

UNIVERSITY OF TWENTE

MASTER THESIS

Blinded by passion?
**The effect of entrepreneurial passion
on the effectual approach of uncertainty
by entrepreneurs**

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Abstract

This study contributes to the understanding of what drives entrepreneurs to follow different decision-making approaches. There is a need for further understanding of the motivations and behavior of entrepreneurs using effectuation strategies. It is suggested that in an environment that poses many uncertainties an effectual approach is more likely to be used. On the other hand, it is also suggested that entrepreneurial passion makes entrepreneurs less sensitive to contrary market information and keeps them focused on their goals. This suggests a high degree of passion can blind entrepreneurs for uncertainties, which will lead to less effectual approaches. This study focusses on the way entrepreneurial passion effects the entrepreneurs' perception of uncertainty and their usage of effectuation strategies.

Validated measurement scales of decision-making strategies, entrepreneurial uncertainty and entrepreneurial passion were combined in a questionnaire and filled out by 90 Dutch software entrepreneurs. The analysis of the data shows that entrepreneurial passion for inventing, founding and developing is not significantly related to perceived state, effect and response uncertainty. Also, no moderating effect was found of the degree of entrepreneurial passion on the relationship between perceived uncertainty and effectuation strategies.

Passionate entrepreneurs do not seem to be blinded by their passion in pursuing their goals. Other individual factors seem to play a more significant role in predicting the decision-making strategy. More research is needed to explain the complex way entrepreneurial decisions are made.

Keywords: Entrepreneurship, decision-making process, effectuation, causation, uncertainty, state uncertainty, effect uncertainty, response uncertainty, entrepreneurial passion, passion for inventing, passion for founding, passion for developing,

Content

1. Introduction	4
2. Theoretical Framework	6
2.1 Effectuation	6
2.2 Uncertainty	8
2.3 Entrepreneurial passion	10
2.4 Conceptual model and hypotheses	11
3. Methods	13
3.1 Sample	13
3.2 Measurement	13
3.3 Method of analysis	14
4. Results	15
4.1 Validity and reliability	15
4.2 Distribution	15
4.3 Descriptives	16
4.4 Correlation analyses	17
4.5 Hypotheses testing	18
4.5.1 Relationship between uncertainty and decision-making strategies	18
4.5.2 Relationship between entrepreneurial passion and perception of uncertainty	19
4.5.3 Effect of passion on the relationship between uncertainty and decision-making strategies	21
5. Discussion, limitations & future research	23
5.1 Implications	23
5.2 Limitations	24
5.3 Future research	24
6. Conclusion	25
References	26
Appendix A: Questionnaire	29

1. Introduction

Entrepreneurship is a popular subject which is already researched numerous times. According to Fisher (2012) the traditional model of entrepreneurship is mostly based on economic thinking on which market there is more need for a particular product or service than there is supply and if an entrepreneur or firm recognizes this entrepreneurial opportunity. When the entrepreneur or firm recognizes it, they should evaluate if it is worth to chase this opportunity (Fisher, 2012). Most entrepreneurship researchers have assumed that entrepreneurs engage in rational goal-driven behaviors when pursuing opportunities (Perry, et al, 2011). Sarasvathy (2001), in contrast, argues that entrepreneurs can act towards a certain opportunity in two different approaches. Next to the rational goal-driven approach, which she calls 'causation', entrepreneurs also employ 'effectuation' processes when pursuing entrepreneurial opportunities.

When using effectuation processes, entrepreneurs start with a generalized aspiration and then attempt to satisfy that aspiration using the resources they have at their immediate disposal (i.e., who they are, what they know, and who they know). The goal is not clearly envisioned at the beginning. Using effectuation processes entrepreneurs remain flexible, take advantage of environmental contingencies as they arise, and learn as they go (Sarasvathy, 2001). Causal entrepreneurs try to predict the future as well as possible. Sarasvathy (2001) defines causation as follows: *"The causation process takes a particular effect as given and focus on selection between means to create that effect"* (p. 245). Causation works towards an expected return (Sarasvathy, 2001). The causation approach uses planning and prediction-oriented techniques.

Entrepreneurs use the effectuation approach to increase the robustness of entrepreneurial ventures to contingencies (Sarasvathy, 2001). Sarasvathy (2001) stated that *"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"* (p. 245). She explains that effectuation rests on the logic of control. Smolka et al. (2018) state that: *"effectuation is a more proactive and emergent way of dealing with uncertain environments, applying logical reasoning as a means of exerting control over the environment"* (p.573). In other words, effectuation is about reacting to opportunities and contingencies using the means which the entrepreneur already has. The effectuation approach represents a paradigmatic shift in the way that we understand entrepreneurship (Perry et al., 2011). Since its introduction the effectual approach of entrepreneurial decision-making is being researched (Chandler et al., 2011; Sarasvathy 2001).

To understand what drives entrepreneurs to follow different decision-making approaches research is looking into different topics. First of all, theory suggests effectuation is positively associated with uncertainty (Alsos et al., 2014; Chandler et al., 2011; Sarasvathy, 2001; Wiltbank et al., 2006). In a situation of uncertainty, it is challenging to define future outcomes and therefore the focus will be on the means at hand (Sarasvathy, 2001). The uncertainty an entrepreneur experiences is expected to heavily influence the choices entrepreneurs make. Entrepreneurial uncertainty will affect the decision-making process of entrepreneurs and therefore will likely be related to choosing an approach of effectuation or causation. But what is uncertainty? There are multiple types of uncertainty in entrepreneurship. Milliken (1987) distinguishes state uncertainty (unpredictable environment), effect uncertainty (unpredictable effects of the future environment on the organization) and response uncertainty (unpredictable consequences of a response choice). Kelvie et al. (2011) state that these different types of uncertainty influence entrepreneurs' decisions differently when they are faced with action-orientated decisions. Yet little research has been done to explore which type of uncertainty leads to effectual strategies (Welter & Kim, 2018).

Literature also suggests that an entrepreneur's choice of choosing a certain decision-making approach is based on their degree of entrepreneurial passion (Cardon, 2009). Entrepreneurial passion is defined as *"consciously accessible, intense positive feelings experienced by engagement in entrepreneurial activities associated with roles that are meaningful and salient to the self-identity of the entrepreneur"* (Cardon, 2009, p. 519). Passion makes entrepreneurs less sensitive to contrary market information and keeps them focused on their goals, even against better judgement (Vallerand et al., 2003). Therefore, it could be possible that entrepreneurs create some kind of tunnel vision because they want to do what they like.

Uncertainty can be less important for them. This raises the question if entrepreneurial passion affects the relationship between uncertainty and effectuation.

As stated before, the effectuation approach represents a paradigmatic shift in the way that we understand entrepreneurship (Perry et al., 2011). However, it remains unclear under which circumstances effectuation strategies are deployed and effective. According to Arend et al. (2015) the exact characteristics of the uncertainties faced by the entrepreneur and the nature of the contingencies remain under-specified. Research on effectuation and causation was primarily concerned with describing the two logics, and only recently researchers started to examine the antecedents and consequences of effectuation (Smolka et al., 2018). There is a need for further understanding of the motivations and behavior of entrepreneurs using effectuation strategies (Arend et al, 2015).

In this thesis the following research question is going to be answered: *'In which way does entrepreneurial passion affect the entrepreneurs' perception of uncertainty and their usage of effectuation strategies?'*

The following sub-questions have been developed:

- What is the relationship between the entrepreneurs' perception of uncertainty and the way they tend to make their strategic decisions?
- What is the relationship between entrepreneurial passion and the perception of (types of) uncertainty?
- In which way does entrepreneurial passion influence the relationship between the perception of uncertainty and the way decisions are made?

This research contributes to the field of entrepreneurial uncertainty in the context of effectuation. It contributes to the understanding of motivations for entrepreneurs for using effectuation strategies, in this case motivations that result from their entrepreneurial passion. First, the research will review the literature which is already written about those subjects. After that the research method is described and results of the research will be presented. A discussion of the results is provided, limitations of this research and possibilities of future research are described. Finally, the conclusion of this research is given.

2. Theoretical Framework

In this chapter the three variables, effectuation, uncertainty and entrepreneurial passion, of this research will be discussed in more detail.

2.1 Effectuation

Entrepreneurs have to make different types of decisions every day. Their decision-making has a major impact on the performance and future direction of the company (Shepherd & Patzelt, 2017). A good decision-making structure can help entrepreneurs cope with uncertainties and seize opportunities (Grégoire & Cherchem, 2020). An entrepreneur's decision-making process is based on different criteria and involves different processes (Sarasvathy, 2001; Sarasvathy & Dew, 2008). Sarasvathy (2001) distinguishes two main approaches an entrepreneur can choose in making decisions: causation and effectuation. Causation is consistent with planned strategy approaches. The planning and analysis required by causation assume conditions in which the outcomes are predictable through calculation or statistical inference (Sarasvathy, 2001). In contrast, effectuation processes are consistent with emergent or non-predictive strategies. When it is impossible to draw statistical inferences and there is no feasible way to calculate an expected return for a given course of action, entrepreneurs select alternatives based on loss affordability. The entrepreneur maintains flexibility, utilizes experimentation, and seeks to exert control over the future by making alliances with, and getting pre-commitments from, potential suppliers, competitors, and customers.

Entrepreneurs following a causation process clearly define the objectives they want to accomplish up front and methodically analyze areas of opportunity, some of which lie within particular companies or industries and some of which lie in broader social or demographic trends. They evaluate and select opportunities that maximize expected returns (Drucker, 1998). Entrepreneurs following an effectuation approach might begin a new venture process with general aspirations to create a new venture, but as they make decisions and observe the results of those decisions, they utilize this new information to change course. Because the future is unpredictable, entrepreneurs using an effectuation approach may try different approaches in the marketplace before settling on a business model. In addition, they are likely to put mechanisms into place that allow them to have some control over the outcome (Sarasvathy, 2001). Entrepreneurs following an effectual logic are less likely to try to predict the future and are more likely to change their initial goals and visions for the new venture. Rather than predicting the future, they are more likely to work with means within their control and make adjustments as necessary (Dew, et al., 2008). Using effectual logic, they frame the future as resulting from co-creation in partnerships with investors, partners, and customers who are "stitched together" (Dew et al., 2008). Goals emerge by developing potential courses of action that are based on the available means of who a person is, what they know, and whom they know. The entrepreneur might have some general sense of what he or she would like to do but does not have a highly defined goal derived from extensive analyses of circumstances (Grégoire & Cherchem, 2020).

Sarasvathy (2001) developed five behavioral principles that relate to effectuation and causation. She suggests that the early stages of entrepreneurial pursuits consist of mobilizing these five key principles:

(1) *Bird in hand* (beginning a set of given means and not with a given goal);

First, effectual behavior has a strong focus on the means of the entrepreneur, rather than his/her goal, which is the main driver in causation. There are three categories of means available to the entrepreneur: (1) Who I am, (2) What I know, and, (3) Whom I know. Who I am consists in the stable traits, abilities and attributes of the entrepreneur, What I know includes his education, experience and expertise and Whom I know refers to his social network. The effectual entrepreneur starts with the question: What effects can I create, given who I am, what I know, and whom I know? (Dew et al, 2008).

(2) *Affordable loss* (focusing on affordable loss and not on expected returns);

Using effectual decision-making the 'affordable loss' is essential, whereas causation is guided by expected returns. The principle of affordable loss states that an entrepreneur will not invest more than he is willing to lose (Dew et al., 2008). This assessment of affordable loss can be almost entirely based upon things already known by the entrepreneur, which minimizes reliance on predictive information. When basing investments on affordable loss, an entrepreneur eliminates the need for clear prediction of the future. Furthermore, the principle of affordable loss diminishes

of the role of uncertainty in decisions (Sarasvathy, 2008). A causal approach contains estimating the return on an investment, where the risk of the investment has to correspond with the return.

(3) *Lemonade* (leverage environmental contingencies and not exploiting preexisting knowledge);

Effectuation has a focus on exploiting contingencies instead of avoidance of contingencies. Surprises are seen as opportunities. The effectual logic is: when life gives you lemons, you make lemonade (Smolka et al., 2018). Pre-existing knowledge belongs to the characteristics of causation and is associated with less flexibility through the tendency to adhere to a business plan. Using an effectual approach, one is expected to remain flexible and therefore able to adjust to changes in the market and environment, whereas with a causal approach the goal is set.

(4) *Patchwork quilt* (emphasizing strategic alliances and precommitments and not competitive analysis)

In effectuation emphasis is on strategic collaboration rather than competitive analysis. According to Dew et al. (2008) effectuation processes start with interactions with people an entrepreneur knows or meets. Sarasvathy (2008) uses the contrasting metaphors of a jigsaw puzzle and a patchwork quilt to capture the differences between the two approaches. In the jigsaw puzzle approach (causation) the entrepreneur's task is to take an existing market opportunity and, through the use of resources, create a sustainable competitive advantage. The assembler of jigsaw puzzles sees the world as one in which all of the pieces are there, but must be assembled. In the patchwork quilt approach (effectuation) the task of the entrepreneur is to develop the opportunity by experimenting and changing direction as new information becomes available. The patchwork quilter sees the world as still in-the-making with a significant role for human action (Sarasvathy, 2008).

(5) *Pilot in the plane* (seeking to control an unpredictable future and not trying to predict a risky future)

Effectuation follows a non-predictive logic, whereas causation follows a predictive logic. The rationale of effectuation can be described as 'to the extent we can control the future we do not need to predict it' (Sarasvathy, 2008, p. 91). A non-predictive logic allows entrepreneurs to adapt to the uncertain environment in which they are active. Firms focusing on control will be able to reduce the need to predict the future and might therefore be more successful in uncertain situations (Wiltbank et al., 2006).

So, when an individual uses causal logic, he or she will begin with a given goal, focus on expected returns, emphasize competitive analyses, exploit preexisting knowledge, and try to predict an uncertain future. When an individual uses effectual logic, he or she will begin with a given set of means, focus on affordable loss, emphasize strategic alliances, exploit contingencies, and seek to control an unpredictable future. The process of entrepreneurial action in effectuation becomes a series of efforts to engage the world with the means one has and to try convincing others to join in these efforts—with the potential effect of changing those circumstances and shaping an otherwise unpredictable future (Sarasvathy, 2001; Sarasvathy & Dew, 2005; Sarasvathy, 2008).

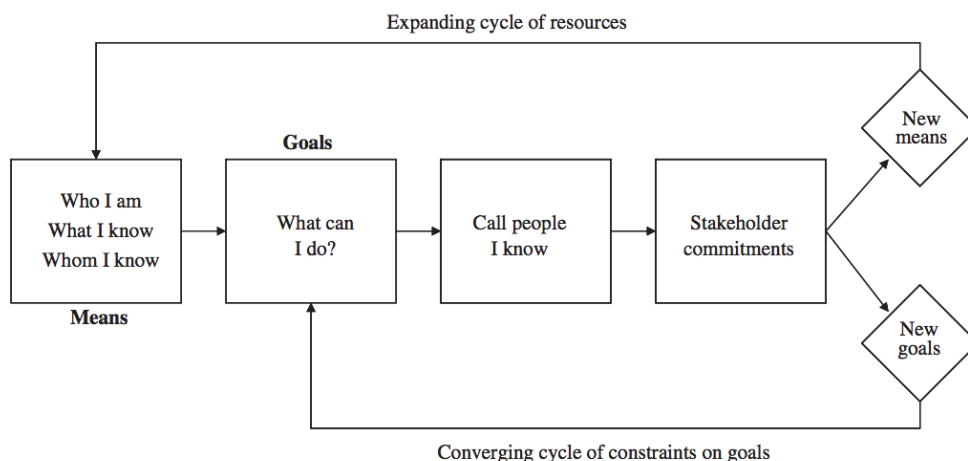


Figure 1: *The effectuation process that leads to creation of a new market* (Sarasvathy & Dew, 2005)

Causation tries to predict the uncertain future through elements of strategic planning and the past. Besides that, it is a decision-making logic, it tries to combine a strict goal orientation that focuses on the maximization of profit, competitive analysis, and surprise avoidance (Smolka et al., 2018).

Instead of pitting causation and effectuation as either/or alternatives, more recent studies argue that entrepreneurial efforts proceed from a combination of the two and some studies even argue that the two approaches effectively complement one another (Grégoire & Cherchem, 2020). Effectuation and causation can be seen as complementary logics, allowing entrepreneurs to cope with different contingencies throughout the life cycle of their ventures (Smolka et al., 2018). Sarasvathy argues that effectual strategies are emphasized in the earlier stages of venture creation with a transition to more causal strategies as the new firm and market emerge out of uncertainty into a more predictable situation. Effectual strategies are likely to be more effective in settings characterized by greater levels of uncertainty (Sarasvathy, 2001). According to Arend et al. (2015) however, in the effectuation literature the exact characteristics of the uncertainties faced by the entrepreneur and the nature of the contingencies remain under-specified. The effectuation theory suggests that the context of effectuation lies between two extreme benchmarks; one benchmark being certainty (with full information) and the other being the non-existence of predictability, control, and any form of resource superiority. According to Arend et al. (2015) effectuation's context involves uncertainty, but not true ambiguity nor true predictability. They consider the lack of an exact specification of the uncertain context, is an important boundary of effectuation theory thus far. The exact characteristics of the uncertainties faced by the entrepreneur, the embodiments of the resources, the nature of the contingencies, and the reaction functions of the identifiable parties involved, all remain under-specified. More research on in which context uncertainty is effectively managed with effectuation strategies needs to be done (Arend et al., 2015).

2.2 Uncertainty

Theory suggests effectuation is positively associated with uncertainty (Alsos et al., 2014; Chandler et al., 2011; Sarasvathy, 2001; Wiltbank, et al., 2006). Under uncertainty, entrepreneurial actions have a non-causation basis and tend to be characterized by both enactment and effectuation to work in a complementary and simultaneous fashion (Bhowmick, 2015). Welter and Kim (2018) found that effectuation outperforms causation in general, until the entrepreneur can accurately predict more than 75% of the future decisions correctly. In a situation of uncertainty, it is challenging to define future outcomes and therefore the focus will be on the means at hand (Sarasvathy, 2001). The effectual logic is: given an uncertain world, what could I do with the means, resources, and capabilities I have or could readily mobilize? (Grégoire & Cherchem, 2020). Uncertainty is present in situations wherein the consequences of one's actions and the conditions and/or factors of success are unknowable in advance (Grégoire & Cherchem, 2020). This is particularly the case when entrepreneurs are launching innovative products, services, and other ways of doing business. The more innovative and disruptive the ideas are, the more uncertain the outcomes and the more need for effectuation strategies (McMullen and Shepherd 2006). Information on possible outcomes cannot be obtained by extrapolating from prior cases. The future is impossible to predict, and using effectuation entrepreneurs can reduce the uncertainty by actively trying to shape the future. They do so in cocreation with partners, suppliers, clients, and other stakeholders (Grégoire & Cherchem, 2020).

But what is uncertainty? Although uncertainty remains fundamental to theories of entrepreneurial action, existing conceptions of uncertainty in entrepreneurship research are complex and problematic (Townsend et al., 2018). Authors have struggled to operationalize uncertainty and few papers have addressed uncertainty in effectuation literature (Welter & Kim, 2018). First of all, it is important to distinguish uncertainty from risk. Frank Knight (1921) formalized this distinction in his classic book *Risk, Uncertainty, and Profit*. Knight identified three types of uncertainty: the first one consists of a future with a known distribution, only the particular draw that will actually occur is unknown. This is called risk. The second one involves a future whose distribution is unknown, but can be estimated by studying draws over time, and the third one, that Knight called true uncertainty, consists of a future whose distribution is not only unknown, but

unknowable (that is now known as Knightian uncertainty). True uncertainty cannot “*by any method be reduced to an objective, quantitatively determined probability*” (Knight, 1921, p. 321). According to Knight, risk applies to situations where we do not know the outcome of a given situation, but can accurately measure the odds. True uncertainty, on the other hand, applies to situations where we cannot know all the information, we need in order to set accurate odds. Change cannot be fully foreseen with probabilistic rules and consequences for market outcomes, and thus payoffs from market participants’ decisions, cannot be fully comprehended. Knight claimed uncertainty bearing to be essential for creating profit as a reward for entrepreneurial actions (Knight, 1921). Because entrepreneurial actions involve novelty, such as the creation of new products, new services or new ventures, uncertainty automatically comes with them (McMullen & Shepherd, 2006). Entrepreneurship research around uncertainty has been intertwined with understanding how individuals act in the absence of predictable outcomes (March, 1982). Since causation processes focus on the predictable aspects of an uncertain future, Sarasvathy (2001) suggests that in case of true Knightian uncertainty, the future is not predictable and therefore entrepreneurs will engage in effectuation processes and focus on the controllable aspects of an unpredictable future. Yet McKelvie et al. (2011) argue that there are different types of ‘true uncertainty’. The type and amount of uncertainty an entrepreneur perceives, might impact the decision-making process. They draw on the three distinct types of entrepreneurial uncertainty, stated by Milliken (1987):

- (1) State uncertainty: when entrepreneurs perceive the environment to be unpredictable;
- (2) Effect uncertainty: an inability to predict what the nature of the impact of a future state of the environment or environmental change will be to the organization;
- (3) Response uncertainty: a lack of knowledge of response options and/or an inability to predict the likely consequences of a response choice. Response uncertainty is likely to be salient when there is a perceived need to act: ‘because a pending event or change is perceived to pose a threat or to provide some unique opportunity to the entrepreneur (Milliken, 1987, p. 137).

Milliken’s three types of uncertainty could be simplified into three questions: (1) What’s happening out there? (state uncertainty), (2) How will it impact me? (effect uncertainty), and (3) What am I going to do about it? (response uncertainty) (McMullen & Shepherd, 2006). Milliken suggests that each of these uncertainty types considered together define the nature and character of uncertainty that surrounds a given entrepreneurial decision. McKelvie et al. (2011) found that state and effect uncertainty, that is uncertainty beyond the entrepreneur’s control, do not impede entrepreneur to act, but lead to efforts to control the environment (effectuation). They also found, however, that entrepreneurs are reluctant to act when the consequences of their actions cannot be predicated or evaluated. Response uncertainty therefore may lead to not acting at all. These findings suggest that there may be important differences in the type of uncertainty encountered in the face of entrepreneurial action. Kelvie at al. (2011) recommend more detailed research into the conditions that may govern the acceptance of greater (or lesser) uncertainty and the different types of uncertainty at play within these relationships.

Characteristics and motivations of the entrepreneur and his perception of uncertainty

Entrepreneurial uncertainty is subjective in that different individuals may experience different doubts in identical situations (McMullen & Shepherd, 2006). Entrepreneurs place different weight or importance on different types of uncertainty with regard to action decisions. Brundin and Gustafsson (2013) show that entrepreneurs attach different attitude to different uncertainty levels with regards to decision making. The uncertainty can be perceived as mild, severe or absolute, depending on the available information. Mild uncertainties may pose intangible effects on the decisions of the entrepreneur and hence, manageable. However, severe uncertainties may create difficult situations for the entrepreneur in discriminating between relevant and irrelevant information in the presence of a foreseeable opportunity. Hence, the perception of the entrepreneur of the nature or amount of the uncertainty determines his or her actions and decision policy (McKelvie et al., 2011). The amount of uncertainty is considered to be a barrier between prospective entrepreneurs and entrepreneurial action. McMullen & Shepherd (2006) state that not only the perception of the amount of uncertainty plays a role, the willingness to bear this uncertainty is crucial for entrepreneurial actions. Those who decide to act entrepreneurially are distinguishable from those who do not, owing to differences in motivation, attitude, or risk propensity (McMullen & Shepherd, 2006). For example, an entrepreneur with extensive knowledge of a market might

perceive the uncertainty of the market different than an entrepreneur lacking this knowledge (Dew et al. 2008).

The literature conveys different decision styles towards opportunity creation or recognition in uncertainty, which most crucially involve the nature of the entrepreneur and his cognition, and to a broader spectrum, the biological building block including genetic factors of the entrepreneur (Nicolaou & Shane, 2010). Further, in analyzing the role of emotions on investment decision under uncertainty, Brundin and Gustafsson (2013) demonstrated that emotions played a significant role in the entrepreneur's decisions to continue or discontinue investment under uncertainty. They noted that personal attributes such as self-confidence and hope magnify the entrepreneur's propensity to invest under high uncertainty. Self-confidence makes entrepreneurs goal directed and keen to pursue highly esteemed investments as well as willing to face uncertainty. It makes them believe they are capable of turning things around and achieving the desired goals (Brundin & Gustafsson, 2013). Furthermore, hope, as an overall perception that goals can be met, will lead entrepreneurs to perceive more control over the investment and motivate them to persist in uncertain circumstances, whereas frustration and embarrassment decrease the entrepreneur's predilection to invest in the presence of high uncertainty (Brundin & Gustafsson, 2013). McKelvie et al. (2011) state that self-confidence and hope will help entrepreneurs to reduce state and effect uncertainty, but will not reduce response uncertainty. Response uncertainty will lead to less confidence and hope and therefore to unwillingness to undertake entrepreneurial action.

Entrepreneurs differ in the way they perceive risk and reward, they vary in their use of effectual and causal logic when confronted with scenarios involving risk and reward, and they differ in how they attempt to predict or control uncertainty (Perry et al. 2012, p. 843). This suggests there are more factors to be looked at while examining the relationship between uncertainty and effectuation. One of them is passion (Stroe et al., 2018).

2.3 Entrepreneurial passion

Cardon et al. (2017) argue that entrepreneurial passion plays a crucial role in entrepreneurship, by providing the fire that fuels innovation and persistence. It is expected to have a great influence on an entrepreneurs' actions and decision making. However, there is a lack of systematic evidence about the critical role that passion may play in entrepreneurs' efforts, dedication and persistence towards goals despite significant obstacles (Cardon et al., 2013).

Passion is defined by Vallerand et al. (2003) as "a strong inclination toward an activity that people like, that they find important, and in which they invest time and energy" (p. 757). Entrepreneurial passion is defined as "consciously accessible, intense positive feelings experienced by engagement in entrepreneurial activities associated with roles that are meaningful and salient to the self-identity of the entrepreneur" (Cardon, 2009, p. 519).

Vallerand et al. (2003) propose that there are two types of passion, harmonious and obsessive. Most individuals who are passionate are able to keep their passion in harmony with other aspects of their lives, thus experiencing harmonious passion. Other individuals are passionate to the extent that the object of their passion dominates their existence causing imbalance with other life domains. Harmonious passion is connected with the pleasure that the entrepreneurs get from doing their tasks and not because of internal or external pressure (Stroe et al., 2018). Obsessive passion means that interpersonal pressures like a boosting self-esteem or feeling superior are important for the entrepreneur (Vallerand et al., 2003). Obsessive passion is characterized by an outcome-focused motivation where the entrepreneurs is fully focusing on the goal. These entrepreneurs try to avoid and anticipate on the unexpected (Vallerand, 2010).

Cardon et al. (2013) state that entrepreneurial passion consists of three different domains:

- (1) *Passion for inventing*: passion for activities related to identifying new market opportunities, developing new products and services, and working with new prototypes (Cardon et al., 2013). Entrepreneurs enjoy exploring opportunities, experimenting with designing possible products and services, and finding solutions for problems and needs.
- (2) *Passion for founding*: passion for the collection of financial, human and social resources that are needed to create a new venture (Cardon et al., 2013).
- (3) *Passion for developing*: passion for growing and expanding new ventures after they have been founded. This includes optimizing marketing efforts, finding investors to secure capital,

improving the value chain and minimizing costs by efficient and effective planning and control (Cardon et al., 2013).

Cardon et al. (2017) argue that entrepreneurial passion keeps the entrepreneur going and helps him in overcoming obstacles and difficulties. Entrepreneurial passion is found to explain entrepreneurial behaviors, such as unconventional risk taking, uncommon intensity of focus, and unwavering belief in a dream (Cardon et al., 2009). Passion facilitates an entrepreneur's efforts to adapt and cope with environmental challenges. Baum and Locke (2004) note that the energy of passion leads entrepreneurs to stick to their initial goals. Passion makes entrepreneurs less sensitive to contrary market information and keeps them focused on their goals, even against better judgement (Vallerand et al., 2003). This does not mean this is a necessarily functional strategy; entrepreneurial passion may make entrepreneurs obsessive, blind, or misdirected.

Entrepreneurial passion may increase the amount of uncertainty an entrepreneur can bear and keep him focused on the long-term goals he is pursuing, whether it is for inventing, founding or developing. Therefore, entrepreneurial passion may moderate the relationship between uncertainty and the usage of effectual strategies. Another possibility is that entrepreneurial passion downsizes the amount of uncertainty an entrepreneur perceives (direct relationship) and therefore leads to lesser usage of effectual strategies.

2.4 Conceptual model and hypotheses

We try to specify the landscape for effectuation strategies, as recommended by Arend et al. (2015). They state that effectuation literature needs to move from a description of what entrepreneurs do and how they act under conditions of uncertainty to explaining why the decisions and actions are made. Arend et al. (2015) also state that the context in which effectuation is being performed, needs to be specified further. To understand whether the degree of entrepreneurial passion influences the way the entrepreneur perceives uncertainty and therefore his effectual approach of decision making, different hypotheses have been formulated:

For the relationship between uncertainty and decision-making strategies:

H1. The usage of effectual strategies will increase as perceived uncertainty (state, effect, and response) increases.

H1.1 The usage of effectual strategies will increase as perceived state uncertainty increases.

H1.2 The usage of effectual strategies will increase as perceived effect uncertainty increases.

H1.3 The usage of effectual strategies will increase as perceived response uncertainty increases.

For the relationship between entrepreneurial passion and perception of uncertainty:

H2. Perceived uncertainty will decrease as entrepreneurial passion increases.

H2.1 Perceived state uncertainty will decrease as passion for inventing, founding and/or developing increases.

H2.2 Perceived effect uncertainty will decrease as passion for inventing, founding and/or developing increases.

H2.3 Perceived response uncertainty will decrease as passion for inventing, founding and/or developing increases

For the moderating effect of passion on the relationship between uncertainty and decision-making strategies:

H3. The positive relationship between perceived (state, effect, and response) uncertainty and the usage of effectuation strategies is moderated by the degree of entrepreneurial passion such that the relationship is less positive for a high degree of passion than for a low degree of passion.

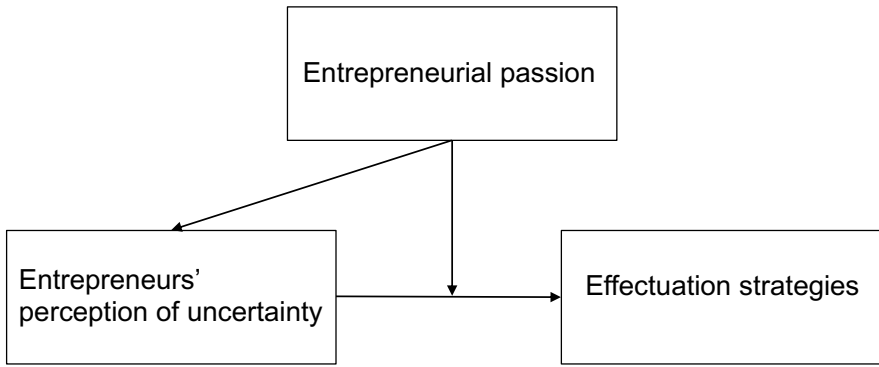


Figure 2: *Conceptual model*

3. Methods

A quantitative study was carried out to measure the relationships between perceived uncertainty, entrepreneurial passion and the entrepreneurs' usage of effectuation decision making strategies.

3.1 Sample

The sample for this study consisted of primary new product development decision makers working in the Dutch software industry. This industry has been chosen because it is characterized by fast-changing developments in technology and customer demands (McKelvie, Haynie, & Gustavsson, 2011), which enforces decision-making under uncertainty. Software entrepreneurs, who are the decision makers for new product development, were asked to fill in a questionnaire.

The questionnaire was made in the online tool Google Forms. Using email and social media channels, the survey was sent to around 100 software entrepreneurs in The Netherlands. To attract participants social networks like Facebook, Instagram and LinkedIn are used. Furthermore, the author contacted people who attended MWC Barcelona 2023. MWC Barcelona is the largest and most influential event for the connectivity ecosystem, targeting global mobile operators, device manufacturers, technology providers and vendors. Via the app for this event, it was possible to connect to people who visited the congress. At last, entrepreneurs who are known by the author are asked to fill in the questionnaire and to spread it in their network. After a month data collection was stopped. At the end approximately 500 software entrepreneurs were contacted from which 90 filled in the survey.

3.2 Measurement

The survey was administered in Dutch. Therefore, the original scales were translated from English to Dutch. The total survey consisted of 29 items (see appendix A), divided in several measures described below.

Uncertainty

To measure the perceived uncertainty a scale was used that was constructed by McKelvie et al. (2011). Entrepreneurs were asked to rate the degree of state, effect and response uncertainty for their newest (most recently developed) product on a scale from 1 (low) to 9 (high). For each type of uncertainty two items were measured. The Cronbach's alpha was calculated for the current study of each type of uncertainty. The reliability seemed to be good for state uncertainty (Cronbach's $\alpha = .88$), for effect uncertainty it was well (Cronbach's $\alpha = .78$), however, for response uncertainty this was not good (Cronbach's $\alpha = .56$). For each uncertainty type a mean score was calculated, with higher means indicating more uncertainty. The cutoff score for uncertainty was score 5 or higher.

Effectuation strategies

To measure the usage of effectuation versus causation strategies for decision making, the scale developed by Alsos et al. (2014) was used. This is a ten-item scale that covers all five principles of effectuation and causation as proposed by Sarasvathy (2001). The scale was successfully tested for validity and reliability. This scale can be requested with the original authors.

Entrepreneurs were asked to rate five effectuation principles and five causation principles on scale form 1 (totally disagree) to 7 (totally agree). Two separate mean scores were calculated, one representing the usage of causation strategies, and one for the usage of effectuation strategies. A higher score indicated more usage of that type of strategy. The cutoff score for the usage of this type of strategy was score 4 or higher.

Entrepreneurial passion

To measure the degree of entrepreneurial passion a scale developed by Cardon et al. (2013) was used. This scale includes 15 items for measuring intense positive feelings (12 items) and identity centrality (3 items) across the three domains of inventing, founding and developing.

Entrepreneurs were asked to express the extent of their agreement with statements on a scale form 1 (totally disagree) to 7 (totally agree). A score of 4 or higher indicates agreement.

Control variables

Several control variables were considered that are likely to have an influence on the outcomes of the questionnaires. A few additional questions were included to gather personal information about the entrepreneur. To analyze whether age, gender (males were coded 0 and females 1), entrepreneurial experience and education level are correlated with perceived uncertainty, entrepreneurial passion and/or entrepreneurial decision-making, a correlation analysis was conducted.

3.3 Method of analysis

The data from Google Forms were exported into an IBM SPSS Statistic Database. The data were first tested by a Shapiro Wilk test/ Kolmogorov–Smirnov test to see whether the data are normally distributed. For both tests, null hypothesis states that data are taken from a normally distributed population. If the outcome is significant ($p > 0.05$) a normal distribution can be assumed (Mishra et al., 2019). If it is not significant, data are not normally distributed, and it is suggested to use the Spearman's rank when testing on correlation.

Although the questionnaire consisted of validated scales, the reliability and internal consistency of the questionnaire was tested with Cronbach's alpha. This was important because the scales were translated into Dutch. A Cronbach's Alpha of at least 0.70 is considered desirable (Taber, 2018). As the original scales are translated from English to Dutch for the questionnaire it justifies the need to perform a reliability analysis.

Correlation analyses using Spearman's Rank Order were performed to see whether there is a relationship between variables: between perceived uncertainty and the entrepreneurial decision-making strategies (effectuation-causation), between the sub-dimensions inventing, founding and developing of entrepreneurial passion and the perceived uncertainty and between the sub-dimensions inventing, founding and developing of entrepreneurial passion and the entrepreneurial decision-making strategies (effectuation-causation). Multiple regression analyses were executed to determine the nature of the relationship, including the moderating effect of passion on the relationship between perceived uncertainty and decision-making strategies. To test the hypotheses, a significance level of 0.05 determines if the output is significant.

4. Results

In this chapter, the results of the performed study are reported and presented. First, the results of the factor analysis are discussed, and subsequently the reliability and validity. Thereafter, the descriptive statistics of the collected data will be shown, including assumptions testing. Next, correlation analyses are presented to test patterns and relationships among the research variables. Finally, hypothesis testing will be done to answer the stated research questions.

4.1 Validity and reliability

The validity was examined for the constructs: causation, effectuation, and entrepreneurial passion. First, the KMO and Bartlett's were run to see if the prerequisites were satisfied before a factor analysis could be undertaken. According to Field (2018), the KMO must be 0.5 or greater and the Bartlett's test of sphericity must be significant. The results showed that the Bartlett's test was significant ($p < .001$) and the total KMO is 0.508. Additionally, the variables underwent separate KMO and Bartlett tests. All of the KMOs, except of passion developing, were higher than 0.5, and all of the Bartlett tests had significant results. Table 1 presents the outcomes. Following those tests, factor analyses were run individually for each variable. The factor matrices' entries that did not load were removed.

Additionally, factor loadings below 0.4 in the factor matrices were removed. This is based on Field's (2018) recommendation that a cut-off value of 0.4 be used. However, all the items loaded above the cut-off value of 0.4, and thus none were eliminated. Although, for causation and passion for developing, the results showed a two instead of a one factor result. So, internal consistency of these separate factors was examined. But the reliability of all the four factors were lower than .70. Cronbach's α above .70 is regarded as a reliable scale. Due to the absence of a gain in using these separate subscale factors, it was decided to keep the original scales, i.e., the 5 items for causation and 4 items for passion development. Based on the reliability results in Table 1 it could be concluded that the scales measured in the current study do not seem to be reliable, i.e., all are below the acceptable score of .70. Although extra analyses had been performed to investigate whether better reliabilities could be achieved, excluding items did not further improve the reliability and therefore it was decided to calculate the mean score on the original items.

Table 1. KMO, Bartlett's significance, and reliability.

Variable	N items	KMO	Bartlett's test	Cronbach's α
Causation	5	.575	< .001	.44
Effectuation	5	.719	< .001	.64
Passion inventing	5	.532	.009	.43
Passion founding	4	.607	< .001	.44
Passion developing	4	.473	< .001	.39

4.2 Distribution

In order to perform certain statistical tests, the data needs to comply with a few assumptions. For parametric tests, e.g., Pearson's correlations, the data needs to be normally distributed. An assessment of the normality of data is a requirement for many statistical tests because normality of data is an underlying assumption in parametric tests (Mishra, et al., 2019; Newman, Obschonka, Moeller, & Chandan, 2021; Nicolaou & Shane, 2010). The Kolmogorov–Smirnov test and the Shapiro–Wilk test are the most well-known and the most widely used methods to test the normality of the data (Mishra et al., 2019). A significance less than 0.05 indicates that the data is unlikely to be normally distributed. Based on the results in Table 2 some variables did show to be from a normal distribution. For example, causation, effectuation and passion invention, all others were significant, hence rejecting the null hypothesis that the data adheres to a normal distribution. The outcomes of the test imply therefore that most of the data is unlikely to be normally distributed. Equivalent non-parametric tests need to be used instead of the parametric to overcome this issue.

Table 2. Results normality tests for research variables.

	Kolmogorov-Smirnov ^a			Shapiro-Wilk		
	Statistics	df	Sig	Statistics	df	Sig
State uncertainty	.185	90	<.001	.883	90	<.001
Effect uncertainty	.161	90	<.001	.934	90	<.001
Response uncertainty	.110	90	.009	.971	90	.039
Causation	.081	90	.196	.982	90	.231
Effectuation	.076	90	.200*	.984	90	.332
Passion inventing	.077	90	.200*	.981	90	.228
Passion founding	.145	90	<.001	.950	90	.002
Passion developing	.094	90	.049	.976	90	.099

a. Lilliefors Significance Correction

4.3 Descriptives

In total, 90 respondents filled in the questionnaire, from which 72 men (80%) and 18 women (20%). There were no missing values, which implies that the respondents filled-out all the questions/statements that were asked. Ages ranged between 25 and 62 years old with 39.03 as the mean age of the respondents (SD = 9.30 years). Years of experience as an entrepreneur ranged between 1 and 30 years, with an average of 6.72 years (SD = 5.38). Most of the respondents had finished a high education level (n = 81, 90%), see Table 3.

Table 3. Level of education

	Freq.	%	Valid %	Cum. %
High (hbo, wo bachelor en wo master, doctor)	81	90.0	90.0	90.0
Medium (havo, vwo, mbo 2, 3 en 4)	5	6.0	6.0	96.0
Low (basisonderwijs en vmbo, mbo 1, havo-/vwo- onderbouw)	4	4.0	4.0	100.0

In Table 4 the descriptives of the main research variables are presented. Based on the means it seems that the respondents tend to use more causation strategies than effectuation strategies in decision making. The mean score for causation strategies was 4.59 and for effectuation strategies was 3.67, while a score of 4 or higher indicates usage of these strategies. Respondents rated the degree of state, effect and response uncertainty with a mean score of respectively 5.16, 5.07 and 4.90, while a score of 5 or higher indicates uncertainty. Furthermore, the respondents are quite passionate, with a mean score of 5.50, 5.64 and 5.61 on passion for inventing, founding and developing, a score of 5 or higher indicates passion.

Table 4. Decision making, perceived uncertainty and passion (mean and median)

	N	Min	Max	Mean	St. dev
Causation	90	2.60	6.40	4.59	.83
Effectuation	90	1.60	6.00	3.67	1.00
State uncertainty	90	1.50	8.50	5.16	2.23
Effect Uncertainty	90	1.00	8.50	5.07	2.00
Response uncertainty	90	1.00	9.00	4.90	1.86
Passion for Inventing	90	4.00	7.00	5.50	.69
Passion for founding	90	3.25	7.00	5.65	.81
Passion for developing	90	3.50	7.00	5.61	.78

4.4 Correlation analyses

Correlation analyses were performed using the non-parametric Spearman's Rank Order test, due to the non-normal distribution of some of the data. The Spearman's Rank Order is a test that deals with this issue in an appropriate manner. The correlation coefficients range from -1 to +1, where -1 indicates a perfect negative correlation if significant (as one variable goes up, the other goes down), +1 indicates a perfect significant positive correlation (as one variable goes up, the other goes up), and 0 indicates no correlation.

As can be seen in table 5, the Spearman's rho correlations outcomes show that there is no significant correlation between the usage of causational and effectual approaches ($r = -.06$, $p = .562$). This means that the usage type is not related to each other. Usage of causation was weak negatively correlated to perceived effect uncertainty ($r = -.28$, $p = .008$), this shows that with more perceived effect uncertainty the usage of causation approaches will decrease. Usage of effectual approaches is weakly positive associated with the perceived state uncertainty ($r = .27$, $p = .009$), effect uncertainty ($r = .29$, $p = .005$), and the perceived response uncertainty ($r = .28$, $p = .009$). Meaning that with more of these uncertainties the usage of effectual strategies seems to also increase. The three uncertainties also correlate positively significant amongst each other. There is a moderate-strongly positive correlation between perceived state and effect uncertainty ($r = .67$, $p < 0.001$), a weak-moderate relation between state and response uncertainty ($r = .38$, $p < 0.001$), and moderate positive correlation between perceived effect and response uncertainty ($r = .42$, $p < 0.001$). If one perceived uncertainty increases also the others tend to increase, and vice versa. Between the degree of entrepreneurial passion for development and perceived state uncertainty was also a weak positive significant association ($r = .21$, $p = .044$). If entrepreneurial passion for development increases the perceived state uncertainty also seems to rise. A similar pattern was found between entrepreneurial passion for development and entrepreneurial passion for founding, ($r = .21$, $p = .048$), if entrepreneurial passion for development increases the entrepreneurial passion for founding also seems to enhance.

Table 5. Correlation analyses

		Correlations								
		Causation	Effectuation	State uncertainty	Effect uncertainty	Response uncertainty	Passion inventing	Passion founding	Passion developing	
Spearman's rho	Causation	Correlation Coefficient	--							
		Sig. (2-tailed)	.							
		N	90							
	Effectuation	Correlation Coefficient	-.062	--						
		Sig. (2-tailed)	.562	.						
		N	90	90						
	State uncertainty	Correlation Coefficient	-.087	.273**	--					
		Sig. (2-tailed)	.415	.009	.					
		N	90	90	90					
	Effect uncertainty	Correlation Coefficient	-.279**	.291**	.666**	--				
		Sig. (2-tailed)	.008	.005	<.001	.				
		N	90	90	90	90				
	Response uncertainty	Correlation Coefficient	-.150	.275**	.383**	.423**	--			
		Sig. (2-tailed)	.158	.009	<.001	<.001	.			
		N	90	90	90	90	90			
	Passion inventing	Correlation Coefficient	.077	.210*	.117	.068	.028	--		
		Sig. (2-tailed)	.469	.047	.274	.524	.797	.		
		N	90	90	90	90	90	90		
	Passion founding	Correlation Coefficient	-.052	.169	.028	-.023	.012	.151	--	
		Sig. (2-tailed)	.623	.111	.797	.826	.909	.155	.	
		N	90	90	90	90	90	90	90	
	Passion developing	Correlation Coefficient	-.015	.146	.213*	.091	.071	.141	.209*	--
		Sig. (2-tailed)	.886	.169	.044	.394	.503	.186	.048	.
		N	90	90	90	90	90	90	90	90

** . Correlation is significant at the 0.01 level (2-tailed).

* . Correlation is significant at the 0.05 level (2-tailed).

4.5 Hypotheses testing

Regression analyses were performed to examine the hypothesized relationships between the entrepreneurial passion, the perception of uncertainty and the way strategic decision are made.

4.5.1 Relationship between uncertainty and decision-making strategies

H1. The usage of effectual strategies will increase as perceived uncertainty (state, effect, and response) increases.

- *H1.1 The usage of effectual strategies will increase as perceived state uncertainty increases.*
- *H1.2 The usage of effectual strategies will increase as perceived effect uncertainty increases.*
- *H1.3 The usage of effectual strategies will increase as perceived response uncertainty increases.*

To test H1 a multiple regression analysis was performed to assess the potential influence of different perceived uncertainties (state, effect, and response uncertainty) and some covariates (age, experience, high education level (dummy), and gender (dummy) on the dependent variable expressed as usage of effectuation approaches.

The model was statistically significant, $F(1, 88) = 3.31, p = .004$. This means that the independent variables did significantly predict the usage of effectual approaches in this sample, it predicts 22.2% of the usage of effectual approaches. When inspecting the unique predictors, it shows that none of the separate predictors reach significance level, see Table 6. This means that no variable in this model has a significant unique association with the usage of effectual approaches.

Table 6. Multiple regression analysis results predicting usage of effectual approaches (N = 90).

Coefficients ^a								
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	3.872	.677		5.717	<.001		
	Age	-.013	.018	-.123	-.704	.483	.317	3.157
	Experience	-.008	.031	-.046	-.269	.789	.329	3.039
	Gender	.461	.240	.192	1.921	.058	.963	1.038
	Dummy high education level	-.581	.336	-.181	-1.729	.088	.874	1.145
	Response uncertainty	.062	.059	.119	1.058	.293	.764	1.309
	State uncertainty	.027	.061	.061	.436	.664	.498	2.007
	Effect uncertainty	.063	.070	.130	.909	.366	.466	2.144

a. Dependent Variable: Effectuation

The regression analysis was also performed with the usage of causation approaches as dependent variable. In the model causation was the dependent variable, the different perceived uncertainties (state, effect, and response uncertainty) and some covariates (age, experience, high education level (dummy), and gender (dummy) the independent variables.

The model was statistically significant, $F(1, 88) = 3.51, p = .002$. This means that the independent variables together did significantly predict the usage of causal approaches in this sample, it predicts 23.3% of the usage of causal approaches. When inspecting the unique predictors, it shows that some of the predictors reached significance level, see Table 7. First, perceived state uncertainty is a predictor, ($b = .10, p = .050$), with every unit increase in perceived state uncertainty the usage of causal approaches increases with .10, meaning that with more state uncertainty the respondents seem to use more causal approaches. On the other hand, the effect uncertainty has a negative relation with the causal approach usage, with every unit increase of perceived effect uncertainty causal usage decreases .17 ($b = -.17, p = .004$). The higher education respondents show .65 less usage of causal approaches in comparison with non-highly educated respondents.

Table 7. Multiple regression analysis results predicting usage of causational approaches (N = 90).

Model		Coefficients ^a			t	Sig.	Collinearity Statistics	
		Unstandardized Coefficients		Standardized Coefficients			Tolerance	VIF
		B	Std. Error	Beta				
1	(Constant)	5.057	.565		8.954	<.001		
	Age	.018	.015	.201	1.163	.248	.317	3.157
	Experience	-.005	.026	-.036	-.212	.833	.329	3.039
	Gender	-.406	.200	-.201	-2.027	.046	.963	1.038
	Dummy high education level	-.654	.280	-.243	-2.333	.022	.874	1.145
	Response uncertainty	-.026	.049	-.058	-.523	.603	.764	1.309
	State uncertainty	.101	.051	.274	1.988	.050	.498	2.007
	Effect uncertainty	-.170	.058	-.417	-2.928	.004	.466	2.144

a. Dependent Variable: Causation

Assumptions for both regression analyses were also tested, there was no multicollinearity (VIF scores all below 4), also the other assumptions were met, the normality, the linearity of the residuals and the data was homoscedastic.

While no evidence was found that a higher degree of uncertainty leads to more effectual approaches of decision making, instead some evidence was found that a higher level of state and lower level of effect uncertainty are related to more causational approaches. This means that an entrepreneur with greater perceived state uncertainty and or more perceived effect uncertainty is more likely to tend towards the causational approach of decision-making. Also, the males and higher educated respondents seem to adhere less to the causational usage approaches.

4.5.2 Relationship between entrepreneurial passion and perception of uncertainty

H2. Perceived uncertainty will decrease as entrepreneurial passion increases.

- H2.1 Perceived state uncertainty will decrease as passion for inventing, founding and/or developing increases.
- H2.2 Perceived effect uncertainty will decrease as passion for inventing, founding and/or developing increases.
- H2.3 Perceived response uncertainty will decrease as passion for inventing, founding and/or developing increases

The regression analysis for H2.1 was to predict perceived state uncertainty by the three entrepreneurial passion variables (inventing, founding, developing) and four covariates (age, experience, high education level (dummy), and gender (dummy)).

The model to predict the perceived state uncertainty was not statistically significant, $F(1, 88) = 1.68, p = .126$. This means that the independent variables together did not significantly predict the perceived state uncertainty in this sample, the model as it now predicts 12.7% of perceived state uncertainty, see Table 8.

Table 8. Multiple regression analysis results predicting perceived state uncertainty (N = 90).

Coefficients^a

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	4.795	3.374		1.421	.159		
	Age	-.026	.046	-.111	-.567	.573	.281	3.560
	Experience	-.066	.076	-.161	-.870	.387	.316	3.163
	Gender	.448	.586	.082	.766	.446	.948	1.055
	Dummy high education level	-.190	.834	-.026	-.228	.820	.829	1.206
	Passion inventing	.082	.350	.025	.235	.815	.924	1.082
	Passion founding	-.204	.306	-.075	-.667	.507	.851	1.175
	Passion developing	.462	.331	.162	1.395	.167	.800	1.250

a. Dependent Variable: State uncertainty

The regression analysis for H2.2 was to predict perceived effect uncertainty by the three entrepreneurial passion variables (inventing, founding, developing) and four covariates (age, experience, high education level (dummy), and gender (dummy)).

The model to predict the perceived effect uncertainty was not statistically significant, $F(1, 88) = 1.61, p = .144$. This means that the independent variables together did not significantly predict the perceived effect uncertainty in this sample, the model as it now predicts 12.2% of perceived effect uncertainty, see Table 9.

Table 9. Multiple regression analysis results predicting perceived effect uncertainty (N = 90).

Coefficients^a

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	9.123	3.053		2.989	.004		
	Age	-.069	.042	-.321	-1.635	.106	.281	3.560
	Experience	-.014	.069	-.037	-.197	.844	.316	3.163
	Gender	.284	.530	.057	.536	.593	.948	1.055
	Dummy high education level	-.025	.754	-.004	-.033	.974	.829	1.206
	Passion inventing	-.027	.317	-.009	-.087	.931	.924	1.082
	Passion founding	-.212	.277	-.086	-.765	.446	.851	1.175
	Passion developing	.002	.299	.001	.008	.994	.800	1.250

a. Dependent Variable: Effect uncertainty

The regression analysis for H2.3 was to predict perceived response uncertainty by the three entrepreneurial passion dependent variables (inventing, founding, developing) and four covariates (age, experience, high education level (dummy), and gender (dummy)).

The model to predict the perceived effect uncertainty was not statistically significant, $F(1, 88) = .91, p = .503$. This means that the independent variables together did not significantly predict the perceived response uncertainty in this sample, the model as it now predicts 7.3% of perceived response uncertainty, see Table 10.

Table 10. Multiple regression analysis results predicting perceived response uncertainty (N = 90).

		Coefficients ^a						
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	6.151	2.901		2.120	.037		
	Age	-.004	.040	-.021	-.104	.917	.281	3.560
	Experience	-.078	.065	-.228	-1.200	.234	.316	3.163
	Gender	.424	.503	.093	.842	.402	.948	1.055
	Dummy high education level	-.176	.717	-.029	-.245	.807	.829	1.206
	Passion inventing	-.066	.301	-.025	-.220	.826	.924	1.082
	Passion founding	.006	.263	.003	.024	.981	.851	1.175
	Passion developing	-.034	.285	-.014	-.119	.906	.800	1.250

a. Dependent Variable: Response uncertainty

The results of the three regression analyses show that entrepreneurial passion does not predict the level of perceived uncertainties.

Assumptions for both regression analyses were also tested, there was no multicollinearity (VIF scores all below 4), also the other assumptions were met, the normality, the linearity of the residuals and the data was homoscedastic.

4.5.3 Effect of passion on the relationship between uncertainty and decision-making strategies

H3. The positive relationship between perceived (state, effect, and response) uncertainty and the usage of effectuation strategies is moderated by the degree of entrepreneurial passion such that the relationship is less positive for a high degree of passion than for a low degree of passion.

To test hypothesis 3 the study conducted a hierarchal regression analysis to test the hypotheses related to how passionate entrepreneurs perceive uncertainty. First, a composite score for entrepreneurial passion was created by summing up the scores for passion inventing, founding, taking into account the number of items per passion type. Due to multicollinearity in this model, all predictors (except the covariates) were centralized, meaning that in each respondent the mean was subtracted from the scores. This can resolve the intercorrelation between the predictors, and indeed it did, see Table 11. The final model was tested through a hierarchal regression analysis, in the first model only the covariates were entered into the model to predict effectuation, thereafter in model 2 the three perceived uncertainty scores and the passion composite were added. In the final model, i.e., model 3, the interactions between the three uncertainty scores and the passion composite were added to all the other predictors.

Table 11. *Multiple hierarchal regression analysis results predicting usage of effectual approaches (N = 90).*

		Coefficients ^a						Collinearity Statistics	
Model		Unstandardized Coefficients B	Std. Error	Standardized Coefficients Beta	t	Sig.	Tolerance	VIF	
1	(Constant)	4.882	.542		9.006	<.001			
	Age	-.018	.018	-.172	-.989	.325	.328	3.050	
	Experience	-.016	.031	-.089	-.519	.605	.337	2.964	
	Gender	.512	.243	.213	2.109	.038	.974	1.026	
	Dummy high education level	-.590	.342	-.184	-1.728	.088	.875	1.143	
2	(Constant)	4.370	.565		7.734	<.001			
	Age	-.004	.019	-.043	-.238	.813	.293	3.408	
	Experience	-.012	.031	-.065	-.384	.702	.328	3.053	
	Gender	.434	.238	.180	1.820	.073	.958	1.043	
	Dummy high education level	-.612	.333	-.191	-1.837	.070	.871	1.148	
	cStateU	.012	.061	.028	.202	.840	.488	2.048	
	cEffeUn	.079	.070	.162	1.132	.261	.458	2.184	
	cRespoU	.064	.058	.121	1.091	.279	.764	1.309	
	ccomposF	.334	.202	.174	1.651	.103	.843	1.186	
	3	(Constant)	4.301	.571		7.529	<.001		
Age		-.003	.019	-.027	-.148	.883	.289	3.463	
Experience		-.007	.031	-.041	-.238	.812	.321	3.111	
Gender		.390	.247	.162	1.580	.118	.900	1.111	
Dummy high education level		-.617	.335	-.192	-1.842	.069	.870	1.149	
cStateU		.010	.062	.022	.156	.876	.469	2.133	
cEffeUn		.095	.073	.195	1.304	.196	.422	2.369	
cRespoU		.058	.061	.110	.951	.345	.713	1.402	
ccomposF		.345	.204	.180	1.689	.095	.838	1.193	
interSc		-.013	.113	-.015	-.118	.906	.561	1.783	
interEc		-.001	.141	-.001	-.006	.996	.492	2.032	
interRc		-.154	.113	-.149	-1.368	.175	.800	1.249	

a. Dependent Variable: Effectuation

The first model (model 1) containing only the covariates, was statistically significant, $F(4,88) = 4.17$, $p = .004$. Interestingly only gender was a significant predictor of the usage of effectual approaches in this sample. Females use .51 more effectual approaches than males, see Table 11. The model only with the covariates predicted 16.6% of the usage of effectual approaches. Model 2, the model with the covariates and the independent variables, was also a statistically significant model, $F(8, 88) = 3.30$, $p = .003$. When inspecting the unique predictors, it showed that none of the separate centralized predictors nor the covariates reached the significance level, see Table 11. This means that no variable in this model had a significant unique association with the usage of effectual approaches. The model does explain the variance of usage of effectual approaches for 24.8%. In the last model, the model with all the covariates, independent variables and the moderation terms was again a significant model, $F(11, 88) = 2.58$, $p = .008$, the model explained 27.0% of the usage. Also, in this model none of the unique predictors reach statistical significance, see Table 11. This again showed that separately they do not explain usage of effectual approaches.

The assumptions were all met, there was no multicollinearity (VIF scores all below 4), also the other assumptions were met, the normality, the linearity of the residuals and the data was homoscedastic.

However, there is no indication of a moderation in the prediction of effectual approach usage. Therefore, there is no evidence to support hypothesis H3 that the positive relationship between perceived uncertainty and the usage of effectuation strategies is moderated by the degree of entrepreneurial passion.

5. Discussion, limitations & future research

5.1 Implications

This study was conducted to provide more understanding of the motivations of entrepreneurs using effectuation strategies. Literature suggests effectuation strategies are positively associated with entrepreneurial uncertainty (Alsos et al., 2014; Chandler et al., 2011; Sarasvathy, 2001; Wiltbank, et al., 2006). Literature also suggests that an entrepreneur's choice of choosing a certain decision-making approach is based on their degree of entrepreneurial passion (Cardon, 2009). The focus of this study was to examine the way in which entrepreneurial passion effects the entrepreneurs' perception of uncertainty and therefore their usage of effectuation strategies.

In contrast to previous findings in literature, this study found no evidence that uncertainty leads to more effectual approaches of decision making. Instead, evidence was found that a higher level of state and lower level of effect uncertainty are related to causal approaches. These findings can be discussed focusing on the sample that was used for this study: primary new product development decision makers working in the Dutch software industry. This industry is characterized by fast-changing developments in technology and customer demands (McKelvie, et al, 2011), which enforces decision-making under uncertainty. This study confirms the entrepreneurs experience high levels of uncertainty. A possible explanation for the conflicting results is that the software entrepreneurs in the sample all are used to this degree of uncertainty and don't tend to base their decision making on existing uncertainties, knowing there always will be several.

Furthermore, the sample consists of mainly highly educated men. The characteristics of the sample could have been of influence on the results of the study. The study reveals that gender and education level have a significant relationship with decision making strategies: males and higher educated respondents adhere less to the causal usage approaches. Other academic findings also suggest that the decision-making logic works differently between genders, but results are inconclusive. Cowden et al. (2023) found women to be more effective in using effectuation approaches, while Melo et al. (2019) found a positive association between the female gender and causal approaches. No literature was found on the relationship between educational level and decision-making approaches, but Dew et al. (2009) found MBA-students (seen as novices) to use more causal approaches than expert entrepreneurs. They seek an explanation in years of entrepreneurial expertise, but also note that another possible explanation can be found in the knowledge structures the MBA-students have acquired through their education, which assumes there might be some kind of (indirect) relationship between education and decision-making approaches. Previous studies found different individual characteristics of entrepreneurs to directly affect their decision-making (Grégoire & Cherchem, 2020). Hensel and Visser (2020) found personality traits of entrepreneurs to be associated with effectual approaches. They even found associated traits to differ across the five dimensions of effectuation, showing effectuation to be a complex process to unravel. It is possible that individual characteristics, associated with highly educated male entrepreneurs, have influenced the results of this study.

Recording to the results of this study, entrepreneurs use causal and effectual approaches simultaneously. No correlation was found between the usage of the two approaches, meaning that using one strategy does not mean one does not use the other strategy. This finding is in contrast with Sarasvathy (2001) who claimed effectuation is the inverse of causation. This finding contributes to the assumption that effectuation and causation cannot be seen as opposites, but as complementing approaches (Perry, et al, 2011; Sitoh et al., 2014; Smolka et al., 2018). The use of the scale developed by Alsos et al. (2014) made it possible to examine the two constructs as separate and reveal this finding.

This study also did not find a significant relationship between the degree of entrepreneurial passion and perceived uncertainties. Also, no moderating effect was found of the degree of entrepreneurial passion on the relationship between perceived uncertainty and effectuation strategies. The respondents were found to be passionate, with a mean score of 5.50, 5.64 and 5.61 on passion for inventing, founding and developing. But none of the passion types were associated with the degree of perceived uncertainty. This finding suggests that passionate

entrepreneurs do not rashly pursue their goal, but more rationally weigh the environmental challenges. This finding is consistent with research by Stroe et al (2018) demonstrating that entrepreneurial passion alone does not call for effectual approaches. To drive effectual decision making, more is required such as a combination of passion with self-efficacy and risk perception.

This study used the definition and measurement scale of entrepreneurial passion offered by Cardon et al. (2009; 2013). The construct of entrepreneurial passion is however subject of academic discussion. While Cardon et al. (2009; 2013) distinguish between passion for inventing, founding and developing, other scholars use different kind of definitions and scales for entrepreneurial passion. Vallerand et al. (2003) distinguish between harmonious and obsessive passion, and Baum and Locke (2004) developed a five-item scale which measures an entrepreneur's passion for work. There are significant inconsistencies in how entrepreneurial passion has been conceptualized, and there is no academic consensus regarding how best to conceptualize and measure passion (Newman et al., 2021). It is possible that other measurements of entrepreneurial passion will be related to perceived uncertainty and therefore moderate the relationship between perceived uncertainty and decision-making strategies.

5.2 Limitations

First of all, there are limits to the method of operationalization. The survey was administered in Dutch. Therefore, the original scales were translated from English to Dutch. The reliability analysis revealed poor Cronbach's alpha for the scales of effectuation, causation and the three types of passion. According to Taber (2018) a score above 0.7 is desirable, but according to Field (2009) a score above 0.6 is still acceptable. However, scores for causation, and the three types of passion were even below 0.6. This means respondents may have had different interpretations of the questions asked, and therefore the results of this study should be considered with caution.

Another limitation is the generalizability of the study. In total 90 questionnaires were retrieved. This is not a big sample, considering the total population of software entrepreneurs in the Netherlands. Hair et al (2018) suggest a minimum observation-to-variable ratio of 5:1 but recommend ratios of 15:1 or 20:1. This means that though a minimum of five respondents must be considered for each independent variable in the model, 15 to 20 observations per independent variable are recommended. This study examined ten independent variables: three types of uncertainty, three types of entrepreneurial passion and four covariates (age, experience, education and gender), meaning a sample of 50 is sufficient but a sample of 150 to 200 respondents is recommended. The number of questionnaires was significant enough to conduct proper analyses, but caution is needed generalizing the results to all Dutch software entrepreneurs.

5.3 Future research

Still relatively little is known about the antecedents of effectual behavior (Hensel & Visser, 2020). Studies have focused on a few environmental and organizational variables to account for the prevalence of causational or effectual approaches, but still very little is known about what individual-level factors interacts with alternative decision making (Cannatelli et al, 2019). Previous studies that did examine the individual antecedents of effectuation have yielded inconclusive results (Grégoire & Cherchem, 2020). It's therefore recommended to further explore the role of individual characteristics of the entrepreneurs, such as gender. Gender is hardly ever used as the primary pursuit of a study, while studies which employed gender as a control variable all suggest gender playing a significant role in decision-making approaches (Cowden et al, 2023).

Although this study did not provide explanations on how entrepreneurial passion is related to effectuation or causation, future studies may explore the effect of passion on other variables that are associated with the entrepreneurial approach. Only a few studies have been done on the subject, but they do seem to suggest passion has some kind of influence on the entrepreneurial decisions made (Cannatelli et al., 2019; Laskovaia et al., 2022). A qualitative study on how passion drives entrepreneurs during their decision-making process may first provide deeper insights, which can then be further validated in quantitative studies.

Thirdly, this study should be administered in other sectors, not being the software industry in The Netherlands. As mentioned before, the software industry is known for its fast-changing developments and unpredictability, which the entrepreneurs might be used to. This could have had an effect on the way entrepreneurs view and deal with uncertainty regardless of their degree of passion. The results may be very different in other sectors, less used to risk taking.

6. Conclusion

The purpose of this study was to examine the effect of entrepreneurial passion on the way they perceive uncertainty and tend to make their strategic decisions. The research question was: *'In which way does entrepreneurial passion affect the entrepreneurs' perception of uncertainty and their usage of effectuation strategies?'*

The relationships between the three types of uncertainty (state, effect and response uncertainty) and the usage of effectuation strategies were tested, as were the relationships between the three types of entrepreneurial passion (passion for inventing, developing and founding), and the three types of uncertainties. Hypotheses were developed that stated that passionate entrepreneurs, for each type of passion, are less likely to let uncertainties drive them away from their goal and therefore tend towards a less effectual approach of decision-making.

This research has not found any significant evidence for supporting these hypotheses. The answer to the research question is that entrepreneurial passion does not affect the entrepreneurs' perception of uncertainty, and does not moderate the relationship between perceived uncertainty and effectuation approaches.

Literature suggests there are a lot of factors to be included when predicting the decision-making process of entrepreneurs. Individual characteristics and motives seem to play an important role. Entrepreneurs differ in the way they perceive risk and reward and they vary in their use of effectual and causal logic (Perry, et al. 2011). According to this study however the degree of entrepreneurial passion is not one of those predicting factors. Passionate entrepreneurs do not seem to be blinded by their passion in pursuing their goals. Their passion does not hinder them in seeing the uncertainties of the environment and therefore does not predict how they deal with uncertainties. Other individual factors seem to play a more significant role. More research is needed to explain the complex way entrepreneurial decisions are made (Arend et al., 2015). Better understanding of how strategic decision making comes about, will enable us to educate students to become successful entrepreneurs.

References

- Alsos, G., Clausen, T., & Solvoll, S. (2014). Towards a Better Measurement Scale of Causation and Effectuation. *Paper presented at the Academy of Management Meeting*, (pp. 1-5). Philadelphia.
- Arend, R. J., Sarooghi, H., & Burkemper, A. (2015). Effectuation As Ineffectual? Applying the 3E Theory-Assessment Framework to a Proposed New Theory of Entrepreneurship. *Academy of Management Review*, *40*(4), 630–651. <https://doi.org/10.5465/amr.2014.0455>.
- Baum, R., & Locke, E. (2004). The Relationship of Entrepreneurial Traits, Skill, and Motivation to Subsequent Venture Growth. *Journal of Applied Psychology*, *89*, 587-598. <https://doi.org/10.1037/0021-9010.89.4.587>.
- Bhowmick, S. (2015). They look while they leap: Generative co-occurrence of enactment and effectuation in entrepreneurial action. *Journal of Management & Organization*, *21*(4), 515-534. <https://doi.org/10.1017/jmo.2014.81>.
- Brundin, E., & Gustafsson, V. (2013). Entrepreneurs' decision making under different levels of uncertainty: The role of emotions. *International Journal of Entrepreneurial Behavior & Research*, *19*(6), 568–591. <https://doi.org/10.1108/IJEBR-07-2012-0074>.
- Cannatelli, B., Pedrini, M., & Braun, M. (2019). Individual-level antecedents of the entrepreneurial approach: the role of different types of passion in the Italian craft brewing industry. *International Entrepreneurship & Management Journal*, *15*, 1193–1219. <https://doi.org/10.1007/s11365-019-00585-6>.
- Cardon, M., Glauser, M., & Murnieks, C. (2017). Passion for what? Expanding the domains of entrepreneurial passion. *Journal of Business Venturing Insights*, *8*, 24-32. <https://doi.org/10.1016/j.jbvi.2017.05.004>.
- Cardon, M., Gregoire, D. A., Stevens, C. E., & Patel, P. C. (2013). Measuring entrepreneurial passion: Conceptual foundations and scale validation. *Journal of Business Venturing*, *28*(3), 373–396. <https://doi.org/10.1016/j.jbusvent.2012.03>.
- Cardon, M., Wincent, J., & Drnovsek, M. (2009). The Nature and Experience of Entrepreneurial Passion. *The Academy of Management Review*, *34*, 511-532. <https://doi.org/10.5465/AMR.2009.40633190>.
- Chandler, G. N., DeTienne, D. R., McKelvie, A., & Mumford, T. V. (2011). Causation and effectuation processes: A validation study. *Journal of Business Venturing*, *26*(3), 375–390. <https://doi.org/10.1016/j.jbusvent.2009.10.006>.
- Cowden, B., Karami, M., Tang, J., Ye, W., & Adomako, S. (2023). The gendered effects of effectuation. *Journal of Business Research*, *155*(B), <https://doi.org/10.1016/j.jbusres.2022.113403>.
- Dew, N., Read, S., Sarasvathy, S., & Wiltbank, R. (2008). Outlines of a behavioral theory of the entrepreneurial firm. *Journal of Economic Behavior & Organization*, *66*(1), 37–59. <https://doi.org/10.1016/j.jebo.2006.10.008>.
- Dew, N., Read, S., Sarasvathy, S., & Wiltbank, R. (2009). Effectual versus predictive logics in entrepreneurial decision-making: Differences between experts and novices. *Journal of Business Venturing*, *24*(4), 287–309. <https://doi.org/10.1016/j.jbusvent.2008.02.002>.
- Drucker, P. (1998). The discipline of innovation. *Harvard Business Review*, *76*(6), 149–157.
- Field, A. (2009). *Discovering Statistics Using SPSS*. Sage Publications.
- Field, A. (2018). *Discovering Statistics Using IBM SPSS Statistics*. In Field. SAGE Publications Limited.
- Grégoire, D., & Cherchem, N. A. (2020). structured literature review and suggestions for future effectuation research. *Small Business Economy*, *54*, 621–639. <https://doi.org/10.1007/s11187-019-00158-5>.
- Hair, J. F., Black, W. C., Babin, B. J., & Anderson, R. E. (2018). *Multivariate Data Analysis (8th ed.)*. Cengage Learning.
- Hensel, R., & Visser, R. (2020). Does personality influence effectual behaviour? *International Journal of Entrepreneurial Behavior & Research*, *26*(3), 467–484. <https://doi.org/10.1108/ijeb-06-2019-0343>.
- Knight, F. H. (1921). *Risk, uncertainty and profit*. Hart, Schaffner and Marx.

- Laskovaia, A., Lee, Y., Bogatyreva, K., & Herrmann, P. (2022). Harmonious passion, effectuation and firm performance: the moderated mediation effect of entrepreneurial experience. *Management Decision*, 60(8), 2331-2348. [https://doi.org/ 10.1108/MD-11-2020-1569](https://doi.org/10.1108/MD-11-2020-1569).
- March, J. G. (1982). The technology of foolishness. In J. March, & J. Olsen, *Ambiguity and choice in organizations* (pp. 69–81). Universitetsforlaget.
- McKelvie, A., Chandler, G., DeTienne, D., & Johansson, A. (2020). The measurement of effectuation: highlighting research tensions and opportunities for the future. *Small Business Economics*, 54, 689–720. [https://doi.org/ 10.1007/s11187-019-00149-6](https://doi.org/10.1007/s11187-019-00149-6).
- McKelvie, A., Haynie, J. M., & Gustavsson, V. (2011). Unpacking the uncertainty construct: Implications for entrepreneurial action. *Journal of Business Venturing*, 26(3), 273–292. [https://doi.org/ 10.1016/j.jbusvent.2009.10](https://doi.org/10.1016/j.jbusvent.2009.10).
- McMullen, J. S., & Shepherd, D. A. (2006). Entrepreneurial action and the role of uncertainty in the theory of the entrepreneur. *Academy of Management Review*, 31(1), 132–152. [https://doi.org/ 10.5465/amr.2006.19379628](https://doi.org/10.5465/amr.2006.19379628).
- Melo, F., Silva, R., & Almeida, T. (2019). Gender and Entrepreneurship: a comparative study between the Causation and Effectuation approaches. *Brazilian Business Review*, 16(3), 273–296. [https://doi.org/ 10.15728/bbr.2019.16.3.5](https://doi.org/10.15728/bbr.2019.16.3.5).
- Milliken, F. J. (1987). Three types of perceived uncertainty about the environment: State, effect, and response uncertainty. *Academy of Management Review*, 12(1), 133–143. [https://doi.org/ 10.2307/257999](https://doi.org/10.2307/257999).
- Mishra, P., Pandey, C., Singh, U., Gupta, A., Sahu, C., & Keshri, A. (2019). Descriptive statistics and normality tests for statistical data. *Annals of Cardiac Anaesthesia*, 22(1), 67-72. [https://doi.org/ 10.4103/aca.ACA_157_18](https://doi.org/10.4103/aca.ACA_157_18).
- Newman, A., Obschonka, M., Moeller, J., & Chandan, G. (2021). Entrepreneurial Passion: A Review, Synthesis and Agenda for Future Research. *Applied Psychology*, 70(2), 816-860. [https://doi.org/ 10.1111/apps.12236](https://doi.org/10.1111/apps.12236).
- Nicolaou, N., & Shane, S. (2010). Entrepreneurship and occupational choice: Genetic and environmental influences. *Journal of Economic Behavior and Organization*, 76(1), 3–14. [https://doi.org/ 10.1016/j.jebo.2010.02.009](https://doi.org/10.1016/j.jebo.2010.02.009).
- Packard, M., Clark, B., & Klein, P. (2017). Uncertainty Types and Transitions in the Entrepreneurial Process. *Organization Science*, 28(5), 840–856. [https://doi.org/ 10.1287/orsc.2017.1143](https://doi.org/10.1287/orsc.2017.1143).
- Perry, J. T., Chandler, G. N., & Markova, G. (2011). Entrepreneurial Effectuation: A Review and Suggestions for Future Research. *Entrepreneurship Theory and Practice*, 36(4), 837–861. [https://doi.org/ 10.1111/j.1540-6520.2010.00435.x](https://doi.org/10.1111/j.1540-6520.2010.00435.x).
- Sarasvathy, S. (2001). Causation and Effectuation: Toward A Theoretical Shift from Economic Inevitability to Entrepreneurial Contingency. *The Academy of Management Review*, 26, 243–263. [https://doi.org/ 10.5465/AMR.2001.4378020](https://doi.org/10.5465/AMR.2001.4378020).
- Sarasvathy, S. (2008). *Effectuation: Elements of Entrepreneurial Expertise*. Edward Elgar Publishing Ltd.
- Sarasvathy, S., & Dew, N. (2005). Entrepreneurial Logics for a Technology of Foolishness. *Scandinavian Journal of Management*, 21, 385-406. [https://doi.org/ 10.1016/j.scaman.2005.09.009](https://doi.org/10.1016/j.scaman.2005.09.009).
- Shepherd, D., & Patzelt, H. (2017). Researching Entrepreneurial Decision Making. In S. D.A., & P. H., *Trailblazing in Entrepreneurship* (pp. 257-285. [https://doi.org/ 10.1007/978-3-319-48701-4_8](https://doi.org/10.1007/978-3-319-48701-4_8)). Palgrave Macmillan.
- Sitoh, M. K., Pan, S. L., & Yu, C. Y. (2014). Business models and tactics in new product creation: The interplay of effectuation and causation processes. *IEEE Transactions on Engineering Management*, 61, 213–224. [https://doi.org/ 10.1109/TEM.2013.2293731](https://doi.org/10.1109/TEM.2013.2293731).
- Smolka, K., Verheul, I., Burmeister-Lamp, K., & Heugens, P. (2018). Get It Together! Synergistic Effects of Causal and Effectual Decision-Making Logics on Venture Performance. *Entrepreneurship Theory and Practice*, 42(4), 571-604. [https://doi.org/ 10.1111/etap.12266](https://doi.org/10.1111/etap.12266).
- Stroe, S., Parida, V., & Wincent, J. (2018). Effectuation or causation: An fsQCA analysis of entrepreneurial passion, risk perception, and self-efficacy. *Journal of Business Research*, 89, 265–272. [https://doi.org/ 10.1016/j.jbusres.2018.01.035](https://doi.org/10.1016/j.jbusres.2018.01.035).

- Taber, K. S. (2018). The use of Cronbach's alpha when developing and reporting research instruments in science education. *Research in Science Education*, 48(6), 1273-1296. [https://doi.org/ 10.1007/s11165-016-9602-2](https://doi.org/10.1007/s11165-016-9602-2).
- Townsend, D., Hunt, R. A., McMullen, J. S., & Sarasvathy, S. (2018). Uncertainty, Knowledge Problems, and Entrepreneurial Action. *Academy of Management Annals*, 12(2), 659–687. [https://doi.org/ 10.5465/annals.2016.0109](https://doi.org/10.5465/annals.2016.0109).
- Vallerand, R. (2010). On passion for life activities: The dualistic model of passion. In M. Zanna, *Advances in experimental social psychology* (Vol. 42, pp. 97–193. [https://doi.org/ 10.1016/S0065-2601\(10\)42003-1](https://doi.org/10.1016/S0065-2601(10)42003-1)). Academic Press.
- Vallerand, R. B., Mageau, G., Koestner, R., Ratelle, C., Léonard, M., Gagné, M., & Marsolais, J. (2003). Les Passions De L'ame: On Obsessive and Harmonious Passion. *Journal of personality and social psychology*, 85, 756-67. [https://doi.org/ 10.1037/0022-3514.85.4.756](https://doi.org/10.1037/0022-3514.85.4.756).
- Welter, C., & Kim, S. (2018). Effectuation under risk and uncertainty: A simulation model. *Journal of Business Venturing*, 33(1), 100–116. [https://doi.org/ 10.1016/j.jbusvent.2017.11](https://doi.org/10.1016/j.jbusvent.2017.11).
- Wiltbank, R., Dew, N., Read, S., & Sarasvathy, S. D. (2006). What to do next? The case for non-predictive strategy. *Strategic Management Journal*, 27(10), 981–998. [https://doi.org/ 10.1002/smj.555](https://doi.org/10.1002/smj.555).

Appendix A: Questionnaire

Questionnaire English

Age ...

Genderm/v

Education level: low (basisonderwijs en vmbo, mavo onderbouw) – medium (havo, vwo, mbo) – high (hbo, wo bachelor en wo master, doctor)

Years of entrepreneurial experience ...

Please rate these statements for your newest product on a scale from 1 to 9.

<i>State uncertainty</i>			
1	Low (1): The demand of our product is likely to fluctuate, but the rate of change is moderate and steady	1 2 3 4 5 6 7 8 9	High (9): The rate of demand for our product will fluctuate significantly.
2	Low (1): Future technological innovations affecting the viability of the product are likely to occur, but they are likely to be incremental (not discontinuous)	1 2 3 4 5 6 7 8 9	High (9): Future technological innovations affecting the viability of the product are likely to be frequent and major, including changes to the underlying technologies related to product usage.
<i>Effect uncertainty</i>			
3	Low (1): We have a strong idea of our customers' preferences and demands with regard to our product, and these are predictable over time.	1 2 3 4 5 6 7 8 9	High (9): It is not possible to predict in advance demand changes affecting the viability of the product.
4	Low (1): We are in a strong position to predict the nature and source of innovations that affect the viability of our product	1 2 3 4 5 6 7 8 9	High (9): It is not possible to predict with any certainty the kinds or timing of future technological innovations that will affect the viability of our product
<i>Response uncertainty</i>			
5	Low (1): We have tangible reasons to believe that our firm has the ability to sustain viability in this product market through further radical and/or incremental innovations.	1 2 3 4 5 6 7 8 9	High (9): It is not possible to foresee the ability of our firm to sustain viability in this product market through further radical and/or incremental innovations.
6	Low (1): While we are not able to fully predict the speed or nature of action of our competitors, we believe that if we act our product will enjoy advantages long enough to realize entrepreneurial returns.	1 2 3 4 5 6 7 8 9	High (9): We have no insights as to how our competitors will react in response to our product innovation, and therefore we cannot predict how long our product will enjoy advantages before a

			competitive response erodes profits.
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	<i>Passion inventing</i>	1 (totally disagree) to 7 (totally agree)
17	It is exciting to figure out new ways to solve unmet market needs that can be commercialized	1 2 3 4 5 6 7
18	Searching for new ideas for products/services to offer is enjoyable to me	1 2 3 4 5 6 7
19	I am motivated to figure out how to make existing products/services better	1 2 3 4 5 6 7
20	Scanning the environment for new opportunities really excites me	1 2 3 4 5 6 7
21	Inventing new solutions to problems is an important part of who I am	1 2 3 4 5 6 7
	<i>Passion founding</i>	
22	Establishing a new company excites me	1 2 3 4 5 6 7
23	Owning my own company energizes me	1 2 3 4 5 6 7
24	Nurturing a new business through its emerging success is enjoyable	1 2 3 4 5 6 7
25	Being the founder of a business is an important part of who I am.	1 2 3 4 5 6 7
	<i>Passion developing</i>	
26	I really like finding the right people to market my product/service to.	1 2 3 4 5 6 7
27	Assembling the right people to work for my business is exciting.	1 2 3 4 5 6 7
28	Pushing my employees and myself to make our company better motivates me.	1 2 3 4 5 6 7
29	Nurturing and growing companies is an important part of who I am.	1 2 3 4 5 6 7

Questionnaire Dutch

Leeftijd: ...

Geslacht: m/v

Hoogst genoten opleiding: Laag (basisonderwijs en vmbo, mavo onderbouw) – middelbaar (havo, vwo, mbo) – hoog (hbo, wo bachelor en wo master, doctor)

Jaar ervaring als ondernemer: ...

Onzekerheid

Wilt u onderstaande stellingen een score geven van 1 tot 9, met betrekking tot uw nieuwste (meest recent ontwikkelde) product.

<i>Onzekerheid over de omgeving</i>			
1	Laag (1): De vraag naar ons product zal waarschijnlijk wel fluctueren, maar de mate van verandering is matig en stabiel	1 2 3 4 5 6 7 8 9	Hoog (9): De vraag naar ons product zal sterk fluctueren.
2	Laag (1): Waarschijnlijk zullen toekomstige technologische innovaties de levensvatbaarheid van het product beïnvloeden, maar dat zal geleidelijk gebeuren.	1 2 3 4 5 6 7 8 9	Hoog (9): Waarschijnlijk zullen toekomstige technologische innovaties de levensvatbaarheid van het product vaak en ingrijpend beïnvloeden, en veranderingen eisen in de onderliggende technologieën die verband houden met het gebruik van het product.
<i>Effect uncertainty</i>			
3	Laag (1): We hebben een sterk beeld van de voorkeuren en eisen van onze klanten met betrekking tot ons product, en deze zijn voorspelbaar in de tijd.	1 2 3 4 5 6 7 8 9	Hoog (9): Het is onmogelijk om van tevoren veranderingen in de klantvraag te voorspellen die de levensvatbaarheid van het product beïnvloeden.
4	Laag (1): We weten de aard en de bron van innovaties die de levensvatbaarheid van ons product beïnvloeden, goed te voorspellen.	1 2 3 4 5 6 7 8 9	Hoog (9): Het is onmogelijk om met enige zekerheid de aard of timing van toekomstige technologische innovaties te voorspellen die de levensvatbaarheid van ons product zullen beïnvloeden.
<i>Response uncertainty</i>			
5	Laag (1): We hebben voldoende redenen om aan te nemen dat ons bedrijf het vermogen heeft om levensvatbaar te blijven in deze markt door verdere innovaties.	1 2 3 4 5 6 7 8 9	Hoog (9): Het is onmogelijk om te voorspellen of ons bedrijf het vermogen heeft om levensvatbaar te blijven in deze markt door verdere innovaties.
6	Laag (1): Hoewel we niet in staat zijn om de snelheid of aard van de reactie van onze	1 2 3 4 5 6 7 8 9	Hoog (9): We hebben geen idee hoe onze concurrenten zullen reageren op onze

	concurrenten volledig te voorspellen, zijn we van mening dat ons product lang genoeg rendement zal realiseren.		productinnovatie, en daarom kunnen we niet voorspellen hoe lang ons product rendement zal opleveren.
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	<i>Passie voor uitvinden</i>	1 (geheel mee oneens) tot 7 (geheel mee eens)
17	Het is opwindend om nieuwe commerciële manieren te vinden om tegemoet te komen aan onvervulde marktbehoeften.	1 2 3 4 5 6 7
18	Ik vind het leuk om te zoeken naar nieuwe ideeën voor producten/diensten die ik kan aanbieden.	1 2 3 4 5 6 7
19	Ik ben gemotiveerd om uit te zoeken hoe ik bestaande producten/diensten kan verbeteren	1 2 3 4 5 6 7
20	Ik vind het heel erg leuk om de omgeving te scannen op nieuwe kansen	1 2 3 4 5 6 7
21	Het bedenken van nieuwe oplossingen voor problemen is een belangrijk onderdeel van wie ik ben	1 2 3 4 5 6 7
	<i>Passie voor oprichting</i>	
22	Het oprichten van een nieuw bedrijf vind ik erg leuk.	1 2 3 4 5 6 7
23	Het bezitten van mijn eigen bedrijf geeft mij energie	1 2 3 4 5 6 7
24	Ik vind het leuk een nieuw bedrijf te begeleiden gedurende opkomend succes.	1 2 3 4 5 6 7
25	Oprichter zijn van een bedrijf is een belangrijk onderdeel van wie ik ben.	1 2 3 4 5 6 7
	<i>Passie voor ontwikkeling</i>	
26	Ik vind het erg leuk om de juiste mensen te vinden om mijn product/dienst aan te vermarkten.	1 2 3 4 5 6 7
27	Het is leuk om de juiste mensen te verzamelen om voor mijn bedrijf te werken.	1 2 3 4 5 6 7
28	Het motiveert mij om mijn medewerkers en mezelf te pushen om ons bedrijf beter te maken.	1 2 3 4 5 6 7
29	Het begeleiden en laten groeien van bedrijven is een belangrijk onderdeel van wie ik ben.	1 2 3 4 5 6 7