

Failure factors to internationalization were partly varying among VC and CT case-companies. Perceived business and technical risks, high transaction costs, and problems with financing were all challenges that were found to be influential in the internationalization process by all participants. We consider that high transaction costs and problems with financing are not specific to cleantech industry, and are more general in consistency with the dynamic resource-based perspective on resource constraints. However, perceived business and technical risks could be considered as cleantech specific factor, as in accordance to Andersson and Newell (2004) perceived technical risk is the most critical challenge for energy-efficiency technologies. Only three of five VC firms pointed that the lack of trust was one of the main barriers to internationalization, while two of five VC firms highlighted competitive alternative

solutions as a failure factor as well. Split regulatory incentives are also a barrier that was found to influence case-companies in the thesis but not in all cases.

Concerning the BM-specific success factors of internationalization, the conclusion of this study is that basic enablers, such as human resources and network, as well as financial resources and customer segments are the basis of successful internationalization. Delivery channels and a financial model are considered to be less significant than above-mentioned factors, but nevertheless they are pointed by our respondents and included in Top 7 of success factors of internationalization. Subsidies and grants are admitted to be an influential factor, however it is rather controversial. From the point of view of our respondents, on one hand, they facilitate international growth and stimulate the flow of customers, but on another hand, they cause the inequality in competition as the government supports certain sectors primary to others (e.g., solar energy primarily to wind energy) what is in agreement with the previous findings (Business Finland 2018).

Moreover, our study suggests that regulation and policy do not play a key role in cleantech industry which correlates to the conclusion of Brüderl and Preisendörfer (2000) arguing that 'state support' has no strong effects on start-up growth (Lee et al. 2001). The least significant factor by the opinion of our respondents is the company's ownership structure. We should admit that it is controversial to the broad range of previous studies (George et al. 2005; Lee et al. 2001; Zahra et al. 2000) and requires more exploration in the context of cleantech ventures. Another less influential factor is location of offices and operations which corresponds to the findings of Gassmann and Keupp (2007).

One more finding is that auxiliary services as a part of sustainable value proposition were assessed as having the most neutral meaning in its importance to the internationalization process. It may be explained by the fact that eco-entrepreneurial cleantech companies are often product-based (Randjelovic et al. 2003), and two of five cleantech case-companies have 100% product offerings, while CT-1 sells products with 98% of its turnover and CT-5 provides products and services in proportion of 50/50. Only CT-2 offers services as the dominant value proposition with 60% of turnover.

What are the main purposes of VC firms and their productivity criteria?

By the general opinion of the respondents, VC firms have the main purposes of acceleration and growth, provision of financial resources for internationalization and providing networks. All these functions refer and contribute to the internationalization process. The most crucial function of the VC firms by the opinion of VC case-companies is to provide financial resources for exploitation of international opportunities. This purpose is ranked on the second place by the cleantech entrepreneurs. At the same time CT case-companies highlighted that problems with financing and high transaction costs were the most serious challenges affecting the viability of internationalization process, which was consistent with the opinion of VC case-companies. These findings give us an understanding that VC firms address the challenges by helping to overcome the main barriers of expanding abroad.

Regarding another purpose of the VC firms, our analysis reveals that almost all our case-companies ranked networking as one of the primary activities of VCs. Thus, we detect that the productivity and impact of VC firms on internationalization is homogenously positive, which means that VC firms contribute significantly to the internationalization process facilitating one of the most essential success factors – networks. This finding also correlates to the perception of the opportunities appeared after VC funding. CT case-companies noticed the opportunities of new markets after involvement of the VC firms as well as new modes of internationalization and monetary resources. However, no one of the cleantech case companies noted relational opportunities concerned with the new customer segments and partners. This controversial finding should be examined further through the interview-based exploration.

We should mention that respondents have not come to the unanimous opinion regarding managerial input of VC firms. Thus, VC firms stressed their Managerial input, while CT entrepreneurs more highly assessed the role of VC firm as an Expert in industry. This finding is aligned to another one made in this study that VC firms assess the innovativeness of BM changes more highly than CT entrepreneurs. Thus, we can reach the conclusion that the impact of VC firm on BMI as a form of managerial input is not so meaningful, at least it is not

ranked in the Top 3 of VC firm's purposes by the respondents of this study, and BM changes implemented after VC funding can be characterized more as adaptation rather than innovation based on our cleantech case-companies.

As academic research suggests and our study reaffirms performance of VC-funded organization is one of the key criteria of VC firms' productivity. Albeit acceleration and growth with contribution to the internationalization process are found to be the most vital among VC firms' purposes, our study shows that the overall productivity of a VC firm is assessed by the general performance of a VC-backed firm and its market capitalization, and only after that by the international growth of a funded venture.

To summarize and answer the research question, our analysis provides the evidence consistent with Sorensen (2007), whose empirical data suggests that sorting of the best companies almost twice as important as managerial impact on the portfolio companies (for the difference in IPO rates). Thus, the selection effect dominates the value addition effect in respect of business model changes. Put simply, VC firms select Finnish cleantech growth companies with preliminary designed, tested and confirmed to be viable business model(s) without significant contribution to the business model innovation after their entrance to the company. It was supported by the mentioning scalable BM as one of the key capability of a potential portfolio company and development of sustainable business model as the key priority in VC approaching. Moreover, the type of strategic changes in cleantech case-companies was identified to be more adaptive than innovative. At the same time, the VC case-firms defended the opposed position and stressed that business model changes had the characteristics of innovation, that is why further research is required to reinforce or to oppose our conclusions.

We can conclude that the influence of VC firms is highly significant in internationalization in cleantech industry as VCs help to overcome the main failure factors and contribute to the BM-specific success factors of internationalization. VC firms facilitate rapid internationalization of born global firms through realization of their main purpose: they provide financial capital for international operations thereby tackling the key challenge of high transaction

costs. This finding is consistent with the previous research suggesting substantial financial benefits of VC in expansion abroad. Additionally, facilitating of networks is one of the most important purposes of VC firms which addresses the main success factor of internationalization. We consider partnership as the key success factor enabling rapid internationalization and performance, in general, of the cleantech growth companies in Finland, and VC firms seem to contribute to it substantially through implementation of networking - its main purpose following financing. Figure 8.1 illustrates our findings about how VC firms influence on business model innovation and internationalization process of Finnish cleantech growth companies.

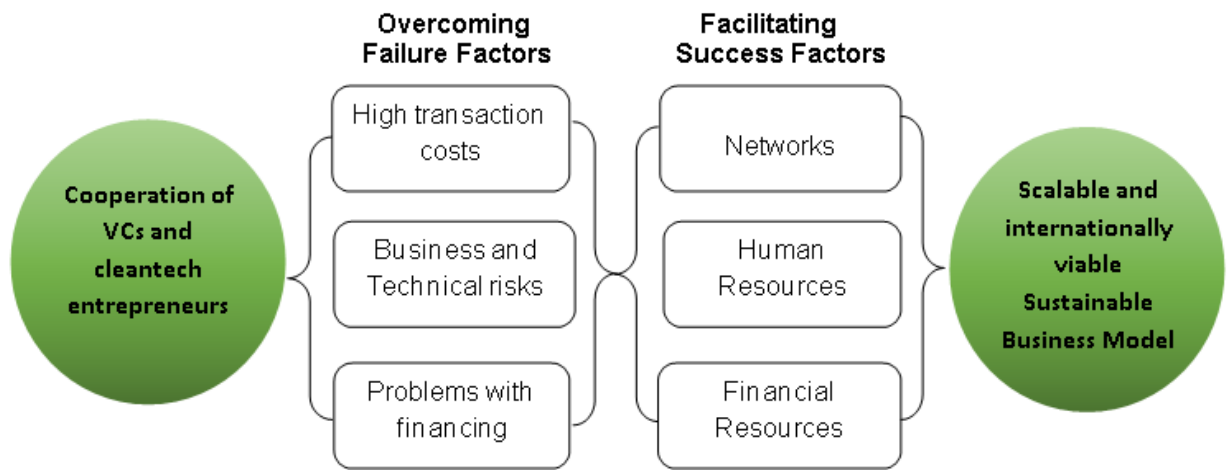


Figure 8.1. The impact of VC firms

8.2 Theoretical contribution

Since business model innovation and internationalization are seen as the critical sources of firms' success, the factors influencing business model innovation and success factors of internationalization have drawn increasing attention from academic researchers. Following this stream, our study makes several contributions to the business model innovation and internationalization literature exploring the impact of VC firms in these fields. This study contributes toward developing a model for successful internationalization framework by covering important literature in the field of business model innovation, entrepreneurial internationalization and VCs' performance. We have attempted to develop both conceptual understanding of the business model changes, and multiple case

analysis related to the VCs-entrepreneurs relationships in the context of Finnish cleantech ecosystem.

The results of our research support previous studies in the internationalization scientific literature, but contradict to the conclusions about great managerial input of VCs (Jeng & Wells 2000; MacMillan et al. 1989). More specifically, our findings highlight the essential influence of VC firms in internationalization process through providing financial capital and networking, but show the ambiguity in the assessment of VCs' managerial input and contribution to the business model innovation.

The present research contributes to the current business model literature by providing a complemented construct of business model for a cleantech company. Additionally, the proposed business model design is likely to enhance the existing institutional theory as it supplements an additional component of regulatory framework: regulation, policies, and subsidies and grants. Another academic implication from this study is that future research concerning the internationalization of firms must take into consideration the ownership type (i.e., VC involvement), as there are strong differences between how VC-backed and non VC-backed enterprises internationalize. We also have studied failure factors of the internationalization process specific for cleantech industry with the purpose to find out the influence of VC firms on overcoming these failure factors.

Our thesis contributes to the link between business model change and the degree of innovativeness (such as “incremental” vs “radical”) established in previous studies, and it is the first study which distinguishes and specifies distinctive characteristics of business model changes regarding BMI and BMA on the base of strategic management literature.

8.3 Managerial implication

We build hypotheses about the experiences of our case-companies which explain what actions should be taken in order to attract VC funding and gain sustainable advantage. Our findings can be applied as the practical tools for entrepreneurs and VCs aiming for international growth and high performance.

Finnish cleantech companies that intend to raise VC funding, and benefit of it in their international pathway, should develop sustainable and scalable business models. Before approaching VC they should focus on sustainable business model innovation with a triple bottom line (Bocken 2015), prepare strong business plan and develop a sustainable value proposition with innovative technology or service characterized by scalability, providing cost savings and requiring low capex. Entrepreneurs can find funding opportunities via their social ties and network, but the more significant factors are a generation of revenues or at least steady cash-flow potential such as developed infrastructure and market potential in a certain sector, and intellectual property rights. A strong management team is a significant factor in VCs' evaluation of a firm. The choice of a VC firm should be also appropriate in accordance to its industry expertise, network and managerial support provided.

Strategizing an innovative business model demands bold and aggressive approach to design and implementation. Novelty-oriented technologies and high-risk implementation drive new business models that are radically altering industries and commercialization. As international growth is constrained by financial capacity and perceived technological risk, more cost-efficient and low-risk technological solutions can facilitate attractiveness for investments and enable rapid expansion to different markets and customer segments. Building networks can enrich value propositions and remove resource constraints modifying business models during internationalization. Following these recommendations, Finnish cleantech growth companies can develop competitive advantage, sustain it in the face of challenges and constantly upgrade in the changing environment.

Formulating the internationalization strategy the business decision makers need to focus on all key areas, which are represented by success factors and barriers, and this strategy should concentrate on enabling success factors and battling the failure factors. This study discussed the impact of VC firms on the internationalization process and highlighted networking, the key success factor of international growth, as one of the main purposes of VCs.

Venture capitalists investing in cleantech sectors can strengthen their business model innovation capabilities through the network of their portfolio companies creating value network chains among their investees and contributing through their most valuable resource – partners in VC and cleantech industries. Through co-investments and syndication networks (Sorenson & Stuart 2001) VC firms can mitigate high transaction costs and eliminate the lack of financial resources for internationalization, which are suggested to be the most challengeable issues from both perspectives of entrepreneurs and VCs. Thus, investors should lend their funds, contacts and work with the management of portfolio companies to develop globally recognizable enterprises.

Sustainable investment should become the mainstream so that cleantech entrepreneurs could more easily find an interested investor audience (de Lange 2016).

8.4 Limitations and future research

The data analyzed in this study involve three primary limitations.

First, the choice of the case companies was spontaneous and conditioned by the availability of managers and their own desire to take part in a survey. Thus, we have a coverage of not all cleantech sectors, and no specific choice for the type VC firms as our case-companies has been made.

Second, the limitation of the findings can be explained by the lack of dependence between case companies: the studied VC firms do not have shares in the studied CT companies. Because of that fact we have no possibility to compare the perspectives of entrepreneurs and venture capitalists in the framework of one company. Hence, our conclusions are made on the basis of perspectives of ten different specialists having experience in VC and CT industries from both sides.

The third limitation of this study is that data collection for qualitative analysis was conducted in the form of digital survey without availability to clarify the meaning of the concepts in the questions and the risk of misunderstanding was high. Although we allowed a possibility to give an open answer to every

question, most of the respondents could find it more complicated to type a reply and avoided providing extensive information.

Several weaknesses of this study need to be noted. First, the multiple case study is qualitative by nature and does not provide a comprehensive picture of VC-entrepreneur relationship in all Finnish cleantech growth companies. Moreover, the data is limited by the multiple-choice options of the survey and time constraints of the participants to share the more detailed opinions on the questions discussed.

Given these limitations, further research should ideally consider revisiting the discussed topics in the form of semi-structured interviews what can give more comprehensive insights and answers to the research question.

We would like to highlight several important areas for future investigation. Because the number of the case-companies involved in this study is small, the findings need to be validated further on a larger sample. Future studies related to the above-mentioned issues could usefully utilize quantitative methodology to get the representative results and reach much more generalization.

Our research intended to cover VC firms investing in cleantech growth companies in general. Not all VCs are the same, therefore the differences between various VCs (e.g., private and corporate) as well as differences between early- and late-stage investors need to be explored. Also, our study follows only Finnish VC funds and cleantech growth companies. Bygrave and Timmons (1992) note that the nature of VC industry varies from country to country (Fried & Hisric 1994), that is why the same research can be implemented taking into consideration the peculiarities and development stage of VC investing in other countries.

We have tried to characterize the type of changes in business models of VC-backed companies after raising the venture capital, while more research is needed in other specific areas, such as which components of BM are changed, what are the reasons and outcomes of changes, what challenges exist with the current business models. As we have looked only on the VC-backed companies, another research can be done for the potential portfolio companies,

which have not yet received VC funding but planned to apply for it; it can be fruitful to assess the support of VC firms in tuning the business models before the investment decision is made. More research is required for further insights on the contribution of VC firms to the performance of portfolio companies considering managerial input in other spheres besides business model changes (e.g., management recruiting, financial governance or market capitalization of a backed venture).

Future studies could explore whether the approach to the failure and BM-specific success factors of internationalization and business model innovation differs between industries or countries, or types of organizations (e.g., SMEs).

Moreover, additional longitudinal research could be very fruitful. Longitudinal qualitative research is required to evaluate changing influences. Thus, it could make a chart of the growth companies' lifecycle and identify the critical influence of VC involvement on the various stages of the ventures' development.

Figures

- Figure 1.1. Theoretical framework of the study, p. 12
- Figure 1.2. The Company Financing Lifecycle (MaRS 2013), p. 15
- Figure 3.1. Global Venture and Growth Equity Investment in cleantech companies, 2010 – 2016 (Sworder et al. 2017), p. 29
- Figure 3.2. Major categories of clean technologies (Kachan & Fugere 2013), p. 30
- Figure 3.3. Finland's metrics in cleantech drivers (Cleantech Group 2018a), p. 34
- Figure 3.4. Indicators of Global Cleantech Innovation Index (Cleantech Group 2018c), p. 35
- Figure 3.5. Finnish cleantech clusters and areas of expertise (Tekes 2013), p. 36
- Figure 3.6. Entrepreneurial ecosystem (Mazzarol 2014), p. 38
- Figure 4.1. Business Model Canvas (Osterwalder & Pigneur 2010), p. 41
- Figure 4.2. Relationship between 3P, CSR and CS (Wempe & Kaptein 2002), p. 45
- Figure 4.3. Sustainable value (Evans et al. 2017), p. 46
- Figure 5.1. Conceptual model of the international business schools of thought (Mtigwe 2006), p. 56
- Figure 5.2. International entrepreneurship as the amalgamation of three fields (Wach & Wehrman 2014), p. 59
- Figure 5.3. Failure factors of internationalization in cleantech industry, p. 65
- Figure 6.1. Research design of this study adopted from Saunders et al. 2009, p. 78
- Figure 6.2. Database scheme showing variables and outcomes, p. 83
- Figure 7.1. Cleantech characteristics in case-companies, p. 99
- Figure 7.2. BMs and capabilities which are looked for to invest in by VC firms, p. 99
- Figure 7.3. Preparation actions before VC approaching, p. 101
- Figure 7.4. Characteristics of business model changes in case-company CT-2, p. 104
- Figure 7.5. Characteristics of business model changes in case-company CT-4, p. 105
- Figure 7.6. Characteristics of business model changes in case-company CT-5, p. 106
- Figure 7.7. Main success factors in value creation of Business Model, p. 112
- Figure 7.8. Main success factors in value delivery of Business Model, p. 112
- Figure 7.9. Top 7 success factors in internationalization of cleantech companies, p. 113
- Figure 8.1. The impact of VC firms, p. 124

Tables

Table 1.1. SME definition by the EU (European Commission 2018c), p. 14
Table 1.2. Structure of the study, p. 17
Table 3.1. Global Cleantech Innovation Index - Country Rank (Cleantech Group 2018b), p. 33
Table 4.1. Literature review on Business model elements, p. 43
Table 4.2. Business model components and their elements in cleantech industry, p. 47
Table 4.3. Characteristics of business model changes, p. 54
Table 5.1. Business model specific factors enabling internationalization, p. 70
Table 6.1. Summary of the sources of data collection, p. 79
Table 7.1. VC firms' description, p. 87
Table 7.2. The ownership of VC firms allocated between the groups (% of shares), p. 87
Table 7.3. Assessment criteria of potential portfolio companies, p. 90
Table 7.4. Cleantech companies' description, p. 91
Table 7.5. The ownership of CT firms allocated between the groups (% of shares), p. 92
Table 7.6. Characteristics of clean technology (value proposition) of cleantech case-companies, p. 98
Table 7.7. Actions before VC approaching, p. 100
Table 7.8. The kinds of changes and their characteristics in BMI and BMA, p. 101
Table 7.9. Total points on the types of changes and their characteristics, p. 102
Table 7.10. Points of VC firms on the types of changes and their characteristics, p. 103
Table 7.11. Points of CT firms on the types of changes and their characteristics, p. 103
Table 7.12. BM changes related issues in cleantech case-companies, p. 107
Table 7.13. Business model changes of cleantech case-companies, p. 108
Table 7.14. Challenges affecting the viability of cleantech firm's internationalization, p. 109
Table 7.15. Grades on the importance of BM elements in internationalization, p. 110
Table 7.16. Calculation of total number of grades on the importance of BM elements in internationalization, p. 111
Table 7.17. VC firms' contributions besides capital, p. 114
Table 7.18. Opportunities after VC funding, p. 115
Table 7.19. VC firm's productivity criteria, p. 115
Table 7.20. Purposes of VC firm, p. 116

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Appendix 1 Structured survey for VC firms

Q1 Name of the Company

Q2 Your position in the company

☐ Chairman

☐ Board Member

☐ Partner

☐ Managing Director (CEO)

☐ Investment Director

☐ Investment Manager

☐ Another key person

Q3 Areas of investments

- ☐ Finland
- ☐ Nordic countries (excluding Finland)
- ☐ Europe (excluding Nordic countries)
- ☐ North America
- ☐ South and Central America
- ☐ Africa
- ☐ Middle East
- ☐ Asia
- ☐ Australia, New Zealand and other Oceania

Q4 How is the ownership of your VC firm allocated between the following groups?

	Private equity investors	Corporate investors	Public sector
% of shares			

Q5 What sectors of cleantech industry are you investing in?

- ☐ Air quality
- ☐ Bioproducts & Materials
- ☐ Clean Water technologies
- ☐ Cleanweb & IoT
- ☐ Energy & resource efficiency
- ☐ Renewables & smart grid
- ☐ Smart transport & logistics
- ☐ Waste-to-value
- ☐ Waste Management
- ☐ Other _____

Q6 What Business Model (BM) and capabilities are you looking for to invest in?

- ☐ Scalable BM
- ☐ Software-as-a-Service (SaaS)
- ☐ Sustainable value proposition
- ☐ Innovative profit formula
- ☐ Strong management team
- ☐ Social capabilities and ties
- ☐ Other _____

Q7 How can a firm prepare before VC approaching?

Please, rank the order of options by their importance, where 1=the most important, 10=the least important.

- _____ Propose innovative product or service
- _____ Develop sustainable Business Model
- _____ Prepare strong business plan
- _____ Have social ties and network with VC firm
- _____ Have revenue records
- _____ Have patents or trademark
- _____ Have environmental or social impact
- _____ Succeed in previous investment rounds
- _____ Implement crowdfunding
- _____ Other _____

Q8 Please, assess the type of BM changes after VC firm involvement? (where "Middle" has a Neutral meaning)

	1	2	3	4	5	6	7	
Novelty-oriented	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Efficiency-oriented
Simultaneous in different markets	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Gradual in different markets
Radical within a particular component	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Incremental within a particular component
Involve Core aspects of the firm's strategy	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Involve Peripheral aspects of the firm's strategy
High-risk and innovative	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Low-risk and conventional
Bold and aggressive in order to maximize the probability of exploiting potential opportunities	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Cautious in order to minimize the probability of making costly decisions

Q9 What criteria is the main for you to assess the productivity of VC firm?

- ☐ Business model changes in VC-backed firm
- ☐ International growth of VC-backed firm
- ☐ Performance of VC-backed firm
- ☐ Capitalization of VC-backed firm
- ☐ Other _____

Q10 What do you offer besides capital?

- ☐ Expertise in industry
- ☐ Networks
- ☐ Managerial input
- ☐ Marketing
- ☐ Other _____

Q11 What is VC firm for?

Please, rank the order of purposes by their importance, where 1=the most important, 10=the least important.

- _____ Receiving financial resources for exploitation of international opportunities
- _____ Acceleration and growing
- _____ Managerial input
- _____ Expertise in industry
- _____ Networks
- _____ Earning above-normal returns
- _____ Risk-sharing
- _____ Allocation of control rights
- _____ Making an impact
- _____ Other _____

Q12 How do policy and regulation affect the internationalization process?

- ☐ Aggressive energy saving goals for public facilities - Supportive policy framework
- ☐ Energy certification for buildings - Supportive policy
- ☐ Energy market liberalization - Supportive policy
- ☐ Preferential tax treatment - Supportive regulation
- ☐ Other _____

Q13 How do subsidies and grants affect the internationalization process?

- ☐ Subsidies and grants facilitate international growth
- ☐ The incentives stimulate the flow of customers
- ☐ Governmental support to certain sectors causes the inequality in competition (e.g., solar energy primarily to wind energy)
- ☐ Other _____

Q14 What are the main 3 challenges (failure factors) affecting the viability of internationalization?

☐ Competitive alternative solutions

☐ Problems with financing

☐ High transaction costs

☐ Split incentives

☐ Perceived business and technical risks

☐ Lack of trust

☐ Other _____

Q15 Please, rank the following list on their importance in internationalization process of a company (where 1 = the least important, 7 = the most important)

	1	2	3	4	5	6	7
Clean technology type	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Auxiliary Services	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Differentiation of offering	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Customers segments	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Market conditions (growth rate, competition)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Marketing strategy	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Delivery channels	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Location of offices and operations	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Company's ownership structure	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Financial Resources	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Human Resources	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Knowledge and know-how (patents)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Network (partners)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Financial model (revenue and cost structure)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Policies (Visions, Plans)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Regulation (taxation and incentives) in the target markets	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Subsidies and grants	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Other	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Other	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Other	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Appendix 2 Structured survey for CT companies

Q1 Name of the Company

Q2 Your position in the company

☐ Managing director

☐ Founder

☐ Partner

☐ Another key person

Q3 Number of employees

☐ < 10

☐ < 50

☐ < 250

☐ 250 and more

Q4 Turnover in euros

☐ ≤ € 2 m

☐ ≤ € 10 m

☐ ≤ € 50 m

☐ more than 50 m

Q5 Year of first international activities

Q6 What was the first country you had international activity in?

Q7 What is the share of international sales in your turnover?

0 10 20 30 40 50 60 70 80 90 100



Q8 The type of sales

	Products	Services
% of turnover		

Q9 The type of exports or other operations the company has (Internationalization Strategy):

☐ Direct exporting

☐ Licensing or franchising

☐ Contract manufacturing

☐ Foreign joint venture or subsidiary

☐ Representatives (Agents or Distributors)

☐ Other _____

Q10 How is the ownership of your company allocated between the following groups?

	Founders/directors	Private investors	Corporate investors	Public sector
% of shares				

Q11 The main specialization of your company

- ☐ Air quality
- ☐ Bioproducts & Materials
- ☐ Clean water technology
- ☐ Bioenergy & biofuels
- ☐ Combined heat and power (CHP) & District heating and cooling (DHC)
- ☐ Energy production & distribution
- ☐ Energy & resource efficiency
- ☐ High-performance buildings
- ☐ Marine & shipping
- ☐ Wind energy
- ☐ Solar energy
- ☐ Smart transport & logistics
- ☐ Recycling
- ☐ Waste Management

- ☐ Waste-to-energy
- ☐ Cleanweb & IoT
- ☐ Other _____

Q12 Which unique characteristics does your clean technology (value proposition) have?

- ☐ Capital intensity
- ☐ Low capex
- ☐ Scalability
- ☐ Resource efficiency
- ☐ Energy efficiency
- ☐ Cost savings
- ☐ Increased property value
- ☐ Renewed equipment
- ☐ Simplified reporting
- ☐ Improved image of the organization
- ☐ Sustainability (diminished environmental harm)
- ☐ Intellectual property licensing
- ☐ Other _____

Q13 What should a firm prepare before VC approaching?

Please, rank the order of options by their importance, where 1=the most important, 10=the least important.

- _____ Propose innovative product or service
- _____ Develop sustainable Business Model
- _____ Prepare strong business plan
- _____ Have social ties and network with VC firm
- _____ Have revenue records
- _____ Have patents or trademark
- _____ Have environmental or social impact
- _____ Succeed in previous investment rounds
- _____ Implement crowdfunding
- _____ Other _____

Q14 Who are your partners in internationalization process?

- ☐ Shareholders
- ☐ Investors
- ☐ Subsidiaries
- ☐ Suppliers
- ☐ Utility and network operators
- ☐ Third party financiers (banks, insurance companies, etc.)
- ☐ Export agents
- ☐ Strategic alliances
- ☐ Guarantee agencies
- ☐ Public authorities
- ☐ Governmental agencies
- ☐ Other _____

Q15 How do you finance your internationalization process?

☐ VC funding

☐ Second/third party financing

☐ Long term contracts

☐ Subcontracting

☐ Other _____

Q16 Please, assess the type of Business Model changes after VC firm involvement?
(where "Middle" has a Neutral meaning)

	1	2	3	4	5	6	7	
Novelty-oriented	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Efficiency-oriented
Simultaneous in different markets	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Gradual in different markets
Radical within a particular component	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Incremental within a particular component
Involve Core aspects of the firm's strategy	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Involve Peripheral aspects of the firm's strategy
High-risk and innovative	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Low-risk and conventional
Bold and aggressive in order to maximize the probability of exploiting potential opportunities	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Cautious in order to minimize the probability of making costly decisions

Q17 How did your Business Model change over the time (at what stages and what components)?

- ☐ Start-up (value proposition)
- ☐ VC funding (administrative techniques, marketing strategy, etc.)
- ☐ Entering new markets (changes in product or service lines)
- ☐ Other _____

Q18 What activities have you taken in order to change your Business Model?

- ☐ Adapting to regulations
- ☐ Launching new products or services
- ☐ Addressing new, unmet customer needs
- ☐ Expanding operations to new industry sectors
- ☐ Expanding to new markets
- ☐ Expanding to new customer segments
- ☐ Utilizing new distribution channels
- ☐ Strengthening customer relationships and retention (e.g., CRM)
- ☐ Receiving investments
- ☐ Receiving subsidy or grant
- ☐ Strengthening management team
- ☐ Implementing HR training and learning
- ☐ Building new partnerships

- ☐ Developing new revenue opportunities (e.g., additional sales, cross-selling)
- ☐ Integrating services for long term financial returns (e.g., maintenance contract, leasing)
- ☐ Utilizing price differentiation strategy
- ☐ Implementing price-quantity strategy
- ☐ Saving manufacturing costs
- ☐ Saving transaction costs
- ☐ Other _____

Q19 What were the outcomes of changes in Business Model?

- ☐ International growth
- ☐ Improved performance
- ☐ Cost reduction
- ☐ Innovativeness
- ☐ Other _____

Q20 What challenges do you see for your further international growth with the Business Model(s) you have today?

- ☐ Institutional (policy & regulation)
- ☐ Relational (customers, partners, competitors)
- ☐ Organizational (resources, skills and capabilities within the company)
- ☐ Technological / knowledge-based (differentiation of offering)
- ☐ Other _____

Q21 What opportunities have you seen after VC funding?

- ☐ Financial (new revenue models, price differentiation)
- ☐ Relational (new customer segments, partners)
- ☐ Market/Industry related (new markets)
- ☐ Strategic (new modes of internationalization)
- ☐ Technological / knowledge-based (new products or services)
- ☐ Other _____

Q22 What is VC firm for?

Please, rank the order of purposes by their importance, where 1=the most important, 10=the least important.

- _____ Receiving financial resources for exploitation of international opportunities
- _____ Acceleration and growing
- _____ Managerial input
- _____ Expertise in industry
- _____ Networks
- _____ Earning above-normal returns
- _____ Risk-sharing
- _____ Allocation of control rights
- _____ Making an impact
- _____ Other _____

Q23 What criteria is the main for you to assess the productivity of VC firm?

- ☐ Business model changes in VC-backed firm
- ☐ International growth of VC-backed firm
- ☐ Performance of VC-backed firm
- ☐ Capitalization of VC-backed firm
- ☐ Other _____

Q24 How do policy and regulation affect the internationalization process in your sector of cleantech industry?

- ☐ Aggressive energy saving goals for public facilities - Supportive policy framework
- ☐ Energy certification for buildings - Supportive policy framework
- ☐ Preferential tax treatment - Supportive policy framework
- ☐ Other _____

Q25 How do subsidies and grants affect the internationalization process?

- ☐ Subsidies and grants facilitate international growth
- ☐ The incentives stimulate the flow of customers
- ☐ Governmental support to certain sectors cause the inequality in competition (e.g., solar energy primarily to wind energy)
- ☐ Other _____

Q26 What are the main 3 challenges (failure factors) affecting the viability of internationalization? (Your company's specific experience)

- ☐ Competitive alternative solutions
- ☐ Problems with financing
- ☐ High transaction costs
- ☐ Split incentives
- ☐ Perceived business and technical risks
- ☐ Lack of trust
- ☐ Other _____

Q27 Please, rank the following list on their importance in internationalization process of a company (where 1 = the least important, 7 = the most important)

	1	2	3	4	5	6	7
Clean technology type	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Auxiliary Services	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Differentiation of offering	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Customers segments	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Market conditions (growth rate, competition)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Marketing strategy	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Delivery channels	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Location of offices and operations	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Company's ownership structure	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Financial Resources	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Human Resources	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Knowledge and know-how (patents)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Network (partners)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Financial model (revenue and cost structure)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Policies (Visions, Plans)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Regulation (taxation and incentives) in the target markets	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Subsidies and grants	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Other	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Other	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Other	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>