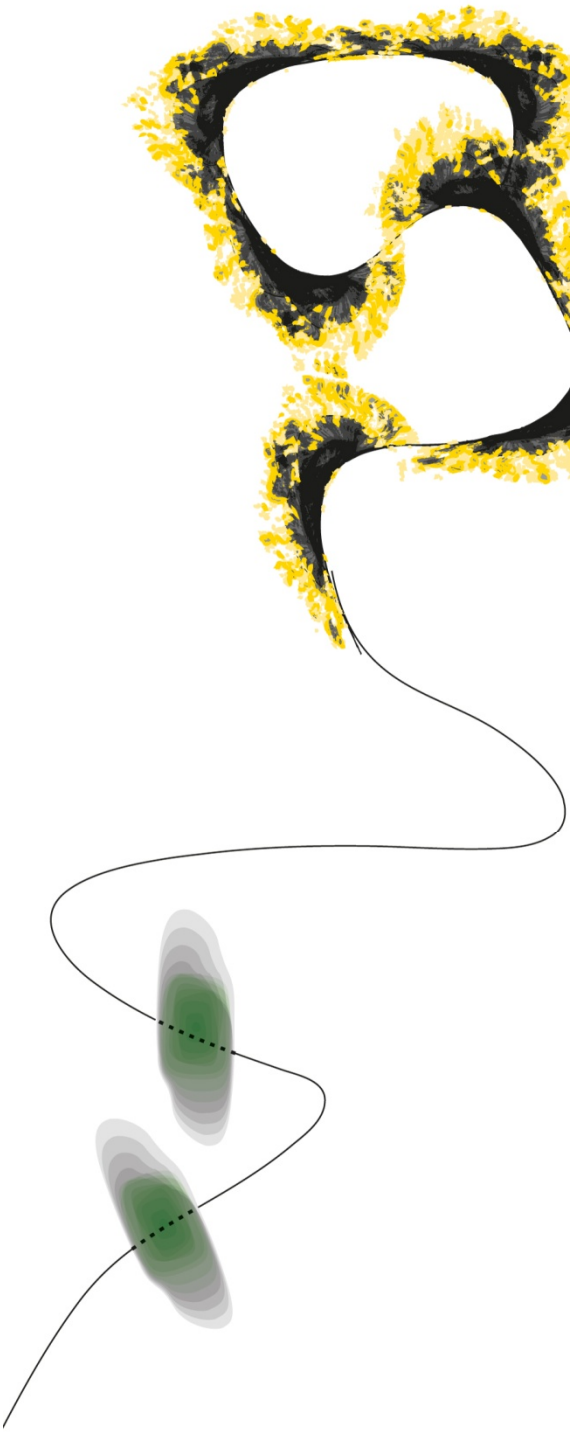
Master Thesis



ENTREPRENEURIAL PROCESSES AND LEARNING IN HIGH TECH START-UP BUSINESSES

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Entrepreneurial processes and learning in high tech start-up businesses

How entrepreneurs learn while creating a new venture in different perceived environments

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Preface

This thesis is submitted to the faculty of Management and Governance of the University of Twente, in fulfilment of the requirements for the degree of Master of Science in Business Administration, with a specialization in Innovation and Entrepreneurship.

"The best way to predict the future is to create it" - unknown

This quote reminds me of my travels in the years prior to my university course. These travels thought me to be positive and to be creative to solve all kinds of problems along the way. In turn these travels have been the inspiration for my study and in the end for writing this master thesis. The way forward, I believe, is through innovation. This innovation is driven by ideas of people, putting opportunity into practise by creating new businesses and learning along the way. Given this argument the choice of study, Innovation and Entrepreneurship, is logical. It also gives an insight in why I performed my master thesis as I did. My thesis connects entrepreneurial processes with learning during these processes. Effectuation as an entrepreneurial process is about creating the future versus causation as an entrepreneurial process which is about predicting the future. These processes relate back to the quote, which reminded me of the importance and relevance of this research.

I would like to take this opportunity to acknowledge the contribution of people around me to the final result of my master thesis. In general, friends, family and roommates who are showing interest in my research, providing me with feedback, interesting insights and discussion were all very helpful. In particular I would like to thank Mr. J.D. Stegeman Msc for offering me a place to stay while collecting my data, keeping me motivated and being a good friend. My appreciation also goes out to Mr. G. Overweg and Mr. L. Krebbers for the fruitful discussions, reviews and insights from other research fields. And I thank my parents for their inspiration, motivation and unconditional support.

Finally, I thank my first supervisor Mr. M.R. Stienstra Msc. for his guidance, quick responses to questions, offering help and thorough feedback. The discussions and feedback helped me to gain useful insights and a structured process for completion of this thesis. Additionally, I thank the 22 entrepreneurs for the YES!Delft incubators who took the time and interest by participating in this research.

Without these people I would not have been able to conduct and complete my research.

Steven Lennard Mannes,

November, 2013, Enschede

Summary

The central concepts in this master thesis are entrepreneurial processes and entrepreneurial learning. The objective is to see how entrepreneurs go from an idea to an actual venture. When an opportunity is recognised it is argued that an entrepreneur can create a new venture by going through the entrepreneurial process. The processes are presented as effectuation and causation (Sarasvathy, 2001). It is argued that not the low wage economies, but instead the other high knowledge economies are the biggest threat to our economies. Therefore, learning is essential to create a competitive advantage. Learning during the entrepreneurial process is referred to as entrepreneurial learning (Politis, 2005). Entrepreneurial learning in itself is also a process of transforming experience into knowledge. This transformation can be facilitated by either exploration of new products, markets or opportunities or by exploitation of current products by refinement and incremental innovation (March, 1991).

Effectuation and exploration are concepts with similar characteristics and therefore it is argued that these concepts are related to each other. In contrast, causation and exploitation also share similar characteristics and are therefore related to each other. Research is performed by asking technological start up companies how they start up the companies and how they learn, while going to the process. Additionally, environmental dynamism, hostility and heterogeneity are believed to influence these relationships which are also investigated.

The main research method was a qualitative measurement instrument. Through a process of thinking aloud a business case was solved, making cognitive processes such as causation and effectuation measurable. This qualitative measurement is supported by a quantitative measurement instrument. A questionnaire was completed to measure causation and effectuation quantitatively, to measure entrepreneurial learning and to measure the external environmental components.

The results indicate that these concepts are indeed related to each other to some degree, but that these relationships are quite complex. Significant relationships have been found between antecedents of the entrepreneurial processes and learning. However, support for the hypotheses is limited. The expected relationships between antecedents of effectuation and entrepreneurial learning are all different from the relationships found in this research, rejecting H1a – H1d. The results for hypotheses H1e and H2 are in line with the expectations, but are not significant. Additional t-tests showed the same result, rejecting these hypotheses as well. Finally, the influence of the environment was hypothesised. The analysis produced a significant influence of heterogeneity on the relationship between effectuation and entrepreneurial learning. Hostility also influences the relationship, but these influences were not great enough to be statistical significant.

The outcomes in combination with the limitations provide fruitful avenues for further research. A large quantitative research could investigate the relationship of entrepreneurial processes and learning during this process with greater statistical power. A qualitative study where both entrepreneurial processes and entrepreneurial learning are measured using a similar think aloud business case could provide more in-depth insights into these relationships.

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1. Introduction

The first chapter introduces the general area of this study, entrepreneurship. To maintain the originality value the entrepreneurship concept is discussed in the introduction of the thesis, because other master theses in similar settings already explain the concept thoroughly (see for example: Drecker, 2012; Ham van den, 2012; Krijgsman, 2012). After the theoretical background the objectives and purpose of this research are presented, followed by an introduction of the research design and strategy.

1.1 Theoretical background

1.1.1 Entrepreneurship in general

Entrepreneurship is becoming increasingly important. Over the past decades entrepreneurship has been an emerging and growing field of research. The field of entrepreneurship emerged as one of the most vital, dynamic and relevant in the social sciences (Wiklund et al., 2011). Entrepreneurship is important, because it is considered the engine behind innovation, job creation, productivity growth and economic growth (Van Praag & Versloot, 2007). Sarasvathy argues: “Business all over the world is becoming more free-market oriented and more entrepreneurial” (Sarasvathy, 2001, p. 244). In addition, it is argued that entrepreneurship should be studied, because entrepreneurship can be used to translate technology into products and services, entrepreneurship can be used to discover and improve inefficiencies in an economy and entrepreneurship can be the driver behind the change process of product and process innovation (Shane & Venkataraman, 2000). Bull and Willard (1993) grouped the different streams of entrepreneurship research under: focus on definition, traits, success strategies, formation of new ventures and the effects of environmental factors.

Defining entrepreneurship proved to be difficult in previous scientific literature, with many different perspectives and opinions. For example, Gartner (1990) conducted research on how to define entrepreneurship by asking academic specialists, business leaders and politicians for their definition on entrepreneurship. None of the participants in his research agreed on a single definition. Gartner (1990) found that entrepreneurship was divided in two streams. One stream focusing on the characteristics (traits) of the entrepreneur and the other on value creation. The debate about the traits and characteristics of the entrepreneur has largely been abandoned, because no ‘typical’ entrepreneur exists (Bull & Willard, 1993). Instead, entrepreneurship is seen as a dynamic process. For example, Bruyat & Julien (2001) define entrepreneurship as a dynamic between the entrepreneur and new value creation. However, the definition of the field of entrepreneurship developed by Shane & Venkataraman (2000, p. 218) is adopted in this research: “the scholarly examination of how, by whom, and with what effects opportunities to create future goods and services are discovered, evaluated, and exploited”. This definition is often encountered in other articles, conceptual and empirical, in entrepreneurial literature. Additionally, Shane & Venkataraman are closely related to the theories used in this research.

Several elements are found in the definition by Shane & Venkataraman (2000), such as sources of opportunities, discovering, evaluating and exploiting opportunities, and the entrepreneur who goes through the process of doing so. In short; the view of the entrepreneur which is essential in exploring, discovering and exploiting opportunities is adopted. In this view entrepreneurship involves the nexus of the presence of entrepreneurial

opportunities and an enterprising individual (Shane & Venkataraman, 2000). Sarasvathy (2008, p. 9) mentions it as "[...] putting [the] entrepreneur (person) and market (opportunity) together in interesting ways".

1.1.2 Entrepreneurship and opportunities

In general, opportunities can be defined as: "a perceived means of generating economic value (i.e., profit) that previously has not been exploited and is not currently being exploited by others" (Baron, 2006, p. 107). In turn, Baron (2006, p. 107) defines opportunity recognition as: "the cognitive process (or processes) through which individuals conclude that they have identified an opportunity". More specifically, Casson (1982) developed a widely used definition for entrepreneurial opportunities: "Entrepreneurial opportunities are those situations in which new goods, services, raw materials, and organizing methods can be introduced and sold at greater than their cost of production" (as cited by Sarasvathy, 2008, p. 175; Shane & Venkataraman, 2000, p. 220). Thus, entrepreneurial opportunities entail the discovery of new means-end relationships. A discovery occurs when certain resources are put to best use by an entrepreneur. These resources should be interpreted differently by each entrepreneur, because else no opportunity would exist. If entrepreneurs hold the same believes over every resources there would not be an option to make a profit, resulting in a loss of an incentive to pursue an opportunity (Shane & Venkataraman, 2000). This theory is referred to by Alvarez & Barney (2007) as discovery theory or metaphorically speaking, mountain climbing. In contrast of existing opportunities waiting to be exploited (climbing an already existing mountain), mountains could be created. This implies that besides discovering existing opportunities; opportunities can also be created by entrepreneurs. Alvarez & Barney (2007) argue that through a process of learning opportunities can be created.

More specifically, Sarasvathy et al. (2003) identify three ways of how opportunities come into existence, through recognition, discovery and creation, which are in turn depended on the conditions of uncertainty. It is important to note that uncertainty is not the same as risk. In a risky situation the probability distribution is known so the probability of certain events happening can be calculated. In an uncertain situation the probability distribution is unknown (or even unknowable with a non-existent distribution) and probability of certain events happening cannot be calculated, only estimated (Sarasvathy, 2001; Sarasvathy et al., 2003; Sarasvathy, 2008). Opportunities are recognised when supply and demand are brought together and match-up. An opportunity is discovered when either demand of supply is absent and the other side is discovered so demand and supply can match up again. In the creation view, the demand side and the supply side do not exist and opportunities have to be created (Sarasvathy et al., 2003).

The discovery of opportunities goes through the possession of prior information and the right cognitive frameworks. With the right stock of information in combination with the right cognitive map the entrepreneur can discover new means-end relationships (Shane & Venkataraman, 2000). Baron (2006) refers to this process as 'connecting the dots'. In addition to the prior information, Baron (2006) identified two other important factors for discovering opportunities: active search and alertness. In contrast to discovery theory, creation theory argues that entrepreneurs act and observe how other people and markets react on their actions. Therefore, creation theory suggests that the origin of an opportunity can also lie outside existing markets. Instead of searching to discover opportunities, in creation theory opportunities are generated through a process of learning (Alvarez & Barney, 2007).

The nature of the opportunities and individual differences between entrepreneurs are the reasons why, when and how some people and not others exploit opportunities which they have discovered. The nature of the opportunity involves the expected value of an opportunity which influences the willingness and believes of the entrepreneur to pursue that opportunity. The individual differences are several influential factors such as: opportunity costs, perception, optimism, individual with greater self-efficacy, more internal locus of control, greater tolerance for ambiguity and who have a strong need for achievement (Shane & Venkataraman, 2000). Sarasvathy (2008) argues that people become entrepreneurs in different ways such as: habitual (in the nature of the person), necessity (for example when a person gets fired from a job), incentivized (for example government subsidies), celebrity, social (for example to make the world a better place).

In the definition of entrepreneurship the concept is presented as a dynamic between a person and opportunities. This implies that venture creation is not a necessary condition for entrepreneurship, although the concept is often associated with it. When opportunities are exploited it is often through newly established institutions, but opportunities can also be sold or even pursued in existing organisations. When an entrepreneur is already exploiting an opportunity, the entrepreneur can explore and discover (or create) new opportunities and exploit those within the existing organisation or decide to set up a new venture specifically for that particular opportunity. Therefore, entrepreneurship does not necessary entail new venture creation (Shane & Venkataraman, 2000; Shane, 2012).

1.1.3 Entrepreneurship as a dynamic process

In sum, entrepreneurship is seen as a process and not as certain traits or characteristics that make an individual an entrepreneur (Bruyat & Julien, 2001; Bull & Willard, 1993; Shane, 2012). The dynamic between the entrepreneur (person) and the opportunities that are recognised, discovered and created is the entrepreneurial process, which is defined as: “[...] all the functions, activities, and actions associated with the perceiving of opportunities and the creation of organizations to pursue them” (Bygrave & Hofer, 1991, p. 14). Moroz & Hindle (2011) reviewed entrepreneurial process models to find one generic yet distinct model. They reviewed 32 models and found 4 models which showed shared entrepreneurial characteristics (generic) and some entrepreneurial characteristics which are unique (distinct). These models are the emergence perspective by Gartner (1985), the value creation perspective by Bruyat & Julien (2001), the creative process perspective (effectuation) by Sarasvathy (2001), and the opportunity discovery perspective (causation) by Shane (2003) (as cited by Moroz & Hindle, 2011). Moroz & Hindle (2011) favour the effectuation and causation models over the other two models, because the emergence perspective does not include innovation and temporality, and includes the necessity of new venture creation. Bruyat & Julien’s model is considered too simplistic by Moroz & Hindle (2011). In addition, Steyaert (2007, p. 470) concludes that the concept of the entrepreneurial process is going towards a “social ontology of becoming”, which entails a creative process view of entrepreneurship such as effectuation.

The way entrepreneurial decision making is understood has been based on rational decision models (Perry et al., 2011). Rational decision models imply the assumption of goal driven behaviours in exploring and exploiting opportunities. These decision models are referred to as causation (Sarasvathy, 2001). In contrast to the rational decision models, Sarasvathy (2001) argues that entrepreneurial decisions are also made using an effectual logic, which is a means driven model instead of a goal driven model. This new model of entrepreneurial

decision making (effectuation) is gaining attention in the entrepreneurial literature (Perry et al., 2011). When the entrepreneur learns during the entrepreneurial process, this is referred to as entrepreneurial learning. The way entrepreneurs learn is believed to be influenced by the predominant logic of the entrepreneur (Politis, 2005; Ravasi & Turati, 2005). The concepts of causation and effectuation are more thoroughly discussed as entrepreneurial processes in the literature review.

1.1.4 Entrepreneurship from a learning perspective

In order for an entrepreneur to recognise, discover and create opportunities it is important to learn. Alvarez & Barney (2007) argue that through a process of learning opportunities can be created. Harrison & Leitch (2005) argue that leaning is important, because it can provide individuals with a competitive advantage. In addition, Franco & Haase (2009) argue that the highly educated economies are a bigger economic threat than the low-wage economies. Entrepreneurs are often challenged by the external environment, not only by globalisation but also by their liability of newness (Van Gelderen et al., 2005; Politis, 2005).

Entrepreneurial learning has emerged as a concept at the interface of entrepreneurship and organisational learning (Wang & Chugh, 2013). Organisational learning has largely focused on large corporations (Politis, 2005). Entrepreneurial learning is similar to organisational learning, but more specific for individuals in smaller organisations (for example start-ups) instead of large established organisations. Politis (2005, p. 401) defines entrepreneurial learning as: "[...] a continuous process that facilitates the development of necessary knowledge for being effective in starting up and managing new ventures". Entrepreneurial learning is an experiential learning process (learning by doing), which takes place during the entrepreneurial process. It entails a learning process of transforming experience into knowledge (Politis, 2005). This transformation can be classified into two different modes: exploration and exploitation (March, 1991). The way entrepreneurs learn (by exploring or exploiting) is expected to be influenced by the predominant logic of entrepreneurs (Politis, 2005). Exploration and exploitation are thoroughly discussed in the literature review as modes of entrepreneurial learning.

1.1.5 Entrepreneurship and the external environment

Finally, external environmental factors are used to explain entrepreneurship (Bull & Willard, 1993). Both the entrepreneurial processes and entrepreneurial learning are believed to be influenced by external environment factors (Bierly & Daly, 2007; March, 1991; Sarasvathy, 2001), but more research is required. Entrepreneurs often operate in environments subjected to change, complexity, and hostility (Van Gelderen et al., 2005). The exploitation of entrepreneurial opportunities is dependent on environmental factors which provide the incentive for the entrepreneur (Cuervo, 2005). Therefore, entrepreneurial firms are often found in dynamic and hostile environments (Miller & Friesen, 1982). Dynamism in an environment is about how fast the environment changes and how unpredictable that environment changes (Miller & Friesen, 1982). Hostility is a constant threat to organisation, such as competition and technological renewal (Covin et al., 1999). In addition to these external influences, the heterogeneity of the environment also influences the behaviour of entrepreneurs and the opportunities that they recognise, discover or create. Environmental heterogeneity is characterised by the amount of different unrelated markets an organisation is active in (Miller & Friesen, 1982).

1.2 Purpose and objectives

Effectuation literature is mainly conceptual and has been linked to few other constructs such as over thrusting, creative imagination and entrepreneurial expertise (Perry et al., 2011). Although the empirical literature supporting the conceptual literature is growing, it does not yet relate effectuation to entrepreneurial learning. Politis (2005) proposes that the predominant logic of the entrepreneur could have an influence on how entrepreneurs transform experience into knowledge and calls for empirical support to back this proposition. In turn, entrepreneurship in general and entrepreneurial processes in particular have been related to theories of learning. Minniti and Bygrave (2001) argue that entrepreneurship is a process of learning, and a theory of entrepreneurship requires a theory of learning. Entrepreneurship is not only about what entrepreneurs should learn, but also about how and when learning occurs. This is regarded fundamental to understanding the entrepreneurial process (Wang & Chugh, 2013). So far, entrepreneurial learning has been mainly related to opportunity recognition, discovery and exploitation (Wang & Chugh, 2013). For instance Corbett (2005) relates experiential learning to the process of opportunity recognition. This indicates that entrepreneurial learning has been related to more rational and planned behaviour, but not yet to a more effectual approach.

The purpose of this research is to find out if entrepreneurial learning has a relationship with effectuation and similar to Sarasvathy (2001) causation is presented as dichotomous. It will explain how effectual entrepreneurs transform their experience into knowledge, either through explorative learning or exploitative learning. This will fill a gap in literature between opportunity recognition, discovery and creation, and learning. As is suggested by Alvarez & Barney (2007), in creation theory opportunities are generated through a process of learning. In addition, Moroz & Hindle (2011, p. 811) argue that the context in which the entrepreneurial process takes place is important: "[...] context really matters: an entrepreneurial process can never be abstracted from its contextual setting; an overt commitment to understanding context must always be an integral part of appropriate process". Therefore, environmental dynamism, hostility and heterogeneity are believed to moderate the relationships, which in turn are explained more thoroughly in the literature review.

In order to achieve the objective of this research the following research question is drafted:

> ***"To which extent are effectuation and causation related to entrepreneurial learning modes and to which extent are these moderated by external environmental components?"***

This question is answered by describing and explaining the different concepts of entrepreneurial processes, entrepreneurial learning and external environmental components. Next, these concepts will be linked together from which more specific hypotheses are derived. These hypotheses are then accepted or rejected based on the statistical results and an interpretation is given in the final section of this thesis.

1.3 Research design and strategy

The design of this research has a cross sectional exploratory nature. The relationships between the entrepreneurial processes effectuation and causation, and the transformation of experience into knowledge through exploration and exploitation are investigated simultaneously. In addition, these relationships are tested under conditions of different external environmental influences. The associations between the variables could be

explanatory, but should be interpreted with caution, because association does not represent a causal relationship. Third variables under the non-spuriousness criterion for nomothetic causality might be present (Babbie, 2009). These variables will not be all included, due to available time, financial funds and scope of this research.

In order to explore the mentioned relationship, empirical research is done qualitatively and quantitatively. Verbal protocol analysis is used to measure effectuation and causation (Ericsson & Simon, 1981). More specifically, a think aloud method is used (Van Someren et al., 1994). This same method has been used by Sarasvathy (2001, 2008) to research effectuation. The think aloud methodology entails a business case which has to be solved verbally and is recorded. When the entrepreneur thinks aloud when solving the business case the cognitive process of this entrepreneur can be measured. The qualitative method is supported by the quantitative part of the study which is performed by a survey. Additionally, entrepreneurial learning and the external environment are not measured qualitatively. Therefore, a questionnaire with validated likert type items is used to measure the entrepreneurial processes, entrepreneurial learning and the external environmental variables. The items are taken from existing empirical literature, which tested the items for both reliability and validity. The items and the literature can be found in the methodology section. After the measurement the likert type items are competed into likert scales.

The focus in this study is on high-tech and full time entrepreneurs. Previous similar master theses already focused on novice student entrepreneurs (Drecker, 2012; Ham van den, 2012; Krijgsman, 2012). Entrepreneurs from the YES!Delft business incubator were asked to participate in this research. The incubator is linked to the Technological University Delft. This group of entrepreneurs represent entrepreneurship in combination with technological knowledge, which has been developed through a process of learning.

The thesis is structured as follows. The second chapter contains a literature review on the entrepreneurial processes of effectuation and causation, entrepreneurial learning modes of exploration and exploitation, and external environment factors of dynamism, hostility and heterogeneity. The concepts are explained and the available research about the topics is discussed. In the third chapter the review of the literature is combined and hypotheses are derived from the theory. The methodology is then more thoroughly explained in the fourth chapter, including the sample, the research methods which have been used and the statistical methods which have been applied. The fifth chapter presents the results. The descriptive statistics are given followed by the acceptance or rejections of the hypotheses. In the final chapter the conclusion is given followed by a discussion and interpretation of the outcomes, including the limitation of the study and the suggestions for further research.

2. Literature Review

In this second chapter the literature on the main concepts of the research are analysed and explained. This will develop a solid background for the study from where hypotheses will be derived in the third chapter. Entrepreneurial processes, entrepreneurial learning and possible external environment influences are being reviewed. The concept of entrepreneurship has been briefly addressed in the introduction and is not further reviewed.

2.1 Entrepreneurial Processes: Effectuation and Causation

2.1.1 Principals of effectuation and causation

Entrepreneurship is a promising field of research which entails the cohesion of the presence of entrepreneurial opportunities and the presence of the entrepreneur (Shane & Venkataraman, 2000). The discussion is about the dynamic between the entrepreneur and the opportunities which are recognised, discovered or created (Bruyat & Julien, 2001) and not about certain characteristics or traits of a certain person which makes someone an entrepreneur (Bull & Willard, 1993; Shane, 2012). This discussion is referred to as the entrepreneurial process, which can be defined as: "[...] all the functions, activities, and actions associated with the perceiving of opportunities and the creation of organizations to pursue them" (Bygrave & Hofer, 1991, p. 14). The entrepreneurial process is still a broad concept in itself. It can be classified under many different conceptualisations and models. Research shows that causation and effectuation are favoured models of entrepreneurial processes (Moroz & Hindle, 2011; Steyaert; 2007) as is explained chapter 1. Additionally, these concepts are gaining attention within the entrepreneurship literature (Perry et al., 2011).

The main body of literature on entrepreneurship is based on rational decision making models (Perry et al., 2011), which entail causation. In contrast, Sarasvathy (2001) presents a model of effectuation. "Causation processes take a particular effect as given and focus on selecting between means to create that effect. Effectuation processes take a set of means as given and focus on selecting between possible effects that can be created with that set of means" (Sarasvathy, 2001, p. 245). The main difference between these two processes is the way decisions are being made. Causation is about choosing between means to create an effect whereas effectuation is about using the means available to choose between possible effects (outcomes). The generalised aspirations and means are the same for both processes, only in effectuation the means are given where as in causation the effects are given. Imagine cooking a meal, it can be cooked with the ingredients available and the skills possessed (means) to create something to eat (no end-goal) which would classify as effectuation. Or a shopping list can be made to prepare a dish which has been defined earlier (getting the means for an already set end-goal) which would classify as causation. Effectuation processes are more general and more ubiquitous than causation processes in human decisions (Sarasvathy, 2001) and are more consistent with emerging and non-predictive strategies. In contrast, causation is more consistent with planned strategies (Chandler et al., 2011; Mintzberg, 1978).

Means for entrepreneurs can be categorized in three different types: who they are, what they know, and whom they know (for example personal traits and capabilities; their knowledge; and the social networks they are a part of) (Sarasvathy, 2001). In effectuation these means are given, the entrepreneur know who they are, what they know and whom they know and possible effects are created using these means, without setting a specific end-goal. Goals

emerge when actions are imagined with the available means (Read et al., 2009a). However, in causation a specific goal is set and the entrepreneur is looking for the means to realise that goal. Thus, causation is goal-driven whereas effectuation is mean driven. Sarasvathy (2001) developed four other behavioural principles which distinguish causation from effectuation. All differences between causation and effectuation are given in table 1.

Table 1: Differences between causation and effectuation (Sarasvathy, 2001)

Causation	Effectuation
Effects are given	Means are given
Focus on expected returns	Focus on affordable loss
Competitive analysis	Strategic alliances
Exploiting pre-existing knowledge	Exploiting contingencies
Predict an uncertain future	Control unpredictable future

Because causation is goal oriented the focus is on maximizing profit by selecting an optimal strategy for the highest expected returns. Future sales and risks have to be estimated and enough resources have to be gathered in order to start a company with its preset goals. The focus is on upside potential pursuing the maximum opportunity (Sarasvathy & Dew, 2005). Effectuation is focused on affordable loss. The entrepreneur only invests what could be lost in a worst case scenario, limiting the downside potential. All the entrepreneur needs is knowledge about the financial situation and the worst case scenario to make a decision. Because the entrepreneur is not bound to any preset goals, it can try different approaches and use the means which are available (Chandler et al., 2011; Sarasvathy, 2001).

In effectuation the entrepreneur relies on collaboration with self selected stakeholders and creatively leveraging slack resources (Sarasvathy, 2008, 2001). Through pre-commitments and partnerships new markets can be created more easily, by reducing uncertainty or removing entry barriers to existing markets (Chandler et al., 2011; Sarasvathy, 2001). Risk and rewards are shared and the collaboration determines the development of the new organisation (Read et al., 2009a). In causation the entrepreneur is focused on competitive analysis and market research in order to determine risks and expected returns (Sarasvathy, 2008, 2001). The entrepreneur protects his share of the opportunity, maximising expected returns (Read et al., 2009a). The predetermined goals determine if and which potential partners to bring in the organisation (Dew et al., 2009). With a competitive attitude towards outsiders the ownership of outsiders is limited as much as possible (Read et al., 2009a; Sarasvathy, 2001).

Causal models prefer to avoid contingencies and rather exploit existing market knowledge. Through prediction and planning the occurrence and impact of surprises can be limited (Read et al., 2009a). The vision for the venture is determined at the start and all the actions taken by the entrepreneur are aimed to achieve the predetermined vision, leaving little room for contingencies (Chandler et al., 2011). Contrary, effectuation sees contingencies as opportunities for value creation. Entrepreneurs leverage uncertainties and exploit contingent information as a resource (Sarasvathy, 2008). Obstacles are seen as challenges and even

possible failures are not avoided. Predictions are prevented and possibilities are rethought with imagination, thus leveraging contingencies (Read et al., 2009a; Sarasvathy & Dew, 2005). When the entrepreneur is confronted with new information, means or surprises, the course of action can be adjusted and new goals can emerge (Read et al., 2009a; Read et al, 2009b).

The final principle is about the underlying logic of causation and effectuation. Causal logics are about predicting and uncertain future: “To the extent that we can predict the future, we can control it” (Sarasvathy, 2001, p. 252). Causal logics rely on prediction based on past experience or analysis of data. An assumed relationship exists between the past and future events (Read et al., 2009; Sarasvathy, 2001). The future is controlled through reliance on previously obtained knowledge, which in turn determines goals and create expected returns making predictions both useful and necessary (Dew et al., 2009; Sarasvathy 2001). Effectual logic is about controlling an unpredictable future: “To the extent that we can control the future, we do not need to predict it” (Sarasvathy, 2001, p. 252). The future is created by what the entrepreneur does, creating new markets, leveraging contingencies, invest only that what can be lost and with whom to collaborate or pre-commit (Dew et al., 2009; Sarasvathy 2001). The focus is more short-term by experimentation to create opportunities in an unpredictable future (Chandler et al., 2011). All the mentioned principles are a dynamic whole overlapping each other and should not be seen as static individual principles. Together the principles shape the entrepreneurial process for new venture creation (Sarasvathy, 2001). Although the principles are referred to as behavioural principles, causation and effectuation are essentially cognitive processes (Perry et al., 2011).

2.1.2 Effectuation and causation as predominant logics of the entrepreneur

Causation and effectuation are presented as a dichotomy above, but in reality features of both process can occur overlapping and intertwining depending on the context of the situation (Sarasvathy, 2001). This becomes apparent in Chandler et al. (2011) operationalization of causation and effectuation, which show that causation is a single dimensional construct and effectuation is a multi dimensional formative construct, where the pre-commitment dimension is shared with causation. In addition, neither causation nor effectuation is a ‘better’ process. Their best use is context dependent. In a predictable context causation might be more suitable and in contrast, effectuation might be more suitable in an uncertain context (Sarasvathy, 2001; Sarasvathy, 2008). Chandler et al. (2011) show that causation measures are negatively related to measures of uncertainty and the experimentation sub-dimension of effectuation is positively related to measures of uncertainty. Also, in the early stages of venture creation, effectual logic is emphasized with a transition to more causal strategies as the new firm and market emerge out of uncertainty into a more predictable situation (Perry et al., 2011).

Causation assumes the existence of the central artefacts and contexts of business, within decision making take place. None of this involves the creation of artefacts such as firms, markets, and economies (Sarasvathy, 2001). The effectuating entrepreneurs' vision appears to involve more than the identification and pursuit of an opportunity; it seems to include the very creation of the opportunity as part of the implementation of the entrepreneurial process (Sarasvathy, 2001). Therefore, referring back to Alvarez & Barney (2007), causation is a process related to mountain climbing and discovering already existing opportunities and effectuation is a process relation to mountain building, creating own opportunities, companies and markets (Sarasvathy, 2001).

Previous research shows that effectuation is moving from a nascent to an intermediate state (Chandler et al., 2011; Perry et al., 2011). Effectuation theory has been applied in fields such as management, economics, finance, marketing, R&D management and internationalisation (Harms & Schiele, 2012). The conceptual articles, mostly written by or partly written by Sarasvathy explain what effectuation is, how it works and how it differentiates from other entrepreneurial processes (Perry et al., 2011). The conceptual work is supported by increasing empirical work, which relates effectuation to other constructs such as entrepreneurial expertise (Dew et al., 2009), international venture creation (Harms & Schiele, 2012), career motives (Gabrielsson & Politis, 2011) and identity construction (Nielsen & Lassen, 2012). Effectuation is applied to the learning field in this research in order to explore learning differences. The relationship with entrepreneurial expertise is highlighted, because expert entrepreneurs posses a large amount of experience which is transformed into knowledge attaining high levels of performance (Read & Sarasvathy, 2005). Research shows that expertise and effectuation share common believes, for example both concepts do not rely on predictive information, both focus on the controllable aspects of the environment, both are mean driven and both leverage contingencies (Read & Sarasvathy, 2005). Empirical results provide evidence that expert entrepreneurs use effectuation to a larger degree than causation, while novices use causation to a larger degree than effectuation. Expert entrepreneurs tent to ignore predictive information, while novices go by the textbook. Additionally, expert entrepreneurs not only have more experience and knowledge, but also have better access to it than novice entrepreneurs do (Dew et al., 2009). The sample of expert entrepreneurs which was used by Dew et al. (2009) and Read & Sarasvathy (2005) all have achieved superior performance with their new ventures. Although it can be argued that the performance is not only dependent on the expertise of the entrepreneurs, but also on the environment they are in, the location of the venture, the choice of market etc. Therefore, knowledge derived from experience influence the strategic decisions made by entrepreneurs, which then in turn influence the new venture performance (Politis, 2005).

In the next section of this report entrepreneurial learning is explained. This section contains entrepreneurial learning in general and modes of transforming experience into knowledge in particular. These modes are expected to be related to the entrepreneurial processes.

2.2 Entrepreneurial learning: Exploration and Exploitation

2.2.1 Entrepreneurial learning in general

Entrepreneurial learning emerged as an important concept at the interface of entrepreneurship and organisational learning (Wang & Chugh, 2013). Organisational learning has largely focused on large corporations (Politis, 2005). Entrepreneurial learning is similar to organisational learning, but more specific for individuals in smaller organisations (for example start-ups) instead of large established organisations. In the new venture creation processes, such as effectuation and causation, there might not be an organisation yet (prior to start-up). In sum, where organisational learning focuses mainly on the firm and network level (inter organisational learning), entrepreneurial learning focuses mainly on the individual level of the entrepreneur (Wang & Chugh, 2013).

Politis (2005, p. 401) defines entrepreneurial learning as: “[...] a continuous process that facilitates the development of necessary knowledge for being effective in starting up and managing new ventures”. The definition of Politis contains learning and knowledge which are two distinct concepts. Knowledge is that which is known (content), and learning is the

process by which knowledge is generated through the transformation of experience (Harrison & Leitch, 2005; Kolb, 1984). Knowledge in itself is a static concept which can be activated through cognitive mechanisms, such as causation and effectuation, to put knowledge into action (Corbett, 2005).

Entrepreneurial learning is often seen as an experiential process where entrepreneurs learn continuously by developing their knowledge (Cope, 2005; Corbett, 2005; Franco & Haase, 2009; Harrison & Leitch, 2005; Politis, 2005). Entrepreneurial learning is the process of transformation of experience into knowledge, whereby concepts are derived from and modified by experience (Kolb, 1984). Experience can entail different phenomena, such as critical learning events (Cope, 2005), success and failures (Minnity & Bygrave, 2001) or prior career experience, management experience and industry-specific experience (Politis, 2005). This experience is then transformed into knowledge through a process of learning. This knowledge can be used to recognise, discover or create opportunities, or to cope with the liability of newness (Politis, 2005; Sarasvathy et al., 2003).

Entrepreneurs start with a stock of experience and knowledge. They approach the entrepreneurial process with a unique set of skills and abilities (Cope, 2005). The development of knowledge derived from experience can influence the strategic decision making, which in turn influence the venture performance. Therefore, the value of learning for entrepreneurs is in the possibility of providing a competitive advantage by developing and/or adding new skills and abilities to their existing stock of knowledge and experience (Harrison & Leitch, 2005).

Entrepreneurial learning takes place from three different perspectives: behavioural perspective, cognitive perspective and action/functional perspective (Cope, 2005; Lumpkin & Lichtenstein, 2005). The behavioural learning is focused on the tangible outcomes of learning-by-doing. Behaviours that have been successful are repeated (trial and error) in contrast to those behaviours which were unsuccessful, leading to routines. Cognitive learning is about the mental frameworks an individual needs for ‘knowing’. It is more focused on the content of learning than on behavioural outcomes. These processes improve the creation of new information and knowledge. Action learning involves learning from correcting misalignments between what ‘said is done’ and what is actually done. These perspectives of learning are important, because they show how individual entrepreneurs learn from their experience and how this learning is conditioned by social contexts (Voudouris et al., 2011). However, they are different from learning mechanism or strategies.

2.2.2 Exploration and exploitation as transformative modes of entrepreneurial learning

Learning mechanisms or strategies are about the transformation of experience into knowledge. Minniti & Bygrave (2001) argue that entrepreneurs have to choose one out of two strategies to make decisions. Entrepreneurs either choose a repetitive action, which they know works, because they have experienced the outcome before, exploiting there pre-existing knowledge. Or entrepreneurs choose an entirely new action broadening their experience and in turn their knowledge. The depth of learning is often captured in a dichotomy (Voudouris et al., 2011), such as single and double loop learning (Argyris & Schön, 1978), lower and higher level learning (Fiol & Lyles, 1985), adaptive and generative learning (Slater & Narver, 1995), or exploration and exploitation (March, 1991). All these typologies stem from the organisational learning literature in which they are widely used. Each typologies show generic characteristics as well as distinct characteristics. It is these

distinct characteristics that make exploration and exploitation well applicable in an entrepreneurial setting. In their literature review of entrepreneurial learning, Wang & Chugh (2013) identified three main learning mechanisms: individual learning and collective learning, intuitive learning and sensing learning and, exploratory learning and exploitative learning. Individual learning and collective learning are mechanisms to integrate individual opportunity seeking behaviour with organisational advantage seeking behaviour. Intuitive learning and sensing learning is about how opportunities come into being, either through discovery (causation) or creation (effectuation) (Sarasvathy, 2001; Wang & Chugh, 2013). Exploratory learning and exploitative learning are mechanisms for skill and resource development in order to gain a competitive advantage (March, 1991; Wang & Chugh, 2013).

Exploration and exploitation represent similarities with the learning strategies mentioned by Minniti & Bygrave (2001). These mechanisms are recognised by Politis (2005) as transformation modes for transforming experience into knowledge. Sarasvathy (2001) already recognises the possible importance of exploration and exploitation in her 2001 article on the basic theory of effectuation versus causation. Sarasvathy (2001, p. 254) argues: “Of particular value to building a theory of effectuation are his (March, 1991) ideas on the tradeoffs between exploration and exploitation in organizational learning”. Finally, the article of March (1991) is often used for learning mechanisms and is a cross-fertilisation between learning and entrepreneurial literature. Therefore, there will be a further elaboration on exploration and exploitation as learning mechanisms in entrepreneurial learning.

Exploratory learning and exploitative learning transform experience into knowledge in different ways. Entrepreneurs have to make decisions about allocation of scarce resources between the exploration of new possibilities and the exploitation of old certainties (March, 1991; Sarasvathy, 2001). “Exploration includes things captured by terms such as search, variation, risk taking, experimentation, play, flexibility, discovery, innovation. Exploitation includes such things as refinement, choice, production, efficiency, selection, implementation, execution” (March, 1991, p. 71). Exploration is about creating variability in experience, exploring new possibilities through experimentation, innovation and discovery, which reduce the speed at which existing competencies and skills are improved and refined. The returns of exploration are more uncertain, more distant in time and are further away from the scope of the business (March, 1991). Exploitation is about creating reliability in experience, exploiting old certainties (learning by refinement, routine and implementation of knowledge) and emphasising planning and control. Exploitation, therefore, increases efficiency and improves the capability to adapt to the current environment (Sirén et al., 2012). The outcomes of exploitation are more certain, more quickly and more precise (March, 1991). This might lead to difficulties adapting to future environmental changes and opportunities (He & Wong, 2004; McGrath, 2001). Additionally, this implies that exploitation can have more success in the short term and exploration can have more success in the longer term (March, 1991; Politis, 2005). March (1991, p. 71) argues that it is important to find the right balance between the exploration exploitation trade-off, because “... [it] is a primary factor in system survival and prosperity”. Too much emphasis on exploration leads to high cost of experimentation without the benefits, too much emphasis on exploitation result in few new opportunities, endangering future returns (March, 1991).

Attention and resources spend on either exploration or exploitation have to be balanced to manage the tension between them. This indicates that exploration and exploitation are fundamentally different logics (He & Wong, 2004). However, it is argued that exploration and

exploitation can also be complementary constructs. This is called organisational ambidexterity, which is first described by O'Reilly & Tushman (2004). Recent empirical literature supports that exploration and exploitation could be rather complimentary constructs, creating synergy instead of a trade-off (Bierly & Daly, 2007; He & Wong, 2004; Su et al., 2011). Bierly & Daly (2007) found that exploration and exploitation are complimentary and can be simultaneously pursued. However, exploration is positively linear related to performance and exploitation has a concave relationship with performance, indicating that there is an optimal level of exploitation. Still exploitation is a stronger driver of performance than exploration. In addition, Bierly & Daly (2007) found ambidexterity to be depended on external environmental factors. He & Wong (2004) conclude that the constructs are complementary. They relate organisational ambidexterity to sales growth rate from a technological innovation perspective (commercialising new technological knowledge and ideas into new products or processes); however, the balance might prove to be unmanageable when pushed to extreme limits or the organisation might not be ambidextrous when the levels of exploration and exploitation are too low. Su et al. (2011) found in their study of Chinese companies that ambidexterity is depended on the organisational structure of a company. Organic structures support ambidexterity and mechanistic structures are negatively related to the interaction effects of ambidexterity. He & Wong (2004) argue that in general exploration is associated with organic structures and exploitation is associated with mechanic structures.

The conditions when effectuation and causation are related to exploration and exploitation might vary. In the original article by Sarasvathy (2001), she not only argues that exploration would contain processes of effectuation and exploitation would contain processes of causation, but also that these can work rather complementary, because effectuation and causation are not necessarily dichotomous. Sarasvathy (2001) speculates that effectuation might be more effective in allocating resources than causation is. Moreover, the environment of the start up organisations might influence these relationships. Issues such as competition, customer habits, and technological renewal could moderate possible relationships. Therefore, three external environmental influences are examined in the next section of this chapter.

2.3 External environmental influences

2.3.1 External environmental influences on entrepreneurial processes and learning

Both entrepreneurial processes and entrepreneurial learning are believed to be influenced by the external environment. The context of the situation determines how the features of causation and effectuation are overlapping and intertwining (Sarasvathy, 2001). Sarasvathy (2001) argues that causation is more useful in the context of static, linear and independent environments, while effectuation is more useful in the context of dynamic, nonlinear and ecological environments. Entrepreneurs using causation try to predict what happens in the external environment in order to control the future, whereas entrepreneurs using effectuation attempt to control the external environment so they do not have to predict the future (Sarasvathy, 2008).

Entrepreneurial learning is also depended on external environmental influences. March (1991) recognizes that exploration and exploitation depends on, what he specifies as environmental turbulence. The balance between exploitation and exploration is important, because effective exploitation is essential to survival, but so is the generation of new

products. This is especially true in a changing environment, because the rate of exploratory variation is sensitive to the links among environmental turbulence, organisational diversity and competitive advantage (March, 1991). Bierly & Daly (2007) test for external environmental factors and find that environmental dynamics and industry technology have significant influence on entrepreneurial learning. In a similar fashion Voudouris et al. (2011) also recognize environmental influences of industry, technology and globalisation on exploration and exploitation from an internationalisation perspective. Therefore, it can be concluded that entrepreneurial learning is affected by the external environment.

Thus, it is argued that both entrepreneurial learning and entrepreneurial processes are influenced by the external environment of the entrepreneur and the organisation. The external environment in this research is captured by the dynamism, hostility and heterogeneity of the environment. These constructs are often used as environmental antecedents (Lindelöf & Löfsten, 2006; Miller & Friesen, 1982; Miller & Friesen 1983; Zahra, 1991, Zahra & Bogner, 2000).

2.3.2 External influences of environmental dynamism, hostility and heterogeneity

Environmental dynamism is an element of the uncertainty in a market or industry (Harms & Schiele, 2012). It refers to the rate of environmental change and the unpredictability of that change (Dess & Beard, 1984). Dynamic markets change unexpectedly and more rapidly than a static environment (Bierly & Daly, 2007). Environmental dynamism can be characterised by the rate of changes in marketing practises, the rate of product obsolescence, predictability of competitor actions, predictability of consumer demand and tastes, and the technological renewal in the market of industry (Miller & Friesen, 1982). Learning is important in a dynamic environment, because the entrepreneur can learn how to cope with the environmental change, which could provide a competitive advantage (Harrison & Leitch, 2005; Sirén et al., 2012). The degree of uncertainty created by the dynamism of the environment might influence the strategic decisions that entrepreneurs have to make (March, 1991; Sarasvathy 2001). For example, the rate of technological renewal in an industry, such as in the IT industry, influences the value of opportunities as they might become obsolete (Sirén et al., 2012).

Environmental hostility is different from dynamism as hostility possesses a constant threat to organisations, possibly resulting in high failure rates of firms (Covin et al., 1999). A hostile environment creates threats to a firm's mission, through increasing competition or lower demand for a firm's products (or services) (Zahra, 1991). Hostility is characterised by high competitive intensity, low customer loyalty, price wars and low profit margins (Covin et al., 1999). Entrepreneurial firms are often found in these hostile environments (Miller & Friesen, 1982). When there is much competition in a market, it can be argued that the way entrepreneurs make decisions is influenced, because they have to differentiate from competition by exploring new opportunities. In addition, there is a need to learn, because entrepreneurs have to find creative ways to deal with the high competitive intensity or low customer loyalty. Environmental hostility increases the information processing tasks of firms and that this seems to require more analysis on the part of decision makers (Miller & Friesen, 1983). In general, the more hostile an environment is, the higher the level of innovation according to Miller & Friesen (1982).

Finally, the external environment is captured by its heterogeneity. Heterogeneity is about the existence of multiple markets, with different characteristics, which a firm is active in (Dess &

Beard, 1984; Zahra, 1991). This external factor can be characterised by the diversity of the firm and the unrelated industries they operate in, difference in customers buying habits between products and markets, differences regarding the nature of competition between products and markets and the perceived differences in dynamism and uncertainty between products and markets (Miller & Friesen, 1982). Hence, a heterogeneous environment is complex because of the different characteristics of markets, competitors and customers that organisations have to deal with (Zahra, 1991). Entrepreneurs might perceive heterogeneity very differently. Some might perceive the environment as low complexity, while others might perceive it as highly complex. Experience and knowledge influence these perceptions of the external environment (Zahra, 1991). Learning can be facilitated through heterogeneity by gaining a broad experience from different markets, customers and competitors. The experience from one market can be applied in a different market (Miller & Friesen, 1982).

The external environment of a firm influences their entrepreneurial process and learning process. How these concepts of entrepreneurial processes, entrepreneurial learning and external environmental influences are related is described more thoroughly in the hypotheses chapter, linking specific concepts under different circumstances with each other.

3. Hypotheses

The concepts of entrepreneurial processes, causation and effectuation, are linked to the concepts of entrepreneurial learning, exploration and exploitation. This chapter contains the hypothesised relationships between the concepts. Effectuation is more specific in terms of the principles of the process, because Chandler et al (2011) found that effectuation is a formative multidimensional construct. However, the principles by Sarasvathy (2001) are used, because these principles have been used to code the think-aloud-protocols which are the main data source in this research. Causation is handled as a coherent one-dimensional construct (Chandler et al., 2011). In addition, the influence of external environmental variables is added to see if all relationships hold in different environments perceived by the entrepreneurs.

3.1 Effectuation and entrepreneurial learning

3.1.1 Means based action, contingencies and exploratory learning

Effectuation is more directly related to exploratory learning (Sarasvathy, 2001), which is the product of discovery, experimentation, flexibility and risk taking (Hughes et al., 2007; March, 1991). Experimentation and flexibility are core constructs of effectuation (Chandler et al., 2011). Risk taking is directly related to the exploitation of contingencies (Sarasvathy, 2001). In turn exploration is about creating variance in experience. This implies that there are no end goals present yet. Instead there is a focus on contingencies when exploring new markets and environments. The absence of end-goals and the focus on contingencies are part of the effectuation concept (Politis, 2005; Sarasvathy, 2001). Corbett (2002) found that entrepreneurs using intuition as a cognitive style, instead of an analytical cognitive style, would identify more opportunities (as cited in Corbett, 2005). Intuition as a cognitive style is more suitable for effectuation as an entrepreneurial process, while identifying multiple opportunities can be related to exploration. Exploration, although related to higher costs, has a high risk rate, but is more likely to lead to a competitive advantage, indicating that surprises are good and contingencies should be leveraged (Bierly & Daly, 2007; Sarasvathy & Dew, 2005). Entrepreneurs learn through “learning by doing”, which includes learning through trial and error, problem solving and discovery, indicating that entrepreneurs learn by exploring contingencies and creation of the future (Cope, 2005; Sarasvathy, 2001). Therefore, it is expected that effectuation is positively related to explorative learning through leveraging contingencies and the means based principle of action.

> H1a: Effectuation is positively related to explorative learning through the means based principle
>
> H1b: Effectuation is positively related to explorative learning through the leveraging of contingencies

3.1.2 Means based action, strategic alliances and exploitative learning

In contrast, effectuation is usually applied in the early stages of a venture when facing higher levels of uncertainty, while exploration is more likely to maximize long term success. However, exploitation is likely to result in more short term success and therefore a positive relationship between effectuation and exploitation is also expected (March, 1991; Perry et al., 2011; Sarasvathy, 2001). Exploitative learning can expend the knowledge base of a young firm rapidly at little costs, supporting this short term success (Hughes et al., 2007). Entrepreneurs learn most through their relationships, indicating the use of means (who I

know) and the use of partners and alliances (Hughes et al., 2007; Sarasvathy, 2001). They learn through existing knowledge of others, indicating exploitative learning. Cope (2005) argues that entrepreneurs learn through reflection, turning experience into learning. This is an incremental way of learning about 'who I am', 'what I know' and 'whom I know' (means) of the entrepreneur. Cope (2005) refers to entrepreneurs as reflective practitioners. Therefore, the expected positive relationship between effectuation and exploitative learning is based on the means based principle and the strategic alliance principle.

> H1c: Effectuation is positively related to exploitative learning through the means based principle

> H1d: Effectuation is positively related to exploitative learning through the use of strategic alliances and partnerships

3.1.3 Ambidexterity

In addition, effectuation possesses the flexibility to simultaneously use exploration and exploitation because of the contingency focus and lack of formulated end-goals, indicating that effectuation can support ambidexterity (O'Reilly & Tushman, 2004; Sarasvathy, 2008; Su et al., 2011). The process of learning involves repetition and experimentation which improves the entrepreneurs stock of knowledge and experience (Minniti & Bygrave, 2001). In addition, entrepreneurs learn from their partnerships and alliances in their network, because innovation is only partly under their control. The support of external actors can be complementary to the existing skills and knowledge of the entrepreneur, which is often required to go from exploration to exploitation, turning explored idea's into actual products or processes (Ravasi & Turati, 2005). Therefore, it is hypothesised that:

> H1e: Entrepreneurs using a higher degree of effectuation than causation have a higher degree of exploration as a mode of entrepreneurial learning than exploitation

3.2 Causation and entrepreneurial learning

Causation can be more directly related to exploitative learning (Sarasvathy, 2001), because both concepts share similar characteristics, as explained in sections 2.1.1 and 2.2.2. Causation focuses on refinement, because it involves less risk, avoiding contingencies. It involves the selection of goals through prediction and analysis of data and efficiency can be achieved through competitive analysis and attempt to pursue the highest expected returns. The terms of both causation and exploitation are focused on maximisation of profits and protecting the entrepreneurs own share (Read et al., 2009a; Sarasvathy & Dew, 2005). In addition, Minniti & Bygrave (2001) argue that entrepreneurs repeat choices which have been successful and discard choices which resulted in failure, thus entrepreneurs learn from failures in an incremental way. Entrepreneurs make choices based on past experience to maximize profits. The actual returns are often different from the expected returns because of the possibility of failure and the reliance on prediction. When actual returns are known only those choices which were successful in reaching initial goals are repeated (Minniti & Bygrave, 2001). Exploitation is about creating reliability in experience through exploiting existing knowledge. Causation is a process that is involved with exploiting pre-existing knowledge for analysis in existing markets and development of efficient competitive strategies. Therefore, it is reasonable to imply that causation can be related to exploitation (Politis, 2005; Sarasvathy, 2001). The entrepreneurs in the sample are part of a business incubator, which build on the available network which contains existing knowledge and

resources. Exploitative learning uses this existing knowledge to make use of what is already known, reducing uncertainty and becoming self-reinforcing (Hughes et al., 2007).

However, contrary to effectuation, causation is often used when the venture emerges out of uncertainty into more predictable situations, while exploitation is maximizing short term success and exploration maximizing long term success (March, 1991; Perry et al., 2011; Sarasvathy, 2001). Therefore, causation can also be related to exploration. Exploration require investment of resources, increasing risk but expecting to gain a competitive advantage, indicating expected returns based on pursuing the risk adjusted maximum opportunity and the usage of resources which are required for this investment (Bierly & Daly, 2007; Sarasvathy & Dew, 2005).

> H2: Entrepreneurs using a higher degree of causation than effectuation will have a higher degree of exploitation as a mode of entrepreneurial learning than exploration

3.3 Influences of the external environment on the expected relationships

It is expected that both effectuation and causation are positively related to entrepreneurial learning in different ways, the expected relationships might be influenced (moderated) by external environmental variables. The external environment is captured by its dynamism, hostility and heterogeneity.

3.3.1 The moderating role of environmental dynamism

Environmental dynamism is an element of the uncertainty in a market or industry and refers to the rate of environmental change and the unpredictability of that change. Dynamic markets change unexpectedly and more rapidly than a static environment (Bierly & Daly, 2007; Harms & Schiele, 2012). Thus, the perceived dynamism of the market can influence the relationship between entrepreneurial processes and entrepreneurial learning. It is expected that environmental dynamism has a moderating influence on the relationships in the first two hypotheses.

How the concepts of effectuation and causation are overlapping and intertwining is dependent on the context of the situation (Sarasvathy, 2001). Effectuation is more effective in the context of dynamic environments, because effectuation prefers uncertain situations over risky situation (Sarasvathy, 2001). In effectuation the future is controlled through creation. Elements of dynamism such as predictability of competitor actions or consumer demands and tastes are less relevant, because effectuation focuses on partnerships, commitments and available means to control the future. Through experimentation and flexibility, effectuation is better in handling the rapid change in the dynamic environment. Causation is more useful in the context of static environments (Sarasvathy, 2001, 2008). Causation relies on prediction based on previously obtained data, which makes it more suitable in a static and stable environment. A stable environment improves the predictability of competitor actions or consumer demand and tastes so goals can be reached and expected returns can be met.

March (1991) also recognizes that exploration and exploitation depends on environmental turbulence. The adaption to change in the environment is essential, but makes learning from experience more difficult (March, 1991). The degree of uncertainty, created by the dynamism of the environment, might influence the strategic decisions that entrepreneurs have to make. Explorative learning is expected to be more effective under uncertain conditions of a dynamic

environment for the same reason as effectuation, because exploration entails experimentation and flexibility to better cope with the rapid change in the environment. In addition, empirical research shows that pursuing an explorative innovation strategy increased financial performance under dynamic conditions. In contrast, exploitative innovation strategy has a negative impact on financial performance under dynamic conditions (Jansen et al., 2006). Exploration was better able to cope with dynamism, because the threat of product obsolescence was less relevant due to the development of new products (and services) and the entrance to new markets and finding new customers (Jansen et al., 2006). Bierly & Daly's (2007) found that environmental dynamism is significantly influencing the relationship between exploitation and performance such that exploitation is positively related to performance in a high technology and stable environment. In a dynamic environment exploration and exploitation seem to work rather simultaneously (Bierly & Daly, 2007; Jansen et al., 2005).

Thus, it is expected that effectuation has a stronger relationship with both exploration and exploitation under conditions of a perceived dynamic environment, because effectuation is better at allocating resources through experimentation and flexibility (Sarasvathy, 2001). Causation has a stronger relationship with entrepreneurial learning, exploitative learning in particular, under a stable environment.

> H3a: Environmental dynamism moderates the relationship between effectuation and entrepreneurial learning such that effectuation will have a stronger relationship with explorative and exploitative learning in dynamic environments than causation
>
> H3b: Environmental dynamism moderates the relationship between causation and entrepreneurial learning such that causation will have a stronger relationship with exploitative learning in stable environments than effectuation

3.3.2 The moderating role of environmental hostility

Entrepreneurial firms are often found in hostile environments (Miller & Friesen, 1982). In order to survive companies have to be innovative, explore new possibilities and markets and have to distinguish themselves from competing firms (Covin et al, 1999). These uncertainties can influence both entrepreneurial learning and the entrepreneurial process. Effectuation and explorative learning are more suitable to apply in a hostile environment with more uncertainty, because through innovation and exploration of new possibilities the future is created and controlled. Causation relies on predictions of the future and thus is more suitable to apply in environments which are perceived as more benign (Sarasvathy, 2001). Causation is often applied by more mature organisations which have grown in size over time. These mature organisations emerge from uncertainty into more predictable and stable environments. The entrepreneurs have established themselves on their market or in their industry and are better able to cope with competition, customer loyalty, price wars and low profit margins (Covin et al., 1999; Sarasvathy, 2001). Therefore, the entrepreneur perceives the environment as more benign. According to Bierly & Daly (2007, p. 499) "Smaller firms can effectively use exploration in high-technology industries to compete against larger firms since customers value, and are willing to pay a premium price for, technologically superior goods". Empirical research shows that exploration is related to effective firm performance under hostile conditions in the environment, while exploitation-oriented firms are related to less effective firm performance under hostile conditions (Auh & Menguc, 2005).

Thus, it is expected that effectuation has a stronger relationship with entrepreneurial learning under a hostile environment and causation will have a stronger relationship with entrepreneurial learning, exploitation in particular, under a benign environment.

> H4a: Environmental hostility moderates the relationship between effectuation and entrepreneurial learning such that effectuation will have a stronger relationship with explorative and exploitative learning in hostile environments than causation

> H4b: Environmental hostility moderates the relationship between causation and entrepreneurial learning such that causation will have a stronger relationship with exploitative learning in benign environments than effectuation

3.3.3 The moderating role of environmental heterogeneity

Entrepreneurial learning and entrepreneurial processes can both be affected by the heterogeneity of the environment. Heterogeneity can be characterised by the diversity of the firm and the unrelated industries they operate in, difference in customers buying habits between products, differences regarding the nature of competition between products and markets and the perceived differences in dynamism and uncertainty between products and markets (Miller & Friesen, 1982). Firms with higher degrees of exploration are more likely to come up with new products, which in turn can be exploited in different industries or markets (March, 1991; Miller & Friesen, 1982). Thus, it is argued that explorative learning is better suitable under heterogeneous environmental conditions. In addition, opportunities can emerge from a heterogeneous environment, because developments from one market can be applied in other markets, but it requires explorative learning (Zahra, 1991).

Although it is expected that both causation and effectuation can entail ambidexterity, it is also expected that effectuation will have a stronger relationship with exploration than causation. Therefore, it is expected that effectuation will have a stronger relationship with entrepreneurial learning under environmental heterogeneity, because heterogeneity creates uncertainty through its complexity. Effectuation is argued to be better able to cope with uncertainties, similar as the arguments under dynamism and hostility (Sarasvathy, 2001).

> H5a: Environmental heterogeneity moderates the relationship between effectuation and entrepreneurial learning such that effectuation will have a stronger relationship with explorative learning in heterogeneous environments than causation

> H5b: Environmental heterogeneity moderates the relationship between causation and entrepreneurial learning such that causation will have a stronger relationship with exploitative learning in homogeneous environments than effectuation

4. Methodology

In order to explore the relationship between entrepreneurial process and entrepreneurial learning, empirical research is done qualitatively and quantitatively. The research is performed on a sample of small high tech companies, which function under support of a business incubator. In the first section the sample and its setting are described. In the second section the measurement tools are explained. Verbal protocol analysis is used to measure the degree of effectuation and causation of these entrepreneurs (Ericsson & Simon, 1981). More specifically, a think aloud method is used (Van Someren et al., 1994). This same method has been used by Sarasvathy (2001, 2008) to explore and develop effectuation theory. The quantitative part of the study is performed by a survey. Finally, the results of this method are analysed using several statistical methods which are explained in the last section of this chapter.

4.1 Sample and setting

A nonprobability sampling strategy is used to gather data. More specifically, purposive sampling is used (Babbie, 2009). Entrepreneurship is a broad concept which makes it difficult to study all entrepreneurs. Therefore, a small homogeneous subset is selected for this study. This subset contains technostarters. The term technostarter can be defined as: “a legal entity that starts, or prepares to start a company based on a new technological finding or a new application of an existing technology” (AgentschapNL, 2011). The entrepreneurs/founders of these companies are full time entrepreneurs with a technological background. Full time entrepreneurs entails that they do not study (student entrepreneurs) or have any other type of career besides their entrepreneurial activities. Student entrepreneurs have been the unit of analysis in similar previous master theses. The technostarters represent entrepreneurship in combination with technological knowledge, which has been developed through a process of learning, capturing both entrepreneurial processes and entrepreneurial learning. It is preferable if the entrepreneurs have an academic background, because it implies the entrepreneurs have affinity with technology and learning, and the transformation of experience into knowledge can be measured.

Technostarters can be found in business incubators. A business incubator supports entrepreneurs in creating new ventures by offering office or laboratory space, access to networks, access to (financial) resources and coaching. Incubators are usually located at business and science parks, which in turn are often linked to knowledge institutions such as universities. For example, Kennispark Twente is a large business and science park in the city of Enschede, where several incubators are present, such as BTC-Twente and VentureLab. These incubators are located near and are closely linked to the University of Twente. An analysis of this business and science park and its incubators showed that most companies are not actually technostarters or have been contacted before for similar research. Alternatively, the other technical universities, Eindhoven and Delft, are investigated for their linkages to science and business parks, incubators and technostarters. Eindhoven has a large business and science park called Brainport Eindhoven with its own incubator called Brainport Development. This incubator tends to focus on larger projects and organisations, functioning more as an accelerator. The science and business park in Delft is called Science Port Holland and is home to the YES!Delft incubator. This incubator meets the sample criteria very well.

The YES!Delft incubator supports a total of 107 companies. 87 of these companies are presented on the website of the incubator. Of these companies 61 were selected for this research. 34 of these are small technostarter companies founded between 2006 and 2012, which are labelled as start-up by YES!Delft. The other 27 organisations are labelled as growing companies and are founded between 2005 and 2011. These technostarters in Delft are approached by telephone and are asked to participate in and contribute to this research. In total of these 61 companies, 15 were not contacted due various reasons, such as not answering the phone, being located at alternative locations or not meeting the sample criteria. Of the 46 companies that were contacted, a total of 22 companies agreed to participate in the research. A telephone script was developed to help convince the entrepreneurs to participate.

Some other interesting homogeneous characteristics of the sample are that all companies are founded between 2007 and 2012, with a majority being founded after 2008 (82%). 21 entrepreneurs have an academic background, mostly in physical sciences (84%) and all entrepreneurs in the sample are men. Besides the homogeneous characteristics, there are some heterogeneous characteristics. The sample contains a different set of work and entrepreneurial experience, different age groups, different organisational sizes (in number of employees) and are functional in different type of industries and markets, ranging from the IT business to industrial solutions.

4.2 Operationalization and measurement tools

4.2.1 Qualitative method

In order to measure the cognitive processes used by the entrepreneur to set up and create businesses, the think aloud method is used. The think aloud method allows the measurement of knowledge and is used for human problem solving (Van Someren et al., 1994). This method consists of collecting verbal think aloud protocols and analysing the protocols to obtain data of cognitive processes, such as effectuation and causation. The entrepreneurs are given a set of typical problems related to entrepreneurship and are asked to think aloud continuously as they solve these problems. They state directly what they think about when solving a problem, showing what goes through the mind of the entrepreneurs. The entrepreneurs verbalise their thoughts as they emerge without trying to explain, analyze, or interpret these. In turn, the researcher attempts to explain the sequential process of thoughts (Ericson & Simon, 1981). This method can be used to investigate differences in problem solving abilities between people (Van Someren et al., 1994). These problems are solved using different cognitive frameworks influencing the decisions being made. In addition, Sarasvathy also used this method to construct and validate her theory of effectuation (Sarasvathy, 2001, 2008). Hence, think aloud protocols are a suitable method to collect data on causation and effectuation.

Although the think aloud method is useful and accepted, it does pose some threats to validity and reliability. Common threats to verbal data are invalidity due to disturbance of the cognitive process, invalidity and incompleteness due to memory errors and invalidity and incompleteness due to interpretation by the subject (Van Someren et al., 1994). These threats are less relevant to the think aloud method, because the entrepreneurs in the sample are not disturbed during the session. It is made sure the setting is as comfortable as possible, with a focus on the task at hand. Clear instructions are given and after a short warm up question the role of the researcher is limited as much as possible. No feedback is

allowed to be given during the session. The only role the researcher has during the session is to keep the participant thinking aloud. Memory errors are absent, because thoughts are spoken aloud when they emerge. The think aloud method, therefore, is not introspective or retrospective (Van Someren et al., 1994). Invalidity due to the interpretation of the subject is also less relevant, because the think aloud method is about the cognitive process of thinking about how to deal with certain problems and making decisions under these circumstances. However, thinking aloud threats the validity of reports (Van Someren et al., 1994). There is incompleteness due to synchronization problems and invalidity due to problems with working memory. Thinking aloud and verbalizing happen simultaneously. However, verbalisation often cannot keep up with the cognitive process, causing synchronization problems. If the verbalisation of the cognitive process is complex and difficult, problems with working memory can occur, threatening validity.

The purpose of using the think aloud method is to collect data on cognitive processes. Therefore, the protocols are recorded. These recordings are transformed into transcripts and these transcripts are analysed using content analysis (Babbie, 2009). A business case, about creating a venture, with 10 decision problems is used during the think aloud session. The business case developed by Sarasvathy (2008) has been used as the basis. This case is quite specific and is related to the IT industry. To keep the situation general, the case has been redeveloped into a simple coffee selling venture, with the same decision problems, but in a different, more general and simplistic context. The business case can be requested from Mr. Stienstra, the first supervisor for this master thesis. The thoughts spoken aloud by the entrepreneurs are recorded and transcribed as literally as possible. In turn these transcripts are coded using the antecedents of causation and effectuation. Coding entails the transformation of raw, in-depth, qualitative data into standardized data (Babbie, 2009). This data is then used to measure the degree (in percentages) an entrepreneur either uses causation or effectuation. The following coding schema is used:

Table 2: Effectual and causal codes, based on Sarasvathy (2008: p.55)

Causation	Effectuation
P: Prediction of the future	C: Creation of the future
G: Goal driven / ends based	M: Means based
R: Expected returns	L: Affordable loss
B: Competitive analysis	A: Use of alliances and/or partnerships
K: Avoidance of contingencies	E: Exploiting contingencies
X: Causal (no subcategory)	N: Effectual (no subcategory)

To maintain the reliability after coding the transcripts, a second person is coding the transcripts as well. The interrater agreeability is calculated using Krippendorff's alpha. Krippendorff's alpha (α) is a reliability coefficient used to measure the agreement between observers and coders (Krippendorff, 2007). The Krippendorff's alpha is preferred over other reliability measures such as Scott's Pi, Cohen's Kappa and Fleiss's Kappa (Hayes & Krippendorff, 2007), because it can be applied to any number of coders, any number of variables, any level of measurement, can deal with missing data and is not influenced by sample size (Krippendorff, 2007). The alpha is calculated using a custom SPSS macro

developed by Hayes & Krippendorff (2007). The interrater agreeability calculated for this research produced a mean alpha of initially .5777. After revision from both coders the mean alpha for the coding increased to .9467. This indicates that coding the antecedents is open for interpretation, because they are overlapping and intertwining concepts. However, after a meeting explaining the different points of view on the interpretations, a much larger alpha was produced.

4.2.2 Quantitative method

The quantitative part of this research is executed by a survey. After the entrepreneurs finished the think aloud session they completed a questionnaire, which has two functions. The first function of the questionnaire is to control for the qualitative measures on effectuation and causation, improving the validity and reliability of the measure (Babbie, 2009). The data from the questionnaire is compared with the data from the think aloud protocols. The second function of the questionnaire is to measure entrepreneurial learning and the environmental variables. Data on entrepreneurial learning and the environmental variables is only gathered by the questionnaire. All operationalizations of the variables are taken from existing literature, which developed validated and reliable measures for all constructs.

Operationalizations for effectuation and causation are taken from Chandler et al. (2011), which developed validated quantitative measures with acceptable Cronbach's alpha levels. They found causation to be a uni-dimensional coherent construct and effectuation to be a multi-dimensional formative construct. Therefore, causation is measured by seven likert-type items. Effectuation is split into four sub-constructs: experimentation, affordable loss, flexibility, and pre-commitments. Experimentation is measured by four likert-type items, affordable loss is measured by three likert-type items, flexibility is measured by four likert-type items and finally, pre-commitment is measured by two likert-type items. These items all use a 5 point likert type scale ranging from "fully agree" to "fully disagree".

Measurement instruments for entrepreneurial learning are taken from Su et al. (2011). In turn they developed their measures based on works of Atuahene-Gima (2005), He & Wong (2004), Katila & Ahuja (2002) and Yalcinkaya et al. (2007). Su et al. (2011) slightly modified how the questions were formulated, but with the same core items to measure the constructs. Their research achieved a higher Cronbach's alpha of 0.849 - 0.92 respectively. Exploration and exploitation are both one-dimensional scales with five likert type items ranging from a five point likert scale from "to little or no extent" to "to great extent" (Su et al., 2011).

The environmental dynamism and heterogeneity scales are taken from Miller & Friesen (1982) and the environmental hostility scale from Covin, Slevin and Heeley (1999) to measure the external environmental variables. Miller & Friesen (1982) developed validated measures with respectable Cronbach's alpha levels (.74 for dynamism and .84 for heterogeneity), which are widely used. They also developed measures for hostility, but achieved lower levels of reliability. Therefore, the hostility measure is taken from Covin et al. (1999), which achieved a Cronbach's alpha of .71. Dynamism is measured as five likert-type items, hostility is measured as six likert-type items and heterogeneity is measured as four likert-type items by a five point likert scale ranging from "fully agree" to "fully disagree".

After the completion of the measurement the likert items are transformed into likert scales, creating so called latent variables (Field, 2005; Skrondal & Rabe-Hesketh, 2007). The

summation or averages of the likert items create the likert scales. These likert scales can be used as interval data so parametric statistical methods can be applied (Brown, 2011; Johns, 2010). Which items to include in the scales is determined by reliability analyses of Cronbach's alpha, which is applied to all separate subscales of the questionnaire (Brown, 2011; Field, 2005). Generally alpha levels of .6 - .7 are accepted as reliable and that those scales consistently reflect the construct it is measuring (Field, 2005; Johns, 2010). The reliability analysis produced results shown in table 3. Most scales used in the further analysis score Cronbach's alphas of > .7, only the effectuation subscale flexibility scored an alpha level which is under the benchmark (α=.515). Lower levels of Cronbach's alpha are still accepted in this research, because of the small sample size and the relative few items per scale.

Table 3: Reliability analysis

Scale	Used scale in further analysis	N of items	Cronbach's Alpha (α)
Causation	X	7	.760
Experimentation		4	.655
Experimentation without item 4	X	3	.717
Affordable loss	X	3	.788
Flexibility		4	.229
Flexibility without item 4	X	3	.515
(Pre) Commitments	X	2	.742
Exploratory learning	X	5	.633
Exploitative learning	X	5	.737
Environmental dynamism		5	.690
Environmental dynamism without item 1	X	4	.741
Environmental heterogeneity	X	4	.727
Environmental hostility		6	.593
Environmental hostility without item 3	X	5	.631

The final measurement instruments on the questionnaire are control variables. These variables are for the characteristics of the entrepreneurs, such as: age, gender, nationality, experience, educational background and the level of that education. Experience is included, because expert entrepreneurs use effectuation to a larger degree than novice entrepreneurs do (Dew et al., 2009; Read & Sarasvathy, 2005). Experience is measured as total working experience, experience as an entrepreneur and international working experience. Educational background and the level of that education are measured to see where their experience originates from and if the entrepreneurs have a technological background. Additionally, company characteristics, such as the founding date, industry the company is active in, number of employees and the function of the entrepreneur within the company, are measured. The full version of the questionnaire is found in appendix 1.

4.3 Method of analysis

The data gathered by think aloud protocols and the questionnaire are processed into a SPSS database. This software program is being used to explore the data and to do statistical analysis. The think aloud protocols are coded into the individual antecedents of effectuation and causation. The counts of de coded antecedents are used as data and degrees of both processes are calculated for each individual entrepreneur. The items measured by the questionnaire are recomputed into variables transforming discrete items into continuous variables. Some items are excluded from the analyses, because those items lower the reliability levels, as is mentioned in section 4.2.2 (table 3).

The variables are first analysed using univariate analysis to explore the underlying distribution of the variables, locating possible outliers and testing for the assumptions of parametric data. These assumptions are: data needs to be normally distributed, variance should be homogeneous throughout the sample, the data should at least be at an interval level and the data collected from different participants should be independent (Field, 2005). Independence and measurement levels are tested by common sense. The normal distribution is tested by the Kolmogorov-Smirnov test, the Shapiro-Wilk test and by screening histograms with a plotted normality curve. Finally, homogeneity is tested by the Levene's test for equal variance and is used when independent groups are compared (Field, 2005). If assumptions are not met, non-parametric tests will be used.

Bivariate methods are applied for identifying relationships between variables, specifically between entrepreneurial processes and entrepreneurial learning. A correlation matrix with Pearson's correlation and Spearman's Rho's correlation is calculated. Pearson's correlation (r) is used when assumptions for parametric tests for two or more variables are met. Spearman Rho (ρ) is a non-parametric measure for correlation, which is used when assumptions for parametric data have been violated by at least one of the variables in the bivariate correlation. A correlation matrix will show how variables are related (positively or negatively), how strong these are related (between 1 and -1) and if these relationships are significant. Significant levels of .01, .05 and .10 are used. The .10 alpha level is not used in mainstream data analysis, yet here it is used, because of the low sample size (n=22). The use of .10 alpha level increases the risk of making a type I error, which indicates when a hypothesis is actually true, it is still rejected (StatSoft, Inc., 2013). One tailed tests are used, because the direction of the relationship is hypothesised beforehand.

T-tests are being used to compare means. Independent sample t-tests are used to compare means of independent groups within the sample. Paired sample t-tests are used to compare differences in means within the sample that are not independent, such as the difference between the degree of causation and effectuation from the think aloud protocol data and the degree of causation and effectuation from the survey data.

More advanced statistical methods, such as factor analysis and multiple regression analysis, have been attempted to perform. However, the sample size is too small to conduct these tests and any attempts have failed to produce results. The results of these tests were mostly insignificant and inferences from the outcomes could not be drawn to provide valid and reliable conclusions. This decreases the statistical power of this research, which is explained as a limitation in chapter 6.

5. Results

In this section the results of the data are given. The data is first explored to check the distribution of causation and effectuation throughout the sample and to check if assumptions for parametric tests are met. Next, hypotheses are tested using correlation matrixes to investigate how the variables of entrepreneurial processes and entrepreneurial learning are related to each other. To compare differences among groups various t-test are used. In the final section of this chapter the influence of the external environment is included in the analysis.

5.1 Descriptive statistics

5.1.1 Exploring the Think Aloud Protocol data

The total amount of observations is 1486. 720 of these observations are causation (48,55%) and 766 observations are effectuation (51,55%). Looking more closely at causation the entrepreneurs showed mostly predictive, goal driven and competitive thinking (cumulative % = 67,78%). Focusing on effectual thinking entrepreneurs show a low degree of affordable loss (7,31%). The other antecedents are reasonably equal around 20%. The underlying distribution of the data obtained from the think aloud protocols are presented in table 4. This table represents averages for the whole sample. The same statistics have been calculated for each individual case as well, from which possible outliers can be located.

The skewness and kurtosis data show that some variables might not be normally distributed. This is confirmed by screening the histograms containing a normality curve plot. The Kolmogorov-Smirnov test and Shapiro-Wilk test point out significant results indicating that variables are not normally distributed. The variables which are normally distributed are: “Causation: goal driven, prediction of the future, total count” and “Effectuation: creation of the future”. When these variables are used simultaneously, parametric tests can be used. To correct the problems in the data a Log-transformation and a Square root transformation is used. The data is not normally distributed due to the presence of outliers and these methods deal with this problem (Field, 2005). This produced results for three of the non-normal variables; therefore, tests are used which do not rely on the normality assumption.

The data contains outliers, because there are differences in the amount of observations per case. The amount of observations per case ranges from 38 to 125. A solution to deal with this problem is to standardize the raw frequencies into proportions. Transforming the counts into an index score of proportions reduce the impact of outliers (Temple University, 2003). The standardized data indeed show fewer problems with normality, which is confirmed by the Kolmogorov-Smirnov test and Shapiro-Wilk test. The variables “Causation: No subcategory” and “Effectuation: Leverage contingencies” are not normally distributed. Again, when the latter variables are included in the analysis non-parametric tests are used, otherwise parametric tests are used.

In the main analysis the raw frequency data is used primarily, because the standardization possibly lowers the statistical power (Temple University, 2003). Due to the small sample size (n=22) the statistical power is already under pressure. However, the standardized data is used for comparison. When large deviations are observed these will be further analysed and reported in the results.

Table 4: Descriptive statistics for think aloud protocol data

	N	Mean	Std. Deviation	Total % of construct	Total % of observed data	Skewness[a]	Kurtosis[b]
Causation: Goal driven	22	6,682	3,617	20,42%	9,89%	,556	,329
Causation: Expected returns*	22	5,545	2,365	16,94%	8,21%	,674	-,204
Causation: Competitive analysis*	22	7,182	2,702	21,94%	10,63%	1,047	1,938
Causation: Avoid contingencies*	22	3,955	2,236	12,08%	5,85%	,006	-1,146
Causation: Prediction of the future	22	8,318	3,695	25,42%	12,31%	,738	-,025
Causation: No subcategory*	22	1,045	1,090	3,19%	1,55%	,388	-1,374
Causation: Total count	22	32,727	10,161	100%	48,55%	,801	,894
Effectuation: Means based*	22	8,955	5,786	25,72%	13,26%	1,355	,769
Effectuation: Affordable loss*	22	2,545	1,845	7,31%	3,77%	1,348	2,785
Effectuation: Alliances or partnerships*	22	6,955	2,853	19,97%	10,30%	1,079	,943
Effectuation: Leverage contingencies*	22	7,682	5,241	22,06%	11,37%	1,159	,391
Effectuation: Creation of the future	22	6,273	3,954	18,02%	9,29%	,438	-,817
Effectuation: No subcategory*	22	2,409	1,968	6,92%	3,57%	,809	,130
Effectuation: Total count*	22	34,818	16,285	100%	51,55%	1,150	,498

a. Std Error Skewness = .491

b. Std Error Kurtosis= .953

* Variables are not normally distributed

Table 5: Descriptive statistics for survey data

	N	Mean	Std. Deviation	Average %	% of construct	% of all scales	Variance	Skewness[a]	Kurtosis[b]
Causation	22	3,7143	,61088	50,95%	100%	20,61%	,373	-,109	,171
Experimentation	22	3,2727	,85224	49,05%	24,26%	19,26%	,726	-,229	-1,117
Affordable loss*	22	3,5455	,82645		24,78%	19,68%	,683	-,798	,209
Flexibility	22	4,1515	,47950		29,03%	23,04%	,230	,153	-,617
Pre-commitment*	22	3,1364	,99021		21,93%	17,41%	,981	-,296	1,213
Exploration	22	3,7182	,69188	51,77%			,479	-,014	-,673
Exploitation	22	3,4636	,71816	48,23%			,516	,142	-,494
Dynamism	22	3,0568	,80524				,648	,198	-,611
Heterogeneity	22	2,9318	,78369				,614	,686	,744
Hostility	22	2,7182	,66091				,437	-,325	-,057

a. Std Error of Skewness = .491

b. Std Error of Kurtosis = .953

* Variable is not normally distributed

5.1.2 Exploring the survey data

The distribution of the survey data is presented in table 5. The variables in the table are the variables which are constructed from the likert items, as mentioned in chapter 4 (also see table 3). The averages are recalculated into percentages to give an explicit description. The means indicate higher rates of causation and flexibility. Looking at the percentages, it gives a total degree of 50,95% for causation and a total degree of 49,05% for effectuation when the concepts are taken as dichotomies. Looking into more detail of this effectuation scale, it consist out of 24,26% experimentation, 24,78% affordable loss, 29,03% flexibility and 21,93% pre-commitment. On a total scale the individual scales are represented as 20,61% causation, 19,26% experimentation, 19,68% affordable loss, 23,04% flexibility and 17,41%, pre-commitment. These last figures are also represented in the means in table 5. For entrepreneurial learning these scales are divided into 51,77% exploration and 48,23% exploitation. All these distributions have also been calculated individually per case.

The skewness and kurtosis data indicate that the data is probably normally distributed. However, further analysis shows that this is not the case. Histograms with normality plots indicate problems, which are confirmed by Kolmogorov-Smirnov tests and Shapiro-Wilk tests. The variables Affordable loss and Pre-commitment, both effectuation sub-constructs, are not normally distributed. After transforming these variables using Log-transformation and Square root transformation, the tests for normality kept showing significant results, concluding that these variables are indeed not normally distributed. Therefore, non-parametric test are used when these variables are analysed. Entrepreneurial learning and the external environmental components show no problems with the normally, thus parametric tests are used when these variables are included in the analysis.

5.1.3 Comparing protocol data with survey data on entrepreneurial processes

Comparison of the data, obtained by the think aloud protocols and the questionnaire, show a noticeable difference. The protocol data show a small, but greater use of effectuation (51,55%), while the survey data show a small, but greater use of causation (50,95%). A paired sample t-test was used to measure if these differences are statistically significant. The results (paired sample t-test(21)=.709, p=.486) show that the differences between the data obtained from the think aloud protocols and the survey are not significant. Thus, it can be concluded that the quantitatively obtained data from the survey is supporting the think aloud protocol data, because they do not differ significantly. In addition, a correlation matrix is constructed to see if and how the variables from both methods are related. Surprisingly, the antecedents of causation from the protocols show weak negative relationships with the causation measure from the questionnaire, from which the relationship between expected returns and causation is significant. Furthermore, avoidance of contingencies and the total causation count show significant positive correlations with affordable loss. Means based and affordable loss are negatively related to causation and positively related to affordable loss, as expected. However, these same antecedents from the protocol are negatively related to flexibility and pre-commitment, which is unexpected. The other relationships in the correlation matrix are weak and not significant. The standardized data for the think aloud protocols show similar results, with fewer significant results. All significant results are shown in table 6.

Table 6: Significant correlations between think aloud protocol data and survey data

Think Aloud variable	Survey variable(s)	Correlation coefficient	p
Goal driven	Pre-commitment	-,430	<.05
Expected returns	Causation & Experimentation	-,287 & -,352	>.10
Causation: no subcategory	Experimentation	-,352	>.10
Causation total count	Pre-commitment	-,304	>.10
Avoid contingencies	Affordable loss	,423	<.05
Causation total count	Affordable loss	,355	>.10
Means based	Causation	-,407	<.05
Affordable Loss	Causation	-,315	<.10
Means based	Flexibility & Pre-commitment	-,352 & -,314	<.10
Affordable loss	Flexibility	-,340	<.10
Means based	Affordable loss	,401	<.05
Affordable loss	Affordable loss	,668	<.01

5.2 Testing the relationships between entrepreneurial processes and entrepreneurial learning

5.2.1 Antecedents of effectuation and entrepreneurial learning

In this section the bivariate methods described in section 4.3 are applied to see what the results of the data are for the expected relationships. The first hypotheses expect effectuation to be positively related to explorative learning and exploitative learning. It is expected that through the means based principle (H1a) and the leveraging of contingencies (H1b) effectuation is positively related with explorative learning. Moreover, it is expected that through the means based principle (H1c) and the use of strategic alliances and partnerships (H1d) effectuation is positively related with exploitative learning. Table 7 shows the correlation matrix for the effectuation think aloud protocol data and the explorative learning and exploitative learning variable measured by the questionnaire.

There are a number of noticeable observations to be made from the correlation matrix. First and most important, the correlation matrix shows that none of the expected relationships are significant. Second, the means based principle is weakly negatively related to explorative learning and exploitative learning, opposing the expected relationship directly. The leveraging of contingencies principle is weakly positively related to exploratory learning, which is in line with the hypothesis, yet is insignificant. The relationship between use of alliances or partnerships and exploitative learning is weakly negative and insignificant, completely contradicting the expectation. There are no significant relationships between effectuation and explorative learning. The strongest relationship present between effectuation and explorative learning is through creation of the future (r =.214). Third, there is a significant negative relationship between the affordable loss principle and exploitative learning, indicating that the more entrepreneurs invest in what they are willing to lose, the

less they learn by exploitation. Finally, explorative learning and exploitative learning are significantly positively related to each other. This indicates if explorative learning increases, exploitative learning also increases, which entails the existence of ambidexterity. The entrepreneurs in the sample transform their experience into knowledge using both modes of entrepreneurial learning.

Table 7: Correlation matrix: effectuation

		1	2	3	4	5	6	7	8	9
1	Think Aloud: Means based	1,000								
2	Think Aloud: Affordable loss	**,355***	1,000							
3	Think Aloud: Alliances or partnerships	**,370****	,053	1,000						
4	Think Aloud: Leverage contingencies	**,286***	,030	**,492*****	1,000					
5	Think Aloud: Creation of the future	**,347***	,103	**,385****	**,857*****	1,000				
6	Think Aloud: Effectual no subcategory	,245	,031	,191	**,465****	**,378****	1,000			
7	Think Aloud: Effectuation total count	**,546*****	,231	**,572*****	**,915*****	**,900*****	**,512*****	1,000		
8	Survey: Explorative Learning	-,163	-,067	,085	,167	,214	-,070	,216	1,000	
9	Survey: Exploitative Learning	-,055	**-,424****	-,020	,114	,178	-,254	,074	**,463****	1,000

* Correlation is significant at the 0.10 level (1-tailed).
**Correlation is significant at the 0.05 level (1-tailed).
***Correlation is significant at the 0.01 level (1-tailed).

Table 8: Correlation matrix: causation

		1	2	3	4	5	6	7	8	9
1	Think Aloud: Goal driven	1,000								
2	Think Aloud: Expected returns	,170	1,000							
3	Think Aloud: Competitive analysis	,158	,213	1,000						
4	Think Aloud: Avoid contingencies	,068	-,135	**,481****	1,000					
5	Think Aloud: Prediction of the future	,268	**,452****	**,305***	,065	1,000				
6	Think Aloud: Causal no subcategory	**,413****	,117	**,478****	**,344***	,046	1,000			
7	Think Aloud: Causation total count	**,639*****	**,563*****	**,699*****	**,378****	**,751*****	**,541*****	1,000		
8	Survey: Explorative Learning	,073	**-,399****	,088	,094	**-,451****	**,304***	-,231	1,000	
9	Survey: Exploitative Learning	**-,311***	-,198	,241	,049	**-,356***	,153	-,272	**,463****	1,000

* Correlation is significant at the 0.10 level (1-tailed).
**Correlation is significant at the 0.05 level (1-tailed).
***Correlation is significant at the 0.01 level (1-tailed).

Comparing this with data on causation, shown in the correlation matrix in table 8, there are more significant relationships, yet most are negatively related. Expected returns and predictions of the future are negatively related to explorative learning. Goal driven behaviours and predictions of the future are negatively related to exploitative learning. However, general causal behaviour (without a subcategory) is positively significantly related to explorative learning. Overall, the total frequencies of observations on effectuation are weakly positively related to entrepreneurial learning, while the overall frequencies of observation on causation are weakly negatively related to entrepreneurial learning, indicating some support for the hypotheses. Yet, H1a, H1b, H1c and H1d are rejected, because the support is not significant and opposing relationships are significant.

Although the hypotheses H1a – H1d are rejected, there is more data which can be analysed. The think aloud protocol data is supported by the questionnaire data and show no significant difference. Therefore, the survey data might be able to tell more about these relationships. The survey correlations in table 9 show that causation is significantly positively related to explorative learning. The strength of that relationship is surprisingly high, especially when the initial expected relationship is completely the contrary. Additionally, causation is also significantly positively related to the effectuation variables flexibility and pre-commitment, which are in turn positively related to entrepreneurial learning. Specifically, flexibility is strongly positively related to explorative learning, which is in line with the expectations. Pre-commitment, a scale which is related to both causation and effectuation (Chandler et al., 2011), is significantly positively related to both explorative and exploitative learning.

Table 9: Correlation matrix: survey

		1	2	3	4	5	6	7
1	Survey: Causation	1,000						
2	Survey: Experimentation	-,218	1,000					
3	Survey: Affordable loss	-,164	,037	1,000				
4	Survey: Flexibility	**,619*****	,062	-,080	1,000			
5	Survey: Pre-commitment	-**,514*****	-,256	,198	**,475****	1,000		
6	Survey: Explorative learning	**,525*****	-,036	,095	**,527*****	**,351***	1,000	
7	Survey: Exploitative learning	,220	-,004	,019	,155	**,419****	**,463****	1,000

* Correlation is significant at the 0.10 level (1-tailed).
**Correlation is significant at the 0.05 level (1-tailed).
***Correlation is significant at the 0.01 level (1-tailed).

5.2.2 Effectuation, causation and entrepreneurial learning

Hypothesis H1e entails entrepreneurs who use a higher degree of effectuation also have a higher degree of explorative learning. Looking at the relationships between effectuation variables and explorative learning this is largely true, providing some support. Table 7 with the think aloud protocol data shows that effectual relationships are more positive (or less negative) with exploration than exploitation, except for the means based principle. However, these relationships are quite weak, with few individual differences. The survey data from table 9 indicate similar results except for the variable pre-commitment. Degrees have also been calculated, as well for causation and effectuation and for exploration and exploitation.

The correlation of these degrees are very weak and non significant, because the distribution of entrepreneurial processes and entrepreneurial learning is near 50-50 for each concept. Yet, if the degree of effectual behaviour increases the degree of exploration also increases and exploitation decreases for the think aloud protocol data. This is in line with the expected relationship. However, results of the survey data are the opposite. This can be seen in the comparison between think aloud protocol data and survey data (table 6). Finally, the associations between the direct counts of the think aloud data show that if the amount of effectual observations increases, exploration and exploitation also increase slightly. Thus, there is a positive relationship, yet this relationship is too weak to be statistically significant. The survey data show two significant relationships between effectuation sub-constructs, flexibility and pre-commitment, and exploration, yet flexibility is equally as strong and pre-commitment is less strong than the relationship between causation and exploration. When these effectuation sub-constructs are recalculated into a single average effectuation construct, the results are that effectuation is significantly positively related to both exploration (r = .497, p < .05) and exploitation (r = .373, p < .05). Effectuation remains positively and significantly related to exploration, yet causation has an even stronger relationship with exploration (r = .525, p < .01). Thus, due to a lack of significance and stronger relationship between causation and exploration, H1e is rejected.

Hypothesis H2 suggests the opposite logic compared to H1e. The higher the use of causation the higher the use of exploitation as a mode of entrepreneurial learning is expected. Yet the results are mixed looking at the correlations between causation antecedents and entrepreneurial learning in table 8. Expected returns, competitive analysis and prediction of the future are more positively (or less negatively) related to exploitation. In contrast, goal driven, avoidance of contingencies and the no subcategory construct are more positively (or less negatively) related to exploration, even with some significant results. In addition, the survey data (table 9) suggest a stronger positive relationship between causation and exploration than causation and exploitation, which contradicts the expectations. The calculated degrees of causal behaviour show the opposite results. If the degree of causal behaviour increases the degree of exploration decreases and exploitation increases, as is expected. Comparing the latter with the total amount of causation observations from the think aloud protocol, show yet another result. If the amount of causation observations increases, both exploration and exploitation decrease, yet insignificantly (see table 8). There is little support for H2, the results which are significant contradict the expected relationships and therefore H2 is rejected.

On average, the entrepreneurs show very similar behaviour. The use of effectuation and causation is close, both for the think aloud protocol measurement as the questionnaire measurement. The use of explorative and exploitative learning is also close. Therefore, it is hard to locate differences. More research is required, especially quantitative research to rule out any coincidence. To explore the ideas of H1e and H2 a bit further, independent sample t-test is used to compare the means. First, the mean for the degree of effectuation was used (51,55%). Scores above this mean indicate a higher use of effectuation, contrary scores below this mean indicate a higher use of causation. Next, a mean for exploration and exploitation is calculated for both effectuation and causation. These means are compared and tested for differences. The results are shown in table 10.

First, assumptions of normality and equality of variance are tested. All assumptions have been met. Tests of normality show no significant results for both groups, indicating that

variables are normally distributed. Levene's test of equal variance is not significant indicating that equal variance can be assumed. The means for both exploration and exploitation are higher for effectuation than causation. The higher mean for exploration and effectuation is in line with the prediction in H1e. The lower mean for exploitation and causation contradicts the prediction in H2. The t statistic and the associated p statistic are not significant for both variables, indicating that the difference between the means is not great enough and that the hypotheses should still be rejected. Using higher cut-off points, creating even greater differences in the use of effectuation and causation produce similar non significant results. Thus, greater use of either effectuation or causation of the entrepreneurs in this sample does not significantly relate to greater use of either explorative learning or exploitative learning. The same analysis is done for the survey data and also produced similar insignificant results, with even smaller differences between the means.

Table 10: Independent sample t-test

					Levene's test		T-test equality of means	
Variable		N	Mean	Std. Dev.	F	p	T(df)	p
Exploration	Effectuation	10	3,94	,82219	2,727	,114	1,404 (20)	,176
	Causation	12	3,53	,52800				
Exploitation	Effectuation	10	3,72	,75542	,124	,729	1,582 (20)	,129
	Causation	12	3,25	,63889				

5.3 Environmental influences on the relationship between entrepreneurial processes and entrepreneurial learning

5.3.1 The influence of environmental dynamism

The perceived dynamism of the environment is believed to influence the relationship of entrepreneurial processes and entrepreneurial learning. In dynamic environments it is expected that effectuation has a stronger relationship with both exploration and exploitation (H3a), while in a more stable environment it is believed that causation has a stronger relationship with exploitative learning (H3b). The correlation between antecedents of effectuation from the think aloud protocols and dynamism is relatively weak, except for the means based principle. This principle is positively and significantly related to dynamism (p = .419, p < .05), indicating that the more dynamic the environment is perceived to be, to more entrepreneurs use the means available to them. However, all other antecedents seem to be almost unrelated. Even the total count of effectuation observations is unrelated (p = .002, p > .10) to dynamism, which is contrary to the expectation. The survey data show a positive significant relationship between experimentation and dynamism (r = .375, p < .05), and a negative significant relationship between pre-commitments and dynamism (p = .522, p < .01). The relationships between experimentation and dynamism is expected; however, there is a negative (non significant) relationship between flexibility and dynamism, which is surprisingly, because it is expected that through the flexibility and experimentation of effectuation, the process is better in coping with environmental dynamism. Exploration and exploitation are both negatively and insignificantly related to dynamism, indicating that dynamism does not facilitate ambidexterity. These relationships are the direct overall

relationships. Do these relationships hold if the environment is perceived dynamic by the entrepreneur, or will the relationships be as expected?

From the total sample size (n=22) sixteen entrepreneurs perceive the environment as more dynamic. From these sixteen entrepreneurs, five entrepreneurs show a higher degree of effectuation and eleven entrepreneurs show a higher degree of causation. Six entrepreneurs perceive their environment as more stable, from which five entrepreneurs show a higher degree of effectuation and one entrepreneur show a higher degree of causation. The group sizes are small and therefore any differences between their means are statistically insignificant (tested by an independent sample t-test). Yet it can give a brief indication of how the variables are related under perceived dynamic conditions.

In a perceived dynamic environment, effectuation is positively related to both explorative and exploitative learning. However, hypothesis H3a is only partly confirmed, because the relationship with explorative learning is significant (p = .467, p < .05), but the relationship with exploitative learning is too weak (p = .078, p > .10). Thus, it can be concluded that a perceived dynamic environment moderates the relationship between effectuation and explorative learning, such that effectuation and explorative learning have a stronger relationship under dynamic conditions. The five entrepreneurs from the sample, who use a higher degree of effectuation in a perceived dynamic environment, learn by using exploration as a mode to transform experience into knowledge. So when the degree of effectuation increases per entrepreneur, so does the degree of explorative learning per entrepreneur, as is expected, moderated by a dynamic environment. The effectual entrepreneurs in a stable environment (n=5) show the opposite behaviour. Here effectuation is significantly negatively related to explorative learning (p = -.754, p < .05) and negatively, but insignificantly related to exploitative learning (p = -.377, p > .10). Thus, when the environment is perceived to be stable, the use of effectuation is decreasing the use of exploration and exploitation.

When the environment is perceived to be stable, one entrepreneur used a higher degree of causation, which is significantly negatively related to both explorative (r = -.698, p < .10) and exploitative learning (r = -.661, p < .10). Causation is used by eleven entrepreneurs under a perceived dynamic environment. Here the degree of causation is negatively related to entrepreneurial learning, but is insignificant (r = -.104 & -.175, p > .10). This outcome increases the support for hypothesis H3a, because when the degree of causation increases the use of entrepreneurial learning decreases. Hypothesis H3b is rejected, because it lacks support, but most importantly it has very low statistical power, because only one case fell in this category.

5.3.2 The influence of environmental hostility

It is expected that effectuation has a stronger relationship with entrepreneurial learning under perceived environmental hostility (H4a) and causation has a stronger relationship with exploitative learning in perceived benign environments (H4b). These hypotheses are quite similar to the environmental dynamism, but now the influence of hostility is tested. Hostility is directly positively and significantly related to the goal driven principle (r = .315, p < .10), prediction of the future principle (r = .382, p < .05) and the total causation count (r = .316, p < .10). In turn hostility is positively significantly related to effectuation antecedents of leveraging of contingencies (p = .378, p < .05), creation of the future (r = .479, p < .05), no subcategory (p = .392, p < .05) and total effectuation count (p = .386, p < .05). This implies that an increase of hostility also increases the use of both processes. The relationship with

effectuation is slightly stronger, implying that use of effectuation is greater than causation under perceived hostile conditions. The survey data show a negative significant relationship between hostility and causation (r = -.303, p < .10), and hostility and flexibility (r = -.360, p < .10). The relationship between causation and hostility is as expected, but similar to dynamism, the relationship between flexibility and hostility is surprising.

From the sample of entrepreneurs (n=22) fifteen entrepreneurs perceive the environment as hostile and the other seven as more benign. From these fifteen entrepreneurs six use a higher degree of effectuation and nine use a higher degree of causation. From the other seven entrepreneurs four use a higher degree of effectuation and three use a higher degree of causation. An independent sample t-test in table 11 shows that in a perceived benign environment there is a statistical significant difference between the exploratory mean for causation and effectuation. The exploratory mean for effectuation is significantly higher than for causation, indicating that in a perceived benign environment the use of exploration by entrepreneurs who use a higher degree of effectuation is significantly higher.

Table 11: Independent sample t-test for perceived benign environment

					Levene's test		T-test equality of means	
Variable		N	Mean	Std. Dev.	F	p	T(df)	p
Exploration	Effectuation	4	4,35	,300	3,329	,128	2,942 (5)	,032
	Causation	3	3,20	,721				
Exploitation	Effectuation	4	4,00	,327	1,429	,286	,624 (5)	,560
	Causation	3	3,80	,529				

Looking at the correlations between entrepreneurial processes and entrepreneurial learning in a perceived benign environment shows that effectuation is significantly positively related to explorative learning (r = .572, p < .10). On the contrary, causation is negatively related to explorative learning, but is insignificant (r = -.450, p > .10). However, this does not confirm any hypothesis yet. It is expected that effectuation has a stronger relationship with entrepreneurial learning in a hostile environment and the t-test show no statistical significance there. Effectuation seems to be almost unrelated to entrepreneurial learning under hostile conditions (r = -.037 & .003, p > .10) according to correlation figures. The difference that is highlighted in benign environments does not exist in hostile environments. There are no significant correlations, so H4a and H4b are rejected.

The survey data show another result. In benign environments causation (r = .660, p > .10) and flexibility (r = .724, p > .05) are significantly positively related to exploratory learning. No significant relationships with exploitative learning exist in benign environments. These relationships are quite similar in hostile environments. Causation is positively and significantly related to explorative learning (r = .408, p < .10) and flexibility (r = .391, p < .10) and pre-commitment (p = .476, p < .05) are also positively and significantly related to explorative learning. Pre-commitment, at the same time, is also positively and significantly related to exploitative learning (p = .382, p < .10). Overall, the effectuation variables are positively and significantly related to entrepreneurial learning (r = .656, p < .01 & r = .385, p < .10). Thus, it can be concluded that the survey data supports H4a and rejects H4b, because

the data tell that under conditions of hostility the degree of effectuation increases simultaneously with the degree of entrepreneurial learning.

5.3.3 The influence of environmental heterogeneity

The different industries and markets an organisation is active in can influence the entrepreneurial process and entrepreneurial learning. It is expected that in a heterogeneous environment effectuation is stronger related to explorative learning (H5a) and causation is stronger related to exploitative learning in homogeneous environments. Environmental heterogeneity is negatively related to all antecedents of both causation and effectuation, indicating that the more heterogenic an environment is perceived to be, the lower the use of causation and effectuation. However, causation (r = -.606, p < .01) has a stronger negative relationship than effectuation (p = -.446, p < .05). The survey data give results more in line with the expectations. Affordable loss (p = -.361, p < .05) is negatively related to heterogeneity, which makes sense, because if someone is investing what they are willing to lose than that would be more difficult in different industries and markets with different competition and customer buying habits. Flexibility (r = .515, p < .01) and pre-commitment (p = .356, p < .10) are positively related to heterogeneity. The more flexible an entrepreneur is and the more pre-commitments an entrepreneur makes, the better they supposedly can deal with the heterogeneity of the environment. Finally, explorative learning is also positively related to heterogeneity (r = .297, p < .10). Operating in different industries requires a relationship with explorative learning, because an entrepreneur can learn from new and different environments it is active in and can apply this knowledge in other markets.

From all the entrepreneurs (n=22) nine operate in a perceived homogeneous environment, from which five use a higher degree of effectuation and four use a higher degree of causation. Thirteen entrepreneurs operate in a perceived heterogeneous environment from which five uses a higher degree of effectuation and eight uses a higher degree of causation. There are statistically significant differences between groups who perceive the environment as heterogeneous, as is presented in table 12. The exploratory and exploitative mean for effectuation is significantly higher than for causation. This implies that entrepreneurs who use a higher degree of effectuation use a higher degree of explorative and exploitative learning, which is in line with H5a. However, H5a did not expect that there would also be a significant difference for exploitative learning as well. In homogeneous environments causation has a greater exploitative mean than effectuation, which is supporting H5b. However, this result is not significant.

Table 12: Independent sample t-test for perceived heterogeneous environments

					Levene's test		T-test equality of means	
Variable		N	Mean	Std. Dev.	F	p	T(df)	p
Exploration	Effectuation	5	4,28	,701	,462	,511	2,206 (11)	,050
	Causation	8	3,53	,534				
Exploitation	Effectuation	5	4,20	,529	,380	,550	2,983 (11)	,012
	Causation	8	3,13	,684				

The correlations between entrepreneurial processes and entrepreneurial learning for heterogeneous environments show a positive significant relationship between leveraging of contingencies and explorative learning (p = .496, p < .05). This supports hypothesis H5a. However, no other variable, including the total effectuation count, is positively and significantly related. The survey data show positive significant data for flexibility (r = .630, p < .05) and pre-commitment (r = .546, p < .05) which supports the hypothesis. However, experimentation is negatively and significantly related to exploratory learning, which counters the expectations. Therefore, hypothesis H5a, based on the correlation figures and the independent sample t-test, is partly confirmed.

When the environment is perceived homogeneous there are no positive correlations between causation and exploitative learning, contrary to the expectations. Expected returns (r = -.548, p < .10) and the total count of causation (r = -.607, p < .05) show negative significant relationships, opposing hypothesis H5b. The survey data show a positive relationship, yet not significant. In addition with the results from the independent sample t-test, hypothesis H5b is rejected.

Finally, there are some other interesting results. Leveraging of contingencies is positively and significantly related to both explorative and exploitative learning under heterogeneous conditions, indicating that the leveraging of contingencies could facilitate ambidexterity. Moreover, the survey data show a positive and significant relationship for pre-commitments with both explorative and exploitative learning, similar to the leveraging of contingencies, indicating that pre-commitments could support this facilitation of ambidexterity. Competitive analysis is significantly positively related to exploitative learning under heterogeneous conditions, which implies that if the environment is perceived to be heterogeneous, entrepreneurs increasingly analyse their competitors and increasingly learning by exploitation. This makes sense, because by improving products and processes organisations are better to cope with the competition.

6. Discussion, conclusion, limitations and future research

In this final chapter the results presented in the previous chapter are discussed and explanations for certain unexpected results are given. After the discussion, the conclusion is drawn, answering the main research question. In the very last section the limitations of this research are described and future research directions are presented simultaneously.

6.1 Discussion

It was expected that the antecedents of effectuation, the means based principle and leveraging of contingencies was positively related to exploration. In contrast, the means based principle and the use of alliances and partnerships was expected to be positively related to exploitation. Through flexibility and the use of experimentation, effectuation was believed to be positively related to both modes of entrepreneurial learning, creating ambidexterity. However, results on hypotheses H1a, H1b, H1c and H1d were all insignificant and rejected. Antecedents of effectuation, measured by the think aloud protocols in this sample, seem to be almost unrelated to entrepreneurial learning. More research is needed to investigate if effectuation and entrepreneurial learning are indeed unrelated. Future research could use other units of analysis or use larger sample sizes. For causation there are significant relationships with entrepreneurial learning. These relationships; however, are negative, implying that if the use of causation increases the use of entrepreneurial learning decreases. This result can be explained, such that causation is more often applied in more mature stages in the lifecycle of organisations. In the early stages of a venture effectuation is argued to be more suitable, while moving on to later stages there is often a transition towards a more causational approach to entrepreneurship. Therefore, learning does not take place during the entrepreneurial process anymore. However, this argument is not yet supported by empirical evidence, which requires further research. The questionnaire presented some results which are more in line with the expectations. The sub-construct of effectuation, flexibility and pre-commitment, are related to explorative learning and pre-commitment is also related to exploitative learning. In contrast, causation is also positively related to explorative learning, which is surprising, but can possibly be explained by the long term implications of both concepts.

Although it is expected that effectuation can entail ambidexterity through its flexibility, the relationship with explorative learning is expected to be stronger than the relationship with exploitative learning. In contrast, the relationship between causation and exploitative learning is expected to be stronger. Results show that the hypotheses for both expectations are rejected. This implies that an increase in the use of effectuation does not necessarily facilitate an increase in exploratory learning for the entrepreneurs in this sample. There is some support for this expectation, but the results are not significant. When the sub-constructs on the questionnaire are recalculated into a single effectuation measure, significant results are found for the relationship between effectuation and exploration. However, the relationship between causation and exploration is even stronger, which causes the hypothesis to be rejected. These results are surprising and a proper explanation is not yet found. More research with other units of analysis of large sample sizes should be able to give more clearance about if these expected relationships are actually true and if not, why they are not true. An explanation for this sample is that the behaviours of the entrepreneurs are quite similar. The differences are not large enough to be statistically significant. If more data is collected and compared, more conclusive results could be produced. However, a partial explanation has been found. When the control variable company age is included in the

analysis there is a statistical significant difference between the exploratory and exploitative means for effectuation and causation for older companies. Older companies are the companies which are aged above the mean age in the sample. The entrepreneurs of these companies show a higher use of exploration and exploitation when there is a higher degree of effectuation (independent sample t-test (exploration) = 2,309, df = 10, $p < .05$ & independent sample t-test (exploitation) = 2,420, df = 10, $p < .05$). This offers only a partial explanation, because it is expected that the use of causation increases over time as the organisation matures and the environment becomes more predictable and less uncertain.

Finally, the relationships might be depended on the environmental conditions entrepreneurs and their ventures find themselves in. Entrepreneurs are often found in dynamic and hostile environments. The influence of heterogeneity of the environment is also checked, because entrepreneurs can be active in a different set of industries and markets. Effectuation is expected to be more suitable in dynamic, hostile and heterogeneous environments and therefore the relationships with entrepreneurial learning under those conditions should be stronger. The contrary is expected for the relationship with causation. Dynamism moderates the relationship between effectuation and entrepreneurial learning such that there is a significant positive relationship with exploration and a positive non significant relationship with exploitation. Therefore, that hypothesis is partly confirmed. On the contrary, causation is not significantly related to exploitation in a stable environment. This could not be checked, because there was only a single entrepreneur with a higher degree of causation in a stable environment.

Environmental hostility does have a significant effect on the relationship between entrepreneurial processes and entrepreneurial learning. However, an opposite effect from the expectation is found. In a benign environment there is a significantly higher exploratory mean for effectuation. This indicates that that in a perceived benign environment an increase in the use of effectuation also increases exploration. This is the opposite of the expectations and an explanation has not been found in the data. A possible explanation is that entrepreneurs who use a higher degree of effectuation perceive the environment to be less hostile, because they are using more effectuation. Effectuation possesses the flexibility to better cope with this hostility and therefore the entrepreneurs perceive the environment as more benign. If that is the case, the results would support the expectations. To give a proper explanation more research is required which can provide empirical evidence.

Finally, the role of the perceived heterogeneity of the environment is investigated. Heterogeneity moderates the relationship of effectuation and entrepreneurial learning such that there is a positive and significant relationship. It was expected that there would be a positive relationship with just exploration, but in a heterogeneous environment effectuation can facilitate ambidexterity for the entrepreneurs in this sample. The results for causation are in line with the expectations. The exploitative mean for causation in a more homogeneous environment is greater than for effectuation, but the difference is insignificant. Therefore, heterogeneity does not significantly moderate the relationship between causation and entrepreneurial learning for this sample.

6.2 Conclusion

Besides the empirical contribution of this research to the entrepreneurship literature, a research gap is filled between entrepreneurial processes and learning. The purpose of this research was to see if and how entrepreneurial processes are related to entrepreneurial

learning. From the results in chapter 5, several inferences can be drawn to answer the main research question. The research question of this research is: “To which extent is effectuation and causation related to entrepreneurial learning modes and to which extent are these moderated by external environmental components?” There is support for the hypotheses that answer this question. However, support is often partly or too weak to be statistically significant. The extent to which effectuation is related to entrepreneurial learning is therefore lower than expected in this research. The antecedents of effectuation are very weakly related to entrepreneurial learning. If the antecedents are recalculated together there is a slightly stronger relationship. Fortunately, the results from the questionnaire indicate that there is a relationship between effectuation and entrepreneurial learning; however, this relationship needs more investigation. From this study it can be concluded that a greater use of effectuation or causation, for the entrepreneurs in this sample, does not significantly relate to greater use of either explorative or exploitative learning. Therefore, it seems that the predominant logic of the entrepreneur does not influence how entrepreneurs learn. It would be interesting to see if this result holds for other type of samples, which different characteristics, perhaps less homogeneous.

The second part of the question is if the existing relationships are moderated by external environmental components. The simple answer to this is yes. Under conditions of environmental dynamism hostility and heterogeneity the relationships change with different significant results. Dynamism shows significant correlations, but the difference in means is not great enough too significant. Therefore it is concluded that the extent of moderation by dynamism is limited. Under heterogeneity the difference in means are statistically significantly, indicating that under conditions of heterogeneity, effectuation has a quite strong relationship with entrepreneurial learning. Therefore, it can be concluded that perceived heterogeneity has a significant moderating effect. The more heterogeneous an environment is, the stronger the relationship between effectuation and entrepreneurial learning. For hostility this effect also exists, but contrary to the expectations. Therefore it can be concluded that the more benign the environment is perceived, the stronger the relationship between effectuation and exploration. This implies that when the environment is perceived to be benign, there is a higher use of explorative learning which is affected by the predominant logic of the entrepreneur, in this case, effectuation. So in general it can be concluded that the external environment moderates the relationship between entrepreneurial processes and entrepreneurial learning to significant extent.

Entrepreneurship is developing as a vital, dynamic and relevant field of the social sciences and is an emerging and growing field of research. The theoretical implication of this study is to provide empirical research for entrepreneurial literature, possibly facilitating theory building for both entrepreneurial processes and learning. The exploratory nature of this study gives some indications and support for possible relationships, but more research is required to develop these theories further. More specifically, effectuation is applied to the learning field in order to explore learning differences. Besides the theoretical implications there are some practical implications. The entrepreneurial process should not only be understood as what entrepreneurs should learn, but also how and when learning occurs. This research shows, to some extent, when a certain predominant logic is used by the entrepreneur, certain desired learning effects can be created under various perceptions of the environment. Experience is transformed into knowledge, which is activated by cognitive mechanism. This facilitates individual differences between entrepreneurs, which determine why, when and how certain

individuals recognize, discover, create and exploit opportunities. Finally, learning during the entrepreneurial process can create a competitive advantage by possession of different or better prior knowledge and the development of (new) skills and abilities. This influences the decisions made by entrepreneurs, which in turn can influence venture performance. These implications should be interpreted with caution, because this study is not without limitations. The limitations are described in the following section.

6.3 Limitations and further research

From the previous discussion section there have been some references to limitations and suggestions for further research. The biggest limitation of this research is its sample size. For the qualitative part of this study a sample size of 22 is large enough, especially because the qualitative part can be used in comparison with other master theses which have been written about similar topics. However, entrepreneurial learning and the environmental variables are measured only quantitatively. For a quantitative analysis a sample size is 22 is simply not large enough. Therefore, generalisations of this research are under pressure and should be cautiously dealt with. However, this research does give an impression of how entrepreneurial processes are related to entrepreneurial learning in general. This limitation simultaneously provides an avenue for further research. The same research could be performed to see if these results are the same for other units of analysis. For example, these units of analysis could be other type of entrepreneurs or geographically located differently. Additionally, entrepreneurial learning might be measured by a verbal protocol analysis as well. A business case could be designed where antecedents of entrepreneurial processes and entrepreneurial learning could be identified. This way learning during the entrepreneurial processes is perhaps even better understood. Another fruitful possibility is to conduct a serious quantitative empirical research, from which inferential statistics could provide more conclusive results, with stronger statistical power.

In this study only basic statistics could be applied, while investigation of this research needs more advanced statistical methods of analysis to draw inferences from the data. Advanced statistical methods have been attempted, such as factor analysis, multiple regression analysis and ANCOVA. The output for these methods did not produce any notable or useful results and are therefore marked as a limitation.

Now the qualitative part is presented as if it is without limitations, unfortunately this is not the case. The qualitative method, the think aloud protocols, are sensitive to the setting in which the data is gathered (Van Someren et al., 1994). The entrepreneurs who participated in the research only had limited time available to solve the business case. Normally a period of maximum two hours is reserved to solve the business case. Most entrepreneurs notified that they only had 30 minutes – 45 minutes available for this research, which can imply that these entrepreneurs rush through the case, not thoroughly thinking all the problems through. However, most entrepreneurs indicated that they enjoyed participating in the research and usually took at least one hour to solve the business case. Furthermore, the coding of the protocols is sensitive towards different interpretation of the antecedents of the entrepreneurial processes. The interpretations of the coding can be different, because the antecedents of causation and effectuation make it two intertwining and overlapping concepts. Additionally, due to the available time for both coders it is almost impossible to code the protocols and then compare all codes for each individual case. The interrater agreeability for the first coding was problematic. Fortunately this was solved after revision, increasing the interrater agreeability to great extent.

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Appendix 1: Questionnaire

University of Twente Entrepreneurship questionnaire

This research is conducted on the University of Twente, Netherlands Institute for Knowledge Intensive Entrepreneurship (Nikos) under the EPICC (Entrepreneurial processes in a cultural context) project. The aim of the researchers is to find out if a relationship exists between the way entrepreneurs think and how they learn. Participating to this research will contribute to a better understanding of entrepreneurship and learning as a process. The data provided by you will only be available to the researcher and will be anonymous to the outside world.

General information

Name:

Gender:	○ Male ○ Female
Company name:	
Company founding date: (DD/MM/YYYY)	
Industry the company is active in:	
Total number of employees currently working:	
Function within the company:	
Educational background:	○ Social sciences ○ Life sciences ○ Health sciences ○ Physical sciences ○ Other:
Level of education:	○ Bachelor ○ Master ○ PhD ○ Other:
Total years of working experience:	
Years of experience as an entrepreneur:	
Years of international experience:	
Nationality:	
Date of birth: (DD/MM/YYYY)	

The entrepreneurial process

Please answer the following questions from "Fully disagree" to "Fully agree". (Causation) Please answer this questionnaire on the basis of reflecting on your own company. Please have a look at the following statements.

	Fully disagree	Disagree	Neutral	Agree	Fully agree
We analyzed long run opportunities and selected what we thought would provide the best returns	○	○	○	○	○
We developed a strategy to best take advantage of resources and capabilities	○	○	○	○	○
We designed and planned business strategies	○	○	○	○	○
We organized and implemented control processes to make sure we met objectives	○	○	○	○	○
We researched and selected target markets and did meaningful competitive analysis	○	○	○	○	○
We had a clear and consistent vision for where we wanted to end up	○	○	○	○	○
We designed and planned production and marketing efforts	○	○	○	○	○

Please answer the following questions from "Fully disagree" to "Fully agree". (Experimentation) Please answer this questionnaire on the basis of reflecting on your own company. Please have a look at the following statements.

	Fully disagree	Disagree	Neutral	Agree	Fully agree
We experimented with different products and/or business models	○	○	○	○	○
The product that we now provide is essentially the same as originally conceptualized	○	○	○	○	○
The product that we now provide is substantially different than we first imagined	○	○	○	○	○
We tried a number of different approaches until we found a business model that worked	○	○	○	○	○

Please answer the following questions from "Fully disagree" to "Fully agree". (Affordable loss)
Please answer this questionnaire on the basis of reflecting on your own company. Please have a look at the following statements.

	Fully disagree	Disagree	Neutral	Agree	Fully agree
We were careful not to commit more resources than we could afford to lose	○	○	○	○	○
We were careful not to risk more money than we were willing to lose with our initial idea.	○	○	○	○	○
We were careful not to risk so much money that the company would be in real trouble financially if things didn't work out	○	○	○	○	○

Please answer the following questions from "Fully disagree" to "Fully agree". (Flexibility)
Please answer this questionnaire on the basis of reflecting on your own company. Please have a look at the following statements.

	Fully disagree	Disagree	Neutral	Agree	Fully agree
We allowed the business to evolve as opportunities emerged	○	○	○	○	○
We adapted what we were doing to the resources we had	○	○	○	○	○
We were flexible and took advantage of opportunities as they arose	○	○	○	○	○
We avoided courses of action that restricted our flexibility and adaptability	○	○	○	○	○

Please answer the following questions from "Fully disagree" to "Fully agree". (Pre-commitment)
Please answer this questionnaire on the basis of reflecting on your own company. Please have a look at the following statements.

	Fully disagree	Disagree	Neutral	Agree	Fully agree
We used a substantial number of agreements with customers, suppliers and other organizations and people to reduce the amount of uncertainty	○	○	○	○	○
We used pre-commitments from customers and suppliers as often as possible	○	○	○	○	○

Entrepreneurial learning

Please answer the following questions from "To little or no extent" to "To great extent". (Exploration)
To what extent has your firm..

	To little or no extent	To a slight extent	To a moderate extent	To a considerable extent	To a great extent
acquired manufacturing technologies and skills entirely new to the firm?	○	○	○	○	○
learned product development skills and processes entirely new to the industry?	○	○	○	○	○
acquired entirely new managerial and organizational skills that are important for innovation?	○	○	○	○	○
learned new skills in areas such as funding new technology, staffing R&D function, training and development of R&D, and engineering personnel for the first time?	○	○	○	○	○
strengthened innovation skills in areas where it had no prior experience?	○	○	○	○	○

Please answer the following questions from "To little or no extent" to "To great extent". (Exploitation)
To what extent has your firm..

	To little or no extent	To a slight extent	To a moderate extent	To a considerable extent	To a great extent
upgraded current knowledge and skills for familiar products and technologies?	○	○	○	○	○
invested in enhancing skills in exploiting mature technologies that improve productivity of current innovation operations?	○	○	○	○	○
enhanced competencies in searching for solutions to customer problems that are near to existing solutions rather than completely new solutions?	○	○	○	○	○
upgraded skills in product development processes in which the firm already possesses significant experience?	○	○	○	○	○
strengthened our knowledge and skills for projects that improve efficiency of existing innovation activities?	○	○	○	○	○

Environmental factors

Environmental dynamism

Please answer the following questions from "Fully disagree" to "Fully agree".

	Fully disagree	Disagree	Neutral	Agree	Fully agree
Our firm must change its marketing practices very frequently	○	○	○	○	○
The rate at which products are getting obsolete in the industry is very high	○	○	○	○	○
Actions of competitors are hard to predict	○	○	○	○	○
Demand and consumer tastes are hard to predict	○	○	○	○	○
The production technology is subject to much and major change	○	○	○	○	○

Environmental heterogeneity

Please answer the following questions from "Fully disagree" to "Fully agree".

	Fully disagree	Disagree	Neutral	Agree	Fully agree
We are a very diversified firm and operate in unrelated industries	○	○	○	○	○
There are great differences amongst the products/services you offer, with regard to customers' buying habits	○	○	○	○	○
There are great differences amongst the products/services you offer, with regard to the nature of the competition	○	○	○	○	○
There are great differences amongst the products/services you offer, with regard to market dynamism and uncertainty	○	○	○	○	○

Environmental hostility

Please answer the following questions from "Fully disagree" to "Fully agree".

	Fully disagree	Disagree	Neutral	Agree	Fully agree
The failure rate of firms in my industry is high	○	○	○	○	○
My industry is very risky such that one bad decision could easily threaten the viability of my business unit	○	○	○	○	○
Competitive intensity is high in my industry	○	○	○	○	○
Customer loyalty is low in my industry	○	○	○	○	○
Severe price wars are characteristic of my industry	○	○	○	○	○
Low profit margins are characteristic of my industry	○	○	○	○	○

Questions and remarks

If you have any further questions or remarks please note them here:

Thank you for participating in this research. Your time and answers are greatly appreciated. The data will be carefully analysed and is anonymous for the outside world.