Understanding the relationship between shared cognition and new venture performance: the role of team attributes

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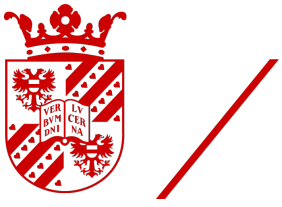

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Abstract

Entrepreneurship is considered a crucial building block for bringing new technologies into society. Researchers have been trying to investigate what makes new technology-based ventures successful. Widely acknowledged is that the performance of new ventures depends on the performance of the new venture team. However, what makes a new venture team superior to competing new venture teams is a debated topic. Preceding research has argued and substantiated that shared cognition, the emergent property resulting from collaboration and deliberation between team members, positively affects new venture performance. Nonetheless, under what circumstances shared cognition affects new venture performance remains to be researched. This thesis aims to increase the understanding of this relationship by studying the effects of two multi-dimensional team attributes on this relationship. The first attribute is entrepreneurial orientation, as entrepreneurial orientation dictates firm behavior following the strategic choices of the new venture team. Entrepreneurial passion is the second attribute hypothesized to influence the relationship between shared cognition and new venture performance. To test the hypotheses, data has been collected during a technology-driven competition involving 100 new venture teams. The data was gathered by asking the participants to fill in a survey before and after the competition. The results indicate that the hypothesized team attributes, including their sub-dimensions, do not moderate the relationship. These results are discussed extensively, including explanations for the non-findings. Lastly, future research suggestions are given to increase understanding of the relationship between shared cognition and new venture performance.

Keywords;
Shared Cognition, New Venture Performance, New Venture Team, Entrepreneurial Orientation, Risk Propensity, Innovativeness, Proactiveness, Competitive Aggressiveness, Autonomy, Entrepreneurial Passion, Entrepreneurial Passion for Inventing, Entrepreneurial Passion for Founding, Entrepreneurial Passion for Developing

Contents

1. Introduction: understanding the relationship between shared cognition and new venture performance

The problem with shared cognition research is that studies on the relationship between shared cognition and new venture performance have led to inconsistent results. Some studies found a negative effect of shared cognition on new venture performance Ensley and Pearce (2001); Banks and Millward (2007), some studies were inconclusive Bourgeois III (1980), and some found a positive effect Waardenburg et al. (2020); Ensley et al. (2006). Shared cognition is an emergent property resulting from collaboration and deliberation between team members (de Mol et al., 2015). It is defined by how group interactions affect the knowledge or understanding of the team (Hutchins, 2006). This emergent property defined by the interactions within a group has long been considered an important influencing factor on the performance of new venture teams (Waardenburg et al., 2020; Ensley and Pearce, 2001; West III, 2007; Rapert et al., 2002; Knight et al., 1999).

Two reasons exist for the conflicting research results. First, there is the issue of studies lacking a formal definition for shared cognition. Consequently, theoretical and empirical development for research on shared cognition and how this relates to new venture performance is hampering (de Mol et al., 2015). Second, there is ambiguity in the operationalization of shared cognition concepts complicating the finding of comparability among studies (de Mol et al., 2015).

Besides the arguments for fragmented research, few studies have addressed factors influencing the relationship between shared cognition and performance. In other words, at what circumstances does shared cognition influence new venture performance (Waardenburg et al., 2020). Performing research on concepts influencing the relationship between shared cognition and new venture performance is crucial because it allows for further understanding of why some new venture teams succeed where others fail. Given the increasing use of work teams in organizations, interest exists in identifying the best team design (Leach et al., 2005). One significant element within team design is the difference in attributes (Wildman et al., 2012). There exist six holistic attributes: the composition of the team, communication, distribution, design approach, information, and the nature of the problem (Ostergaard and Summers, 2009).

An attribute of entrepreneurial firms is the presence of entrepreneurial orientation. Strategic decisions influence new venture performance (Cooper, 1993) and entrepreneurial orientation is a business-level strategic orientation that encompasses the strategy-making practices, managerial philosophies, and business behaviors that are entrepreneurial in nature (Anderson et al., 2009). Therefore, it would be interesting to investigate the influence of entrepreneurial orientation on the relationship between shared cognition and new venture performance. Researchers analyze the sub-dimensions of entrepreneurial orientation (risk propensity, innovativeness, proactiveness, competitive aggressiveness, and autonomy) concerning their impact on new venture performance also (Lumpkin and Dess, 1996; Wiklund and Shepherd, 2005).

In addition to entrepreneurial orientation, it would also be interesting to research the degree to which entrepreneurial passion influences the relationship between new venture performance and shared cognition. The interest in entrepreneurial passion is partly due to the positive

relation between team entrepreneurial passion and performance (Santos and Cardon, 2019). Furthermore, the interest in entrepreneurial passion originates from the theory of componential theory of creativity presented in Amabile (2012). The theory denotes that passion can be seen as intrinsic task motivation that positively affects employee mood, learning capabilities and voluntary knowledge sharing (Deci and Flaste, 1995; Osterloh and Frey, 2000).

This study continues on the work of Waardenburg et al. (2020), arguing that the relationship between shared cognition and new venture performance is also affected by team-level factors other than coordinated work and focused team deliberation. Therefore, the goal of this research is to develop knowledge on the relationship between shared cognition and new venture performance. This knowledge will be in the form of how the positive relationship between shared cognition and new venture performance in Waardenburg et al. (2020) is affected by entrepreneurial orientation or entrepreneurial passion as attributes of the team. From this, the main research question reads as follows:

Research question: ***To what extent is the relationship between shared cognition and new venture idea performance influenced by entrepreneurial orientation and entrepreneurial passion?***

Practically, answering the research question adds to the understanding in which situations having shared cognition is desirable for new venture performance improvement. New venture teams could use this knowledge to focus their efforts rather than always striving to attain some state of shared cognition for each decision. Entrepreneurial orientation and entrepreneurial passion arguably benefit new venture performance if the team experiences shared cognition. Based on the results, it is possible to derive if shared cognition positively influences new venture performance based on attributes embedded in the team-level. Adopting the same attributes, investors can better assess if a team will be successful in establishing and growing their company. Incubators, trainers in entrepreneurial education, and prospective entrepreneurs know to strive for a state of shared cognition. However, should also be provided with guidance on how and when shared cognition will positively affect new venture performance.

Theoretically, this research adds to the understanding of the relationship between new venture performance and shared cognition by providing an overview of relevant concepts and terminology. Additionally, a direction is given on theorizing the interaction between shared cognition and factors individual from nature to formulate team attributes analyzing their collective impact on new venture performance.

Last, the content of this thesis requires an introduction. Following this introduction is the literature review. The literature review contains an explanation of shared cognition, new venture performance, entrepreneurial passion, entrepreneurial orientation, and the respective dimensions. After the concept explanation, the thesis addresses relations between the concepts, the hypotheses, and a conceptual model on the hypothesized relationships. The methodology section contains the data acquisition method and the computation of the variables of interest to the relationship. Hereafter, the results of the statistical analysis are written. Following is the deliberation of research limitations and future research directions. Finally, this thesis ends with concluding remarks concerning the shared cognition new venture performance relationship.

2. Literature review: concepts of interest to understanding the relationship

In this chapter, a literature review is conducted on entrepreneurial concepts relevant to this research, these concepts are: *new venture performance*, *new venture team*, and *shared cognition*. Second, the chapter includes the relationship between shared cognition and new venture performance. Hereafter, the potentially influencing attributes (*entrepreneurial orientation* and *entrepreneurial passion*) are elaborated. Both concepts use multiple dimensions. Therefore, hypotheses are given concerning the effect of the sub-dimensions also. The reason is to have a more detailed explanation of why the relationship between entrepreneurial orientation or entrepreneurial passion and the relationship between shared cognition and new venture performance is significant or insignificant.

Following is a discussion on the expected effect of these attributes on the relationship between shared cognition and new venture performance. However, the effect of entrepreneurial orientation, entrepreneurial passion, or their respective sub-dimensions on the relationship between shared cognition and new venture performance is mostly missing in the literature. For this reason, some of the considered variables are related to shared cognition and new venture performance separately to postulate on the effect on the relationship. At last, a conceptual model representing the hypotheseses is presented 2.1.

2.1 New venture performance

Researchers have proposed a variety of concepts influencing performance (Valentine et al., 2015). The performance of new ventures is related to the financial capital and human capital of new ventures (Cooper et al., 1994). Also, the social cognitive factors and how to address conflicts in the new venture team can impact the performance (Ensley et al., 2002). Next to cognition, financial capital, and human capital, empowering leadership is relevant (Carmeli et al., 2011; Ensley et al., 2006). Leadership shapes the behavior of the new venture teams. Another critical concept influencing new venture performance is that of the business environment in which the new venture operates (Cooper, 1993).

Including all these aspects is one of the earliest models on new venture performance. The model denotes that new venture performance is a function of entrepreneurial attributes, strategy, and the industry structure (Cooper et al., 1994). Hence, the strategic decisions of the new venture representatives impact the performance of a new venture. These strategic decisions can result in the following performance classifications: failure, marginal survival, and high growth (Chrisman et al., 1998). New venture performance can also be related to strategic management Sandberg and Hofer (1987). It is denoted that existing new venture performance models were incomplete as the models did not include the resources and the organizational structure, processes, and systems developed by the venture to implement its strategy and achieve its objectives (Sandberg and Hofer, 1987).

However, even though there exist multiple factors influencing new venture performance this thesis focuses on team attributes. This partially due to strategic choices made by the team representing the new venture rather than individuals (Ensley and Pearce, 2001). But also because of the upper echelon theory. The upper echelons theory is a meaningful aspect of new

venture performance as prior experiences, values, and personality of the executives influence the interpretations of situations and the choices the executives make (Hambrick, 2007). It is possible to relate the upper echelon theory to research on expert knowledge also. To achieve exceptional levels of team performance, an extensive, active learning process is required during which individuals have polished their skills and abilities (Sandberg and Hofer, 1987). Hence, teams that increase their experiences or skill set should experience better results for the firm.

2.2 New venture team

Following the upper echelon theory is explaining what is a new venture team. Furthermore, the term must be well defined to have comparable research results on what causes one team to thrive while other teams struggle or fail in either thinking of an idea, founding the new venture, and grow the new venture (Knight et al., 2020). However, research lacks consensus on how to conceptualize and operationally define a new venture team (Knight et al., 2020; Kuckertz and Mandl, 2016). Due to the absence of a strong paradigm, the systematic advancement of knowledge regarding new venture teams has stagnated, impacting the viability of the research (Knight et al., 2020). To prevent this fragmentation of research Knight et al. (2020) provides an overview of terminology described to denote the new venture team. The following terms are included in the research of knight: *start-up team* (Franke et al., 2008), *entrepreneurial team* (Kamm et al., 1990), *new venture team* (Klotz et al., 2014), *founding team* (de Mol et al., 2015), *entrepreneurial top management team* (Ensley and Pearce, 2001). The top management team here refers to the highest possible management in the new ventures. In essence, top management teams are executives working together in the top management teams of ventures that have been in operation for several years (Ensley et al., 2002). This also implies that new venture teams in the founding stage are considered top management teams per definition.

Next to the overview of terminology, there exists a useful framework that includes a multidimensional conceptualization using three points of interest: *ownership of equity*, *autonomy of strategic decision-making*, and *entitativity* (Knight et al., 2020). Intentionally, the framework reviews and integrates past research and serves as a guide to integrate future research. Instead of discrete classifications, the framework uses a multidimensional approach because the multidimensional approach allows for better comparisons between new venture teams. *Ownership of equity* refers to how much has been financially invested in the new venture by the different members of the new venture team. *Autonomy of strategic decision-making* entails to which extent new venture team members are allowed to make strategic-decision on resource allocation, product development and introduction, and competitive environment orientation without the interference of the management, fellow team members, or an external party (Knight et al., 2020). The third term, *entativity*, denotes the property of the group. These properties include the boundaries, internal homogeneity, social interaction, clear internal structure, common goals, and common fate (Knight et al., 2020). It is the degree to which a group is considered a pure entity.

Having explained new venture team as a concept enables the discussion on elements relevant to new venture teams and the performance of new ventures. Strategic choices are made more often by the team than by individuals (Ensley and Pearce, 2001). However, teams discuss strategic matters introduced by individuals. Hence, there is some degree of deliberation present. The other relevant element is cognition because cognition encompasses the various mental capabilities that an individual has as thinking, reasoning, remembering, problem-

solving, learning, attention, and decision-making (Fisher et al., 2019; Danili and Reid, 2006). Synthesizing both elements would imply that there seems to be a link between the cognition of individuals in a team and the strategic choices made by the team. The upper echelon theory is also relevant to the relationship between individual contributions and strategic choices the team makes. The theory states the choices executives make result from prior experiences, values, and personality. These prior experiences, values, and personality differ per person are thus related to the cognitive capabilities of that individual (Bromiley and Rau, 2016).

2.3 Shared cognition

Argued is that individual cognition is important to team performance and that if teams make strategic choices there must be a form of deliberation present. A term combining these two elements is shared cognition that refers to the cognition shared by the team. However, research on cognition in team settings varies in terms of the definition used. To clarify the concept and to provide an overview of prior research, the chapter includes table 2.1. Table 2.1 is an expansion of the table provided in Waardenburg et al. (2020) that used the research of de Mol et al. (2015) to create an overview of definitions for shared cognition.

Besides the synonyms provided in table 2.1 the terms *shared knowledge, shared understanding, distributed cognition, group cognition, and team cognition* can also be used to express shared cognition (Razzouk and Johnson, 2012). Except for this section, the thesis will only use the term shared cognition to prevent ambiguity.

One of the earliest terms used for shared cognition was *shared mental models*, which denoted that team members develop a shared understanding of a situation that includes the problem definition and solving strategy (Orasanu, 1990). Following this research was the coupling of mental models to strategy stating that strategic consensus is the extent to which individual mental models overlap on strategy (Wooldridge and Floyd, 1989). Next to the shared mental models, *shared strategic cognition* was also used to define the concept (Ensley and Pearce, 2001).

Shared strategic cognition defines the extent to which strategic mental models of top management teams overlap. Another term for shared cognition is *creative cognition* that focused on the degree to which there exists a shared repertoire of problem-solving ideas (Shalley and Perry-Smith, 2008). *Collective cognition* is also a synonym for shared cognition. Research on collective cognition stressed that perspectives could integrate, differentiate, or merge within a team (West III, 2007). One of the most recent terminologies is that of *entrepreneurial team cognition*, where the concept is seen as an emergent state de Mol et al. (2015).

Having explained the terminology of prior research allows for finding similarities in the terminology. From these similarities, a more elaborate definition of shared cognition can be formulated. A comparison of shared cognition studies found that shared cognition is an emergent state, embedded in team processes, and involves shared content-related knowledge (de Mol et al., 2015). The difference between cognition and shared cognition is that shared cognition refers to the cognition formed by the whole team. If an activity is experienced alone, the knowledge gained in the end is different than when two members experience it together and discuss their experience.

Shared cognition is defined by how the group interactions affect the knowledge or understanding of the team (Hutchins, 2006). Additionally, performance depends on social cognitive factors

and how conflict is addressed within new venture teams (Ensley et al., 2002). High levels of shared cognition are often related to team members attaining more comparable problem definitions, solutions, and customer selections (Fiore and Schooler, 2004).

Table 2.1: Different definitions and synonyms for the concept of shared cognition, sources: (Waardenburg et al., 2020; de Mol et al., 2015)

Term	**Author**	**Definition**
Collective cognition	West III (2007)	The extent to which two perspectives, integration and differentiation, merge within a team.
Creative cognition	Shalley and Perry-Smith (2008)	The extent to which there is a shared repertoire of ideas on how to solve problems
Entrepreneurial team cognition	de Mol et al. (2015)	An emergent state that refers to the manner in which knowledge is mentally organized, represented and distributed within the team.
Shared cognition	Razzouk and Johnson (2012)	The collective cognitive activity from individual group members where the collective activity has an impact on the overall group goals and activities.
Shared strategic cognition	Ensley and Pearce (2001); Thompson and Fine (1999)	The extent to which strategic mental models held in the hearts and minds of the top management team members overlap or agree
Strategic consensus	Wooldridge and Floyd (1989); Knight et al. (1999)	The extent to which individual mental models overlap on strategy
Strategic consensus	Rapert et al. (2002)	the extent to which intraorganizational perceptions converge on shared understandings of strategic priorities.
Shared mental models	Orasanu (1990); Castellan (2013); Mohammed and Dumville (2001)	Team members that have developed a shared understanding of the situation including definition of the problem, plans, and strategies for solving the problem, interpretation of cues and information and roles and responsibility of participants.

However, research on shared cognition in entrepreneurial settings is limited. First, because of contradictory findings when discussing the relationship between shared cognition and new venture performance (de Mol et al., 2015). Second, few studies focus on the effect of other entrepreneurial concepts such as passion on shared cognition, for example, (Waardenburg et al., 2020). In other words, research on the relationship between new venture performance and shared cognition is too limited.

2.4 The relationship between shared cognition and new venture performance

Having discussed new venture performance and shared cognition enables a discussion on their relationship. As entrepreneurial firms are the cornerstone of the economy, the importance of cognition on how entrepreneurs approach problems, and because entrepreneurs work in teams rather than individually, the relation between shared cognition and performance is considered relevant for entrepreneurial studies. Multiple studies have investigated the relationship, with examples found in Ensley and Pearce (2001); Ensley et al. (2006); Salas and Fiore (2004); West III (2007). However, the results vary, complicating the direction of future studies (de Mol et al., 2015).

To prevent ambiguity, this thesis builds on the findings of Waardenburg et al. (2020) finding a positive relationship between shared cognition and performance. Besides researching the relationship between new venture performance and shared cognition Waardenburg et al. (2020) also investigated variables affecting the relationship. The study concludes that work coordination has a mediating effect on the relationship between new venture performance and shared cognition. Next to work coordination, a negative moderating effect of focused deliberation is hypothesized but not supported. The study concludes that more variables need to testing for their influence on the relationship between shared cognition and new venture performance (Waardenburg et al., 2020). In essence, this research adds to our understanding of the relationship. This understanding will be on how team attributes impact the relationship between new venture performance and shared cognition.

2.5 The moderating effect of entrepreneurial orientation

Entrepreneurial orientation is a business-level strategic orientation that encompasses the strategy-making practices, managerial philosophies, and company behaviors that are entrepreneurial in nature (Anderson et al., 2009). The concept relates to sustainable competitive advantage, company growth, and the ability of a company to renew itself regularly (Covin and Wales, 2012). It is one of the most acknowledged research constructs concerning literature on entrepreneurship (Wales, 2016) and is researched concerning new venture performance (García-Villaverde et al., 2018).

Entrepreneurial orientation is a continuous variable with multiple sub-dimensions that enable the framing of new ventures (García-Villaverde et al., 2018). Entrepreneurial orientation is not limited to some specific or unique act but is a behavior essential to the entrepreneurial process (Covin and Lumpkin, 2011). At first, nine sub-dimensions have been introduced to assess entrepreneurial orientation (Covin and Slevin, 1989), but the majority of studies adopt three factors: risk-taking, proactiveness, and innovativeness (Rauch et al., 2009). However, competitive aggressiveness and autonomy are often considered also (Lumpkin and Dess, 1996). Researching the sub-dimensions independent of each other could be used to create additional insight (Lumpkin and Dess, 1996). To have a one-dimensional construct, entrepreneurial orientation is represented by the combined effect of its dimensions (Covin and Slevin, 1989). However, regardless of the conceptual diversity between sub-dimensions, the independent variation between the sub-dimensions is a topic of debate (Wales et al., 2013). Entrepreneurial orientation as a core firm strategic orientation continues to be researched in terms of understanding the effects of being entrepreneurial on other research contexts also (Wales et al.,

2013). However, the number of studies analyzing the antecedents of entrepreneurial orientation is limited as entrepreneurial orientation research focuses on the individual context (García-Villaverde et al., 2018).

Entrepreneurial orientation has been researched in a social context as well (De Clercq et al., 2013; García-Villaverde et al., 2018). A mediating role of internal knowledge sharing concerning trust and goal congruence was found as an aspect of organizational social capital and entrepreneurial orientation (De Clercq et al., 2013). Next to the mediating role of internal knowledge sharing, it seems that a strong exchange of valuable knowledge between team members of the network enables new ventures to have high entrepreneurial orientation also (De Clercq et al., 2013). The other social context is that of cognitive social capital. Cognitive social capital describes the cognitive connection with contacts close to the new venture and related to the knowledge absorptive capacity of the team (García-Villaverde et al., 2018). It is a dynamic capability related to the exploration and exploitation of external knowledge concerning entrepreneurial orientation.

Another interesting aspect is the difference between homogeneous and heterogeneous networks (García-Laencina et al., 2010). It is written that for homogeneous networks, or cognitively closed networks, knowledge absorptive capacity can enhance innovation exploitation. This because knowledge is easily accessible from contacts. For heterogeneous networks, knowledge absorptive capacity can be directed to be more exploratory as different contacts provide knowledge usable to detect new opportunities. Hence, if a new venture has access to diverse knowledge and is skilled in identifying and using shared knowledge, new ventures can enhance the use of singular knowledge and more heterogeneous information.

However, this does not explain how entrepreneurial orientation will affect the relationship between shared cognition and new venture performance. For higher levels of shared cognition, team members have similar perceptions of the interaction between the members. Consequently, it is easier to avoid confusion on how to communicate effectively and how effectively the team shares knowledge (García-Laencina et al., 2010). The team will have better access to valuable knowledge and can identify opportunities by acting proactively. Shared cognition is also related to having similar perceptions on the standards to maintain, goals, and culture within the new venture. The higher the standards and the more common the goals and culture, the higher the team members' tendency to share crucial knowledge is (Doh and Acs, 2010). Following this enhanced knowledge sharing is the improved performance. If the team also focuses on entrepreneurial orientation, that would mean that crucial knowledge of strategic matters embedded within entrepreneurial orientation is better shared and deliberated. Consequently, the interaction between shared cognition and entrepreneurial orientation enhances the performance of the new venture. The improved knowledge sharing and similarity in goals combined with the strategy-making practices embedded within entrepreneurial orientation lead to the following:

Hypothesis 1: Entrepreneurial orientation positively affects the relationship between shared cognition and new venture performance

As mentioned, entrepreneurial orientation is the combined effect of its sub-dimensions. Hence, the next sections will focus on explaining the sub-dimensions that entrepreneurial orientation uses. Hypotheses are created for the sub-dimensions to gain further insight into how entrepreneurial orientation affects the relationship between shared cognition and new venture performance.

2.5.1 Risk propensity

The first sub-dimension is that of risk propensity. Risk propensity here is the extent to which a team is willing to act given a perception of possible future gains or losses (Gartner and Liao, 2012; Ketchen and Short, 2013). The link between risk- and decision-taking in entrepreneurial environments have long been a subject of study. A significant relation is found between the methods used to make decisions and how likely the entrepreneurs are to take a risk (Adams, 1974). Current research supports Adams (1974) with various studies relating risk-taking and decision making (Forlani and Mullins, 2000; Zhang et al., 2019; Czerwonka, 2019). Risk-taking is also related to the cognitive functioning of the entrepreneur (Palich and Bagby, 1995; Kahneman and Lovallo, 1993; Czerwonka, 2019; Li and Ahlstrom, 2019).

The effect of risk propensity on the relationship between shared cognition and new venture performance has not been researched so far. This does not apply to the relationship between risk propensity and performance. Risk propensity as an entrepreneurial characteristic significantly connects to economic behavior prediction and the understanding of the goals set (Danso et al., 2016). Nonetheless, due to the lack of significant empirical evidence and conflicting research outcomes, it is difficult to pinpoint how exactly performance and risk propensity are related (Danso et al., 2016). Several studies argue that the contradictory outcomes result from the absence of risk perception (Boermans and Willebrands, 2017). The risk perception is considered important as overestimating or underestimating risk can have severe consequences for the new venture (Simon et al., 2000; Baum and Locke, 2004). This overestimating and underestimating is also in line with the cognitive bias for risk aversion and risk-seeking when the opportunity is framed more positively or negatively than it is, in reality, (Fang and An, 2017). Researching risk propensity is thus challenging as risk propensity differs per individual per situation (Keil et al., 2000).

Having explained literature on the concepts of shared cognition, new venture performance, the relation between these two, and risk propensity allows for a prediction on how risk propensity affects the relationship. Under the condition of shared cognition, all team members enjoy a collective understanding of the risk and the connected consequences of that risk. However, both underestimating and overestimating risk can have undesired consequences (Simon et al., 2000; Baum and Locke, 2004). For shared cognition overestimating or underestimating risk applies to the entire team. The expectation, therefore, is that the complete team is willing to take a risk that is potentially disastrous to the new venture for a high-risk propensity i.e. underestimating or risk-seeking. For low-risk propensity, the expectation is that the entire team is not willing to act on a risk that is potentially beneficial to the new venture i.e. overestimating or risk-aversion. Therefore, low- and high-risk propensity levels are likely to harm new venture performance given its interaction with shared cognition. However, for average-risk propensity, the shared understanding of the risk leads to less time spent discussing the risk. Which in turn increases the available time for other performance-enhancing activities. Besides, for average levels of risk propensity, the prediction is that teams are willing to act on a future gain while having at least considered realistic consequences. In short, the effect of risk propensity on the relationship between shared cognition and new venture performance is in the form of an inverted U-shape.

Hypothesis 2: There is an inverted u-shape between risk propensity and the relationship between shared cognition and new venture performance

2.5.2 Innovativeness

Innovativeness can as a company attribute is the tendency of entrepreneurs to engage in and support a culture that stimulates new products, services, or technological processes development (Wang, 2008). It is defined by the degree to which a culture is present that supports new ideas, allows for experimentation, introduces novel solutions to problems, and the creative processes of the entrepreneurs (Lee and Peterson, 2000). In essence, innovativeness focuses the attention of entrepreneurs on developing new products, services, or processes and using such innovations to increase new venture performance (Ketchen and Short, 2013).

Having explained the concept allows for a discussion on how innovativeness affects the relationship discussed in section 2.4. The literature on how innovativeness affects the relationship between shared cognition and new venture performance is missing. However, three articles discuss relationships between cognition, innovativeness, and performance. Organizations use multi-functional teams to innovate considering the teams' diverse skill-set and elaborate knowledge base enhancing the teams' creative potential (Weingart et al., 2010). However, the article undermines this statement by arguing that that same diversity potentially causes differences in problem perception resulting in communication interference, poorer coordination, increased conflict, and ultimately less integrated information and lower team performance. Hence, the increased similarity in the team members' perception can improve coordination among team members however removes creativity in the team i.e. innovation (Weingart et al., 2010).

It is necessary to consider the groups' abilities as some diverse groups can reach a shared view where others are not (Camelo et al., 2010). The article concludes that diversity in education and demographic characteristics negatively impacts innovation performance if strategic consensus is present. The reason for this is that the debate better predicts the performance than a mediated causal model. Next to the groups' abilities, social capital and cognitive orientation for performance are critical for the innovation process to enhance the internal knowledge capabilities and the accessibility of external sources of knowledge (Xu, 2016).

That innovation is critical to new venture performance has long been recognized by the scientific community. Innovativeness focuses the entrepreneurs' attention on developing new products, services, or processes and, if performed correctly, use such innovation to increase new venture performance. The relationship between shared cognition and innovativeness is not extensively researched in literature as research focuses mainly on individual processes (Reiter-Palmon et al., 2012). However, some articles tackle this subject (Gibson, 2001; Choi et al., 2011). One recurring element is that innovation requires diversity, thereby supporting the findings of Weingart et al. (2010).

Synthesizing the previous information on innovation, shared cognition, new venture performance, and the effects between the different concepts enables a more in-depth presumption on innovativeness's impact on the relationship between shared cognition and new venture performance. In line with the research of Weingart et al. (2010); for shared cognition, all team members have similar knowledge and understanding of potential innovative projects, and the proposed solutions of team members are more aligned. The prediction, therefore, is that teams are more likely to pursue an agreed innovation project considered by other team members rather than discuss conflicting views on different innovation projects. As a consequence, the team could have limited considered possibilities. Combining this with the

requirement of diversity for innovation, it is expected innovativeness negatively impacts the relationship between shared cognition and new venture performance.

Hypothesis 3: Innovativeness negatively affects the relationship between shared cognition and new venture performance

2.5.3 Proactiveness

Proactiveness denotes the tendency of the new venture team to anticipate and act on future needs rather than reacting to occurring events (Ketchen and Short, 2013). Team proactive behavior is the degree to which a team engages in self-starting and future-focused action to change the team or the external situation (Erkutlu, 2012). The concept is related to businesses embracing opportunity-seeking perspectives. Acting before changes in the market and being the first to enter a new market are examples of proactive behavior (Ketchen and Short, 2013). Entrepreneurial proactiveness is also positively related to market orientation, and market orientation positively affects business profitability and sales growth (Blesa and Ripollés, 2003).

Continuing on the effect of proactiveness on the relationship; no study addresses proactiveness's influence on the relationship between shared cognition and new venture performance. Research related to the three concepts mainly argues that proactiveness is part of the entrepreneurial personality and clarifies entrepreneurial intentions (Crant, 1996). Furthermore, the relationship between cognition and proactiveness focuses on individuals rather than teams or focuses on businesses in general instead of on entrepreneurial firms. Hence, to provide the basis of the expected relation, literature on the relationships between proactiveness and new venture performance and between proactiveness and shared cognition are reviewed.

When investigating the literature on the relation between proactiveness and new venture performance, it is possible to determine that the majority argues a positive effect of proactiveness on new venture performance. Arguably, market participants acting proactively can launch more action at a high rate, enabling these market participants to shape their territory and increase their market share through customer recognition (Lumpkin et al., 2006; Linton, 2019). Additionally, proactiveness positively affects market orientation and market orientation positively affects business profitability and sales growth (Blesa and Ripollés, 2003).

The relation between shared cognition and proactiveness has founded its origin in psychological studies. Psychological studies on teamwork have revealed that effective team members often use similar mental models to anticipate team-members' need for information and providing desired relevant information proactively (Yen et al., 2003). The relationship between proactiveness and shared leadership is also researched based on cultural impact, providing examples of traits connected to proactive teams (Erkutlu, 2012). Proactive teams introduce new work methods, prevent rather than reacting to problems, and scan the environment for potential opportunities.

With shared cognition, new venture performance, their relation, and proactiveness being introduced, the section continue with synthesizing this information to form a hypothesis. Under shared cognition, it is known that a team acting proactively is engaged in self-starting and future-focused action. That is, the teams avoid problems by handling these problems before the damage is irreversible. The team anticipates other information needs, saving time on finding information. The anticipation of information needs in combination, with the argument for proactiveness leading to introducing new services faster and the positive influence of

proactive behavior on market orientation the prediction is that the effect of shared cognition on performance increases when proactiveness increases.

Hypothesis 4: Proactiveness positively affects the relationship between shared cognition and new venture performance

2.5.4 Competitive aggressiveness

Competitive aggressiveness relates to entrepreneurs preferring to strategize intensely and directly challenging competitors over avoiding competitors (Ketchen and Short, 2013). The concept includes price-cutting, increasing marketing budgets, enhancing products or service quality, and changing production capacity. However, companies that are too aggressive can be their undoing. An example of this is a small firm attacking larger companies causing a price war (Ketchen and Short, 2013). Another argument for being careful with aggressiveness is that companies with an aggressive reputation are less likely to be included in collaborative efforts such as joint ventures (Ketchen and Short, 2013). New venture teams thus would do well in attaining a cautious approach regarding competitive aggressiveness. Contradictory, there is a positive relationship between competitive aggressiveness and performance in (Muhonen et al., 2017).

Businesses can profit from competitive aggressiveness if specialized technological resources and support from a well-connected network of partners are present (Andrevski and Ferrier, 2019). Research on how competitive aggressiveness affects the relationship is limited. A mediating effect of competitive aggressiveness on the relationship between shared cognition and new venture performance is found for top management teams (Luo and Lin, 2020). Considering this is only a single study, the relations between competitive aggressiveness and performance and competitive aggressiveness and shared cognition are addressed to facilitate the hypothesis formulation.

The relation between shared cognition and competitive aggressiveness is the awareness, motivation, and capability, or AMC, framework arguing that the three are critical drivers for competitive behavior (Miller and Chen, 1994). Awareness relates to the understanding of trends in the market and the intention of competitors, Motivation is the incentive to compete, and Capability refers to the resources needed for competitive behavior. It is also possible to base the resources on human capital.

Several articles are concluding that competitive aggressiveness is beneficial for new venture performance (Luo and Lin, 2020). Here it is crucial to consider the importance of first-mover advantage (Ferrier, 2001). Competitive aggressive entrepreneurs are proactive market participants launching more actions at a higher rate of speed, creating business territory, and increase market share through customer recognition (Chen et al., 2010). This is also in line with the first-mover argument. The difference between proactiveness and competitive aggressiveness is that competitive aggressiveness is proactive behavior focused on eliminating competing ventures whereas proactiveness can also be applied more broadly. Another aspect of competitive aggressiveness is that competitive and aggressive actions also have a higher probability of requiring resources (Lumpkin et al., 2006). Continuing on the study of Lumpkin et al. (2006), competitive capabilities are developed following organizations' behaviors and learning processes rather than being inherent to the organization. Last, there is the argument of the possible issue of new ventures not being able to aggressively compete because resources

are limited (Lumpkin et al., 2006). Therefore, these resources cannot be used to develop competitive capabilities.

Following the separate relations is combining the given information on the different concepts and hypothesizing the effect competitive aggressiveness has on the relationship between shared cognition and new venture performance. With shared cognition, members have the same understanding of the market trends, have a collective incentive to compete aggressively, and share some capabilities. As a result, less time is needed for deliberating on whether to perform a competitive action. The increased time enables teams to introduce new products and processes faster comparing to their competitors where shared cognition is more absent. The faster introduction of products and services with the first-mover advantage described in Ferrier (2001) leads to the following prediction. The expectation is that competitive aggressiveness positively affects the relationship between shared cognition and new venture performance.

Hypothesis 5: Competitive aggressiveness positively affects the relationship between shared cognition and new venture performance

2.5.5 Autonomy

Autonomy in a team setting, or team autonomy, denotes the extent of autonomy given to a group of interdependent employees responsible for the daily management, decision making, and problem-solving (Leach et al., 2005; Ketchen and Short, 2013). Autonomy on team-level is defined as the extent to which a team has considerable discretion and freedom in deciding how to carry out tasks (Langfred, 2005). On an individual level; embedded within autonomy is the authority of an employee given by a manager such that the employee can dictate his or her way of performing the required task, the ability to act independently, and to the degree to which an employee requires permission or approval by higher management (Langfred and Moye, 2004; Legault and Inzlicht, 2013; Pihie and Bagheri, 2013). Applying this to a team-level implies that for autonomous teams, the teams have the authority to dictate the way of working, the team can act independently, and the team has to ask for permission collectively.

Similar to risk propensity and entrepreneurial passion, research on the effect of autonomy on the relationship between shared cognition and new venture performance is missing in the literature. However, relations between team autonomy and shared cognition and between team autonomy and new venture performance have been addressed to some extent. Concerning the relation between shared cognition and autonomy, three independent mechanisms are considered to be of influence, namely the motivational effect of autonomy, the asymmetry of information, and the structural features of the task (Langfred and Moye, 2004).

Concerning the relation between autonomy and performance; numerous studies concluded that performance is positively affected by greater levels of autonomy (Leach et al., 2005). Autonomous entrepreneurial decision-making enables new venture team members to explore business opportunities, create business concepts, and from this start building the new venture (Pihie and Bagheri, 2013; Bird, 1988; McMullen and Shepherd, 2006; Lumpkin et al., 2009). It also argued that to effectively research opportunities and champion new venture concepts, individuals or teams making the strategic decisions require to be unobstructed by strategic norms or organizational traditions (Lumpkin et al., 2009). Furthermore, prior research indicates that autonomy drives innovation, aids in founding new ventures, and increases both the effectiveness and competitiveness of firms (Lumpkin et al., 2009). Moreover, job autonomy is

positively related to employee motivation, skill development, commitment, job satisfaction, and well-being and negatively related to stress, burnout, absenteeism, and employee turnover (Preenen et al., 2016). However, effective teamwork can also be negatively impacted by many factors where uncooperative behaviors, inadequate process skills, and poor technical skills are provided as examples of such factors (Leach et al., 2005).

Having discussed the existing literature allows for a postulation on the type of effect autonomy has on the relationship between shared cognition and new venture performance. Given the presence of shared cognition, it can be said that team members have a similar understanding of the problem, similar approaches in terms of the solution, and therefore agree more on the decisions to be made (Fiore and Schooler, 2004). The prediction, therefore, is that autonomous teams spend less time deliberating. In addition to that, autonomous teams can decide on strategic choices without asking for permission. Combining this with autonomous entrepreneurial decision-making stimulating the exploration of business opportunities, creation of business concepts, and from this start building the new venture (Pihie and Bagheri, 2013; Bird, 1988; McMullen and Shepherd, 2006; Lumpkin et al., 2009), autonomy as a driver for innovation (Lumpkin et al., 2009), and the positive effects of autonomy on motivation and skill development Preenen et al. (2016) lead to the expectation that autonomy would enhance the relationship between shared cognition and new venture performance.

Hypothesis 6: Autonomy positively affects the relationship between shared cognition and new venture performance

2.6 The moderating effect of entrepreneurial passion

As said next to the attribute embedded within entrepreneurial orientation, entrepreneurial passion is also considered a relevant attribute to the relationship. Researchers have introduced passion to explain the irrational behavior of entrepreneurs such as unconventional risk-taking, the uncommon intensity of focus, and unwavering belief in a dream (Cardon et al., 2009). Passionate entrepreneurs experience business success and growth (Baum and Locke, 2004). Passion is considered the entrepreneurial fuel to continue new venture growth and can be seen as an important indicator of the creativity, persistence, and new venture performance of an entrepreneur (De Mol and Khapova, 2020).

However, literature differs in the definition of entrepreneurial passion (Cardon et al., 2009). Furthermore, the relation between entrepreneurial passion and new venture performance has not been acknowledged yet (Collewaert et al., 2016). Besides the difference in terminology and the relatively unproven significant relation between passion and performance, there is the issue of entrepreneurial passion research lacking a proper measurement instrument (Cardon et al., 2013). The term *entrepreneurial passion* has found its origin in psychological research on emotions and behavior (Cardon et al., 2005). Earlier research focused mainly on understanding passion in terms of love, romance, artistic work, passion for sports, gambling, and gaming without necessarily assessing its impact on venture performance or success (Ho et al., 2011; Drnovsek et al., 2016).

Widely acknowledged is that passion can be either harmonious or obsessive (Vallerand et al., 2003). *Harmonious passion* is considered to be an automatic internalization leading to entrepreneurs choosing to actively participate in the activity the entrepreneurs enjoy exerting. Being characterized by process-focused motivation, entrepreneurs with harmonious passion are

more likely to focus on the activity and improving their performance instead of on outcomes and goals. For *obsessive passion*, defined by the entrepreneurial identity, there exists a controlled internalization of activity to engage in the activity that the entrepreneurs like (Stroe et al., 2018). Obsessive passion is more based on outcome-focused motivation where entrepreneurs focus on achieving planned goals (Stroe et al., 2018). Oppositely to harmonious passionate entrepreneurs, obsessive entrepreneurs show less risky behavior due to their tendency to avoid and anticipate the unexpected.

Passion was first conceptualized as an individual activity and combined with human identity in (Vallerand et al., 2003). On an individual level passion is considered as a strong inclination toward an activity that people like, that they find important, and in which they invest time and energy (Vallerand et al., 2003). The concept of passion in entrepreneurial settings was further developed in Cardon et al. (2009). Entrepreneurial passion is considered a team trait and passion is combined with the entrepreneurial identity that is inventor, founder, or developer. There is also a second key assertion of entrepreneurial passion that is an intense positive feeling, meaning that passionate entrepreneurs experience such feelings due to being involved in entrepreneurial activities. The term created to define passion as a team trait in combination with intense positive feelings and identity centrality is *team entrepreneurial passion* (Santos and Cardon, 2019). Team entrepreneurial passion is considered to be the level of shared intense positive feelings for a collective team identity that is high in identity-centrality for the new venture team (Santos and Cardon, 2019). In this thesis, the definition of Santos and Cardon (2019) will be referred to when discussing entrepreneurial passion.

Having discussed what entrepreneurial passion entails, allows for investigating the term's impact on the relationship. Research on the importance of passion for the entrepreneurial process and its influence on behavior is increasing including the empirical evidence (de Mol et al., 2020). However, research on the influence of entrepreneurial passion on the relation between shared cognition and new venture performance is lacking. In addition to this relation missing in the literature, there exist contradictory findings on the effect of entrepreneurial passion on new venture performance (Cardon, 2008).

The interest to research entrepreneurial passion's effect on the relationship between shared cognition and new venture performance, in this case, is based on the theory of componential creativity. This theory is relevant due to the creative nature of the competition used for data generation. Creativity is influenced by domain-relevant skills, creativity-relevant processes that are cognitive processes conducive to novel thinking, and task motivation as individual components and by the social environment as the surrounding component (Amabile, 2012). To ensure that the creativity is highest, people need to be intrinsically motivated with high domain expertise and developed skills in thinking creatively whilst operating in a creativity supportive environment (Amabile, 2012). The links with shared cognition and the theory of componential creativity are the domain expertise and the required skills. Meaning that with the presence of shared cognition the knowledge and skills of team members will be more similar. The link with passion is that passion can be seen as intrinsic task motivation (Amabile, 2012). Because people are the most creative when they are motivated by interest, enjoyment, satisfaction, and the challenge of the work itself. Intrinsic motivation is related to positive moods created by willing employees, results in increased learning, and causes colleagues to participate more in the process of sharing knowledge voluntarily (Deci and Flaste, 1995; Osterloh and Frey, 2000). Additionally, intrinsic motivation is also associated with increased task engagement (Deci and

Ryan, 2010). At last, it is argued that inherent satisfaction derived from a specific activity is influenced by intrinsic motivation (Deci and Ryan, 2010).

Having discussed the literature on entrepreneurial passion, shared cognition, new venture performance, and the relations between enable a postulation on how entrepreneurial passion affects the relationship between shared cognition and new venture performance. If the team has a shared view of being entrepreneurially passionate the team is intrinsically motivated (Amabile, 2012). All members are willing to create positive moods, are open to learning new things, share information voluntarily, and focus on their tasks while enjoying a shared understanding Deci and Flaste (1995); Osterloh and Frey (2000); Deci and Ryan (2010). Combining the with inherent satisfaction for specified activities (Deci and Ryan, 2010), the expectation is that the positive effect of shared cognition on new venture performance increases as entrepreneurial passion increases.

Hypothesis 7: Entrepreneurial passion positively affects the relationship between shared cognition and new venture performance

Similar to entrepreneurial orientation, entrepreneurial passion is a one-dimensional construct using sub-dimensions. Hence, the next section includes an elaboration on the different sub-dimensions that are an entrepreneurial passion for inventing, entrepreneurial passion for founding, and entrepreneurial passion for developing (Cardon et al., 2009). However, why is this identity centrality surrounding entrepreneurial passion important? The entrepreneurial identity centrality implies that entrepreneurs are passionate due to engagement in activities that mean something to the identity of the entrepreneur (Cardon et al., 2009). The inclusion of the dimensions enables the investigation of why entrepreneurial passion is negatively or positively and significantly related to the relationship between shared cognition and new venture performance.

2.6.1 Entrepreneurial passion for inventing, founding and developing

Before the hypotheses argumentation for the sub-dimensions of passion, first, the identities that form the sub-dimensions need to be specified. The inventing identity refers to all activities surrounding the identification, invention, and exploration of new opportunities (Cardon et al., 2009). Entrepreneurial passion for founding means that entrepreneurs enjoy participating in activities relating to the establishment and commercial exploitation of the opportunities found in the inventing stage. The third identity, developing, implies that entrepreneurs prefer activities that include the nurture, growth, and expansion of the new venture (Cardon et al., 2009).

With the sub-dimensions discussed, the postulation for their effect on the relationship between shared cognition and new venture performance can be instigated. Similar arguments are applicable here as for entrepreneurial passion. The identities only mean that being entrepreneurially passionate is limited to that identity rather than being conceptually different. Being passionate for one of the three identities would imply that the team is intrinsically motivated for activities embedded within that identity (Cardon et al., 2009). The other arguments are also applicable. Connecting the identities with the researches of Deci and Flaste (1995); Osterloh and Frey (2000); Deci and Ryan (2010); team members are willing to create positive moods as long as the team limits itself to activities within an identity, the team is open to learning new things for activities embedded within the identity, share information interesting to a specified identity,

and focus more on task embedded within an identity. Furthermore, entrepreneurial passion relates to inherent satisfaction for pre-specified activities. With the focus on entrepreneurial identities, these activities are more specified. Hence, the expectation is that the hypotheses for the identities align with the entrepreneurial passion hypothesis.

Hypothesis 8: Entrepreneurial passion for inventing positively affects the relationship between shared cognition and new venture performance

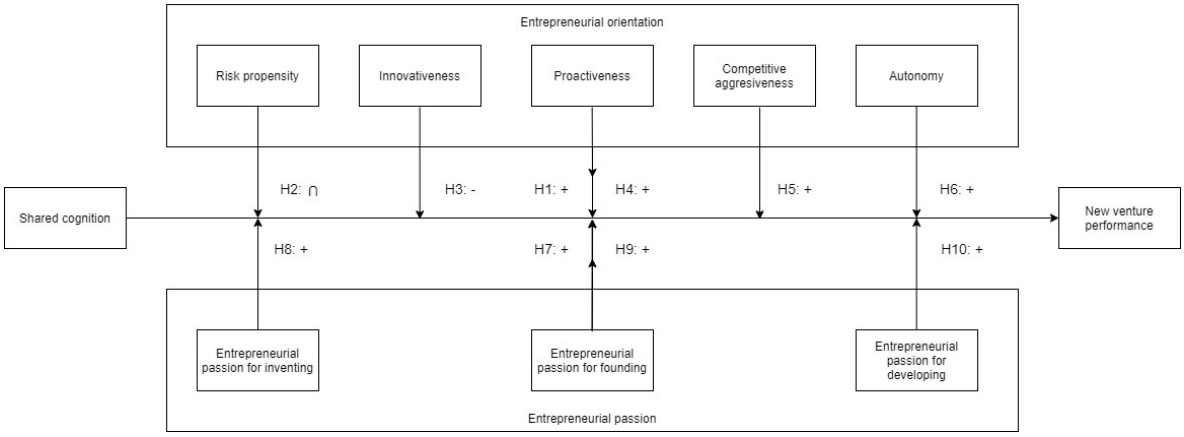
Hypothesis 9: Entrepreneurial passion for founding positively affects the relationship between shared cognition and new venture performance

Hypothesis 10: Entrepreneurial passion for developing positively affects the relationship between shared cognition and new venture performance

2.7 Conceptual representation of the influence of the concept of interest to the relationship

The conceptual model includes the ten hypotheses. The hypotheses will be subject to statistical research and are present in figure 2.1. As can be seen from figure 2.1, the relationships between entrepreneurial passion, competitive aggression, innovativeness, proactiveness, risk-propensity, and autonomy, entrepreneurial passion, entrepreneurial passion for inventing, entrepreneurial passion for founding, and entrepreneurial passion and the relationship between shared cognition and new venture performance are moderating relationships.

Figure 2.1: Conceptual model representing the hypotheses



3. Methodology: data acquisition and manipulation needed to operationalize the concepts of interest

The methodology chapter contains a description of how to operationalize the variables. Operationalization requires a description of the data sample and how the concepts described in chapter 2 will be measured also.

3.1 Data sample used for operationalization

The data used to analyze the effect of the concepts on the relationship between shared cognition and new venture performance is generated using a technology-driven competition. During the competition, the participants have to solve complex 21st-century challenges such as fossil-free future or conscious cities by applying digital solutions using blockchain and artificial intelligence. Via the technology-based competition, the organization was able, to an acceptable degree, to simulate the new venture environment. The new venture environment must be a dynamic and competitive environment experiencing time pressure (Eisenhardt, 1989). The 48 hours in which the assignments have to be completed assure the time pressure. To ensure that the competition is dynamic and competitive hundred teams participated, and the competition consisted of eleven categories. Per category, the teams receive either one or two challenges. Each challenge involves five teams. The competition's goal is to have competing teams create the best possible solution concerning the specified challenge. During the competition, the teams have limitless access to support from experts from different backgrounds, for example, legal or financial experts. At the end of the competition, a jury is present to assess the performance of the teams.

Next to the importance of simulating a competitive environment, it is also crucial to relate the competition to the multidimensional framework of Knight et al. (2020) discussed in section 2.2. The competition simulates teams at the start of a new venture with the complete freedom to make strategic decisions assuring the high entitativity and high equity of ownership. Concerning the autonomy of decisions, it is crucial to discuss the type of teams participating. The participating teams had different backgrounds. Teams are participating due to self-interest, teams from new ventures, and teams working at multinational companies. All the teams are given full autonomy during the competition. However, the degree of autonomy is dependent on the team itself because under normal circumstances the teams could have less autonomy than is given during the competition. An example here would be a team from a multinational company that normally would have to wait for decisions made by higher management. The teams thus complied with the framework of Knight et al. (2020) but there is some variation present to test the degree to which autonomy affects the relationship between shared cognition and new venture performance. Giving the teams complete autonomy of decision making is also desired because having a shared understanding of a problem the same team does not have to decide on, is rather wasteful in terms of the invested time.

Continuing on the procedure for data gathering during the competition; all team members are provided a survey before the competition start and a survey after the 48 hours pass and the teams present their solutions. From the initial analysis; a hundred teams participated with on

average 5.69 members per team. These hundred teams had on average 3.88 members filled in the pre-survey and 4.02 the post-survey.

Five teams did not submit any answers concerning either of the surveys. There were nine teams with less than two team members filled in the pre-survey and there were twelve teams with less than two members that filled in the post-survey. This resulted in a reduction from 100 to 74 teams. On average these 74 teams had 6.04 members, on average 4.91 team members filled in the pre-survey, and on average 4.85 team members the post-survey.

Hereafter, individuals that did not fill in any of the surveys are removed from the data-set. This results in a reduction to 5.43 members on average per team of which on average 4.51 and 4.85 members filled in the pre-survey and post-survey respectively. Continuing in the characteristics of these teams; from the remaining teams 68.2 % are men, 8.1 % are women, 3.4% denotes to be neither man nor women, and 20.2% did not fill in their gender. The average age of the remaining team members is 44.43 years old, the average tenure of the teams was 288.6 days.

3.2 Concept operationalization

In this section, it will be discussed how the team values for the variables discussed in chapter 2 are derived. The variables used for testing the hypotheses are presented in *italic*. First, the variables will be addressed separately based on how the variables are measured. Hereafter, the calculation of the variables from the gathered data will be addressed. Following is a general description of the procedure on how to calculate the variables using the surveys. Lastly, the methodology chapter contains an overview of all relevant variables and the correlations between these variables.

3.2.1 New venture performance

As stated in section 2.1, measuring new venture performance remains troublesome due to the stochastic nature of new ventures (Cooper, 1993). The assessment of new venture performance can only be reasonable if the assessment targets processes and outcomes (Valentine et al., 2015). Furthermore, there is the issue that the assessment should also connect to a context in which the new venture team pursues a goal (Valentine et al., 2015). In the context of shared cognition; new venture performance could be determined using self-assessment and observable or objective assessment (West III, 2007; Andersson et al., 2017).

One of the variables that can be used to measure the new venture performance is *Subjective Performance* (West III, 2007). *Subjective Performance* was asked via three separate sub-questions (see Appendix A), all using the Likert scale from 1 to 5 (i.e. 1 = completely disagree and 5 = completely agree).

A solely individual perspective on their solutions is a limited approach because to achieve the link with a context, measurements of relative performance are needed (Andersson et al., 2017). Therefore, next to three sub-questions on the participants' view on their solution, the participants are asked three sub-questions on how their solution performed relative to their competitors. *Comparative Performance* used the same scale as *Subjective Performance*. The two variables used for the self-assessment then require aggregation into a single variable, that is *Performance Self*.

The objective assessment was performed by a jury, introducing the variable *Observed Performance Jury*. As discussed in section 3.1 per challenge, five teams were competing. The performance of the teams is assessed such that the solution observed to be the lowest-performing, was awarded fifth place. To align with the Likert scale questions for subjective and comparable performance these values have to be reversed so that the best performing teams would also receive the highest assessment value 5. The final variable for new venture performance, *Overall Performance* is based on the aggregate of *Performance Self* and *Observed Performance Jury*. After the general procedure, see table 3.2, was completed, the sub-questions were aggregated to obtain a value per participant for *Subjective Performance* and *Comparative Performance*. The mean of these two values was computed and aggregated to obtain a value representing the self-assessed performance, *Performance Self*. The last step is to compute the mean of the self-assessed performance with the team value observed by the jury to retrieve the variable overall performance.

3.2.2 Shared cognition

As discussed in section 2.3, shared cognition includes the shared understanding and having comparable problems, solutions, and customer. Therefore, the participants were asked in total nine sub-questions: three on the problem/ challenge *SC Problem Self* in table 3.3), three on the solution *SC Solution Self* in table 3.3), and three on customer definition (*SC Customer Self* in table 3.3).

The three variables are also subjected to the general procedure in table 3.2. For all three variables, the third question focused on disagreement rather than agreement. For that reason, all three variables in the third question need reversion. From table 3.3; for all three shared cognition from self-assessment variables a sub-question is removed. Resulting in an increase of the coefficient alpha from 0.049 to 0.776, from -0.198 to 0.681, and from 0.111 to 0.584 for the problem, solution, and customer definition respectively. As the alpha coefficient needs to be above 0.67 to be considered at least reasonable (Taber, 2018), the exclusion of the customer definition in determining the value for shared cognition from the self-assessment is justified.

Finally, the value for shared cognition is derived. The mean of the values for understanding the problem (*SC Problem Self*) and the solution (*SC Solution Self*) from the Likert scale is computed. Hereafter, the values for individual participants need computation followed by a computation of the value per team. This variable is called *Shared Cognition Self* and represents shared cognition from self-assessment. Next to the Likert scale, the participants have to describe the core problem, core solution, and the potential customers via open-ended questions, that are variables *SC Problem Open*, *SC Solution Open*, and *SC Customer Open* respectively. Using table 3.1 it was possible to compare the participants' answers on a 1-5 rating scale for the problem, the solution, and the customer definition on team-level but separately per team To ensure that table 3.1 resulted in objective values, two assessors used the framework separately on the entire sample. After a single iteration, is the marking of values where the difference between assessors is two or higher on the 1 - 5 Likert scale.

Hereafter, a new score is given. Following the second iteration of the framework is that the answers between the two assessors are more aligned. Hence, there seems to be a learning cycle in applying this framework. As the open questions share the scale size of the Likert scale, the results from the framework can be seen as ordinal data. Due to the data being ordinal and because there only two raters, the Weighted Kappa method is used to determine the inter-rater

reliability (Gisev et al., 2013). The Weighted Kappa Method uses the principle that the higher the disagreement is, the higher the weight connected to this disagreement. Therefore, it is possible to reduce the inter-rater reliability by increasing the weight as the difference increases. For the assessment of the open scores, this is also desirable as the differences should be as low as possible for the framework to be reliable. The values representing the Weighted Kappa are 0.782, 0.852, and 0.795 for the problem, solution, and customer respectively, and are therefore substantial according to (Gisev et al., 2013).

Table 3.1: Framework used for assessing the open ended questions on shared cognition, source: (Waardenburg et al., 2020)

No.	**Description**	**Assessment criteria**
1.	*No shared cognition*	• There are no similarities present
2.	*Shared cognition minority group*	• There are similarities within a small section of the group
3.	*Fragmented shared cognition*	• There is a fragmented shared understanding present. Different groups have similarities within those groups, but not with the other group • There is a fragmented shared understanding present. There are similarities between a part of the answers within a majority of the team • A majority of the team gives a similar answer
4.	*Shared cognition majority group*	• All team members provide a similar answer. However, there is a difference in the span of the answer present. Some members provide extra non trivial information for that similar concept, and thus have a broader perception. • A large majority (>=(Group total -1)) of the team gives exactly the same answer
5.	*Full shared cognition*	• All members provide exactly the same answer • All team members provide the same answer but with synonyms, or trivial extra description

The second to last step for the open-ended questions is that the scores for *SC Problem Open*, *SC Customer Open*, and *SC Solution Open* are aggregated to form the final variables representing the value for shared cognition via the open-ended questions, *Shared Cognition Open*. Finally, the value for shared cognition is derived by taking the mean of the variables *Shared Cognition Self* and *Shared Cognition Open* called *Shared Cognition Team*

3.2.3 Entrepreneurial orientation

As the variable for entrepreneurial orientation is based on its sub-dimensions, first the operationalization of the sub-dimensions has to be discussed. The variables *Risk Propensity*, *Innovativeness*, *Proactiveness*, *Competitive Aggressiveness*, and *Autonomy*, embedded within entrepreneurial orientation Lumpkin and Dess (1996) were all subjected to the general procedure. The variables were measured using the 1-5 Likert scale from the pre-survey only.The Cronbach alpha was calculated over 3, 3, 3, 3, and 6 sub-questions for *Risk Propensity*, *Innovativeness*, *Proactiveness*, *Competitive Aggressiveness*, *Autonomy* resulting in Cronbach alpha values of 0.711, 0.810, 0.734, 0.755, and 0.759 respectively. The individual values for the variables were derived by taking the aggregate of the sub-questions. Following this individual value is to take the average score of all members of the team to create the team-values. Following the operationalization of the sub-dimensions is the operationalization for the variable for entrepreneurial orientation. Entrepreneurial orientation is discussed after its sub-dimensions as entrepreneurial orientation is represented by the combined effect of its sub-dimensions Covin and Slevin (1989). Hence, the team values for *Risk Propensity*, *Innovativeness*, *Proactiveness*, *Competitive Aggressiveness*, and *Autonomy* are aggregated to form the team value for entrepreneurial orientation.

3.2.4 Entrepreneurial passion

Similar to entrepreneurial orientation, *Entrepreneurial Passion* is computed using its sub-dimensions. Therefore, before addressing the concept itself is the discussion on the derivation of the variables representing the sub-dimensions. The variables *Entrepreneurial Passion for Inventing*, *Entrepreneurial Passion for Founding*, and *Entrepreneurial Passion for Developing* from Cardon et al. (2013) were also measured according to the general procedure described in table 3.2. Hence, the questions are asked from 1 - 5 Likert scale (Cardon et al., 2013). For illustration, there were 5, 4, and 5 sub-questions, see Appendix A, resulting in Cronbach Alpha values of 0.807, 0.842, and 0.838 connected to a passion for inventing, passion for founding, and passion for developing, respectively. There were no discrepancies regard to the general procedure for the three variables. The team value for these three variables is derived from aggregating the sub-questions into individual values and thereafter into a value per team. The value representing *Entrepreneurial Passion* as a whole, is simply the aggregate of its sub-dimensions. This as the combined effect of the three is seen as the overall term for entrepreneurial passion (Cardon et al., 2009).

3.2.5 Procedure used to calculate the team values

The reliability of the Likert scales is determined using the Cronbach alpha (Santos, 1999; Croasmun and Ostrom, 2011). If the sub-questions are reliable, the missing data is classified. There exist three types of classification for missing data: Missing Completely at Random (MCAR), Not Missing at Random (NMAR), and Missing at Random (MAR) (García-Laencina et al., 2010). To determine this missing data classification Little's MCAR test can be used (Little, 1988). The following procedure is applied to determine the team values per variable if the variable is asked via the 1 - 5 Likert Scale.

As can be seen from table 3.3, using Little's MCAR test, all variables failed to reject the null hypothesis meaning that the data is MCAR. For MCAR data both list-wise and pair-wise deletion do not result in biased estimates for correlations and covariances (Leite and Beretvas,

Table 3.2: Procedure used to determine the team values per variable

1. Compute the reliability of the Likert scale questions via Cronbach alpha
2. If applicable: remove questions that reduce the reliability
3. Determine missing data size and classification
4. Select imputation / estimation method
5. Impute / estimate missing values
6. Aggregate sub-question values into an individual value per variable
7. Aggregate the individual values into a team value

2010). Therefore, the individuals who did not fill in any sub-questions related to a specific variable are omitted from the data-set. The Expectation-Maximization (EM) algorithm can be applied to MCAR data without jeopardizing the reliability of the data also Bennett (2001); Lou et al. (2017). Hence, the EM algorithm imputes the values where the participants fail to answer all sub-questions of a variable. An example would be a participant only filling in the first two questions from figure 8.1in the appendix. With the missing values imputed, the different sub-questions per variable are aggregated to have an individual value for that variable and then aggregated into a team value.

Table 3.3: Variables subjected to the general procedure including procedural details

Variable	**Cronbach α**	**Little's MCAR**	**% Missing data**
Comparative Performance	0.828	MCAR	<3.30
Subjective Performance	0.848	MCAR	<2.00
SC Problem Self	0.774*	MCAR	<2.50
SC Solution Self	0.679*	MCAR	<0.80
SC Customer Self	0.591*	MCAR	<1.52
Risk Propensity	0.711	MCAR	<3.41
Innovativeness	0.810	MCAR	<3.50
Proactiveness	0.734	MCAR	<3.50
Competitive Aggressiveness	0.755	MCAR	<2.60
Autonomy	0.759	MCAR	<2.50
Entrepreneurial Passion for Inventing	0.807	MCAR	<1.90
Entrepreneurial Passion for Founding	0.842	MCAR	<2.99
Entrepreneurial Passion for Developing	0.838	MCAR	<2.86

*sub-question removed to increase variable reliability

3.3 Overview of operationalized concepts and correlation matrix

This section includes the correlation matrix concerning the variables representing the discussed concepts in this chapter. Per concept variable the mean and standard deviation are determined and the correlations between the variables are given, see table 3.5 and table 3.6.

Using table 3.5, table 3.6 and the studies of (Kowang et al., 2015; Care et al., 2018) stating the acceptance rates of the correlation coefficient r, interesting correlations are addressed. It can be seen that the variables that are derived using other variables show strong relationships with each other. Amongst these relations are the correlations between *Comparative Performance* and *Performance Self* and *Subjective Performance* and *Performance Self* where both relations are very strong positive significant ($r = 0.91$, $p < 0.01$).

Table 3.4: Mean and standard deviation per variable

No.	**Variable**	**Mean**	**Std. dev**
1	*Comparative Performance*	3.87	0.52
2	*Subjective Performance*	4.27	0.51
3	*Performance Self*	4.07	0.47
4	*Observed Performance Jury*	2.95	1.47
5	*Performance Team*	3.51	0.81
6	*SC Problem Self*	4.18	0.49
7	*SC Solution Self*	4.16	0.55
8	*Shared Cognition Self*	3.65	0.67
9	*SC Problem Open*	3.10	1.00
10	*SC Solution Open*	2.86	1.19
11	*SC Customer Open*	3.00	1.12
12	*Shared Cognition Open*	2.93	0.84
13	*Entrepreneurial Orientation*	4.03	0.30
14	*Risk Propensity*	4.16	0.38
15	*Innovativeness*	4.37	0.38
16	*Proactiveness*	3.96	0.42
17	*Competitive Aggressiveness*	3.34	0.56
18	*Autonomy*	4.28	0.28
19	*Entrepreneurial Passion*	3.99	0.49
20	*Entrepreneurial Passion for Inventing*	4.29	0.34
21	*Entrepreneurial Passion for Founding*	3.62	0.75
22	*Entrepreneurial Passion for Developing*	3.93	0.53

Table 3.5: Correlation matrix variables

	1	2	3	4	5	6	7	8	9	10	11
1.	1										
2.	0.65**	1									
3.	0.91 **	0.91**	1								
4.	0.02	-0.08	-0.03	1							
5.	0.31**	0.21	0.29*	0.95**	1						
6.	0.63**	0.30*	0.36**	0.01	0.21	1					
7.	0.43**	0.36**	0.44**	0.15	0.28*	0.79**	1				
8.	0.43**	0.36**	0.43**	0.13	0.26*	0.94**	0.95**	1			
9.	0.19	0.32**	0.28*	-0.18	-0.08	0.16	-0.03	-0.03	1		
10.	0.26*	0.30*	0.30**	0.19	0.27*	0.27*	0.19*	0.19	0.41**	1	
11.	0.15	0.26*	0.23	0.03	0.10	0.26*	0.26*	0.26*	0.34**	0.37**	1
12.	0.26*	0.38**	0.35**	0.03	0.14	0.31**	0.19	0.19	0.80**	0.75**	0.74**
13	0.44**	0.35**	0.44**	0.00	0.14	0.60**	0.59**	0.63**	0.05	0.16	0.01
14.	0.26*	0.17	0.23*	-0.06	0.02	0.39**	0.44**	0.44*	0.00	-0.02	-0.08
15.	0.36**	0.23*	0.33**	0.13	0.23	0.47**	0.54**	0.54**	-0.01	0.01	-0.09
16.	0.46**	0.36**	0.45**	-0.02	0.12	0.52**	0.48**	0.48**	0.14	0.26*	0.07
17.	0.25*	0.31**	0.31**	-0.04	0.06	0.38**	0.35**	0.55**	0.06	0.25*	0.11
18.	0.33**	0.16	0.27*	0.02	0.10	0.45**	0.36**	0.36*	-0.05	-0.03	-0.04
19	0.36**	0.32**	0.37**	0.04	0.16	0.39**	0.36**	0.40**	0.02	0.19	0.01
20.	0.33**	0.30**	0.34**	-0.01	0.10	0.48**	0.41**	0.41**	0.01	0.17	0.13
21.	0.30**	0.29*	0.33**	0.01	0.12	0.22	0.21	0.21	0.01	0.16	-0.05
22.	0.36**	0.27*	0.35**	0.10	0.02	0.46**	0.45**	0.45**	0.05	0.19	0.02

Note: *p < .05, **p < .01

Table 3.6: Correlation matrix variables continued

	12	13	14	15	16	17	18	19	20	21	22
12.	1										
13.	0.10	1									
14.	-0.04	0.73**	1								
15.	-0.04	0.74**	0.73**	1							
16.	0.21	0.87**	0.59**	0.55**	1						
17.	0.19	0.63**	0.08	0.09	0.51**	1					
18.	-0.05	0.74**	0.52**	0.58**	0.52**	0.34**	1				
19.	0.10	0.64**	0.40**	0.47**	0.66**	0.41**	0.44**	1			
20.	0.14	0.67**	0.44**	0.60**	0.60**	0.33**	0.56**	0.81**	1		
21.	0.05	0.49**	0.32**	0.34**	0.53**	0.32**	0.30**	0.94**	0.65**	1	
22.	0.12	0.65**	0.36**	0.43**	0.68**	0.46**	0.43**	0.91**	0.65**	0.76**	1

Note: *$p < .05$, **$\mathbf{p} < .01$

Performance Team is aggregated from *Performance Self* and *Observed Performance Jury*, resulting in correlation coefficients of ($r = 0.29$, $p < 0.01$) and ($r = 0.95$, $p < 0.01$) respectively. Significant relations due to aggregation can also be found between *SC Problem Self* and *Shared Cognition Self* ($r = 0.94$, $p < 0.01$) and *SC Solution Self* and *Shared Cognition Self* ($r = 0.95$, $p < 0.01$). There is a strong relationships resulting from aggregation between *SC Problem Open*, *SC Solution Open*, and *SC Customer Open* with *Shared Cognition Open*, that is ($r = 0.80$, $p < 0.01$), ($r = 0.75$, $p < 0.01$), and ($r = 0.74$, $p < 0.01$) respectively. Strong correlations are found for *Entrepreneurial Orientation* and *Risk Propensity* ($r = 0.73$, $p < 0.01$), *Innovativeness* (r

= 0.74, $p < 0.01$), *Proactiveness* ($r = 0.87$, $p < 0.01$), *Competitive Aggressiveness* ($r = 0.63$, $p < 0.01$), and *Autonomy* ($r = 0.74$, $p < 0.01$) again due to aggregation. Additionally, there are strong relations for *Entrepreneurial Passion* and it sub-dimensions as a consequence of aggregation: Entrepreneurial Passion with *Entrepreneurial Passion for Inventing* ($r = 0.81$, $p < 0.01$), *Entrepreneurial Passion for Founding* ($r = 0.94$, $p < 0.01$), and *Entrepreneurial Passion for Developing* ($r = 0.91$, $p < 0.01$).

Besides the significant relations due to aggregation it is seen that there is a very strong positive relationship between *Innovativeness* and *Proactiveness* ($r = 0.55$, $p < 0.01$). This shows that the study of Linton (2019) seems to be acknowledged by the data set used in this report.

Additionally, it is found that *Comparative Performance* and *Subjective Performance* are strongly related ($r = 0.65$, $p < 0.01$), implying that both methods of performance result in similar values for performance thereby supporting the research of (Andersson et al., 2017).

Contradictory to the study of West III (2007) it is seen that *Observable Performance Jury* shows no significant relationships except for the variables used for aggregation. Especially interesting here is that there seems to be no link with the self-assessment values. An argument for the differences could be the group process of the jury. It could be that some jury members with a stronger opinion have directed the process more than their conflict avoiding colleagues. However, there is no data available per jury member, only the final value. Hence,

Entrepreneurial Orientation has strong correlations with the performance variables and the variables connected to *Shared Cognition Self*: *Comparative Performance* ($r = 0.44$, $p < 0.01$), *Subjective Performance* ($r = 0.35$, $p < 0.01$), *Performance Self* ($r = 0.44$, $p < 0.01$), *SC Problem Self* ($r = 0.60$, $p < 0.01$), *SC Solution Self* ($r = 0.59$, $p < 0.01$), *Shared Cognition Self* ($r = 0.63$, $p < 0.01$). However, *Entrepreneurial Orientation* has no correlation with *Shared Cognition Open*.

Innovativeness has a strong correlation with Entrepreneurial Passion ($r = 0.47$, $p < 0.01$) and it sub-dimensions. This correlation then supports the research of Amabile (2012) that argued that *Entrepreneurial Passion* is significantly related to creativity and thus innovativeness.

Entrepreneurial Orientation is strongly related to *Entrepreneurial Passion* ($r = 0.64$, $p < 0.01$) but also with *Entrepreneurial Passion for Inventing* ($r = 0.67$, $p < 0.01$), *Entrepreneurial Passion for Founding* ($r = 0.49$, $p < 0.01$), and *Entrepreneurial Passion for Developing* ($r = 0.65$, $p < 0.01$). Also interesting is that the sub-dimensions of *Entrepreneurial Orientation* and *Entrepreneurial Passion* are all strongly correlated.

Similar to *Entrepreneurial Orientation*, *Entrepreneurial Passion* has strong correlations with *Comparative Performance* ($r = 0.36$, $p < 0.01$), *Subjective Performance* ($r = 0.32$, $p < 0.01$), *Performance Self* ($r = 0.37$, $p < 0.01$), *SC Problem Self* ($r = 0.39$, $p < 0.01$), *SC Solution Self* ($r = 0.36$, $p < 0.01$), and *Shared Cognition Self* ($r = 0.36$, $p < 0.01$) respectively. Last, it is seen that *Entrepreneurial Passion for Inventing*, *Entrepreneurial Passion for Founding*, and *Entrepreneurial Passion for Developing* all share a significant relationship with each other.

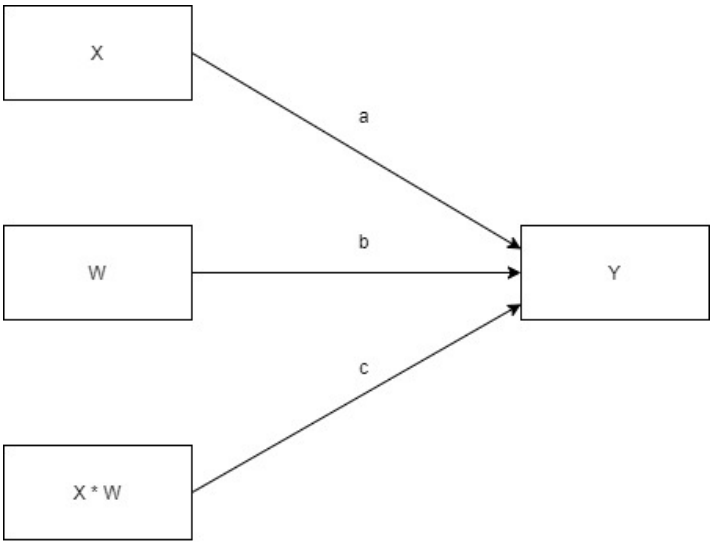
4. Results: empirical evidence for understanding the influence of the concepts on the relationship

The result section will include the outcome of the analysis on the hypotheses discussed in chapter 2. Through the statistical program SPSS, the operationalized variables from chapter 3 are embedded within the hypotheses testing. The hypotheses testing uses hierarchical regression as the main-approach (Lindenberger and Pötter, 1998; Baron and Kenny, 1986) and curvilinear moderation (Li, 2018) as means to test the inverted U shape of the second hypothesis.

In the results chapter, four sections are included. The first section addresses the conceptual form of the analysis or simple moderation Second, the chapter provides an overview of the used variables and explains the regression approaches. Third, the results of both the main regression model and the models used for the robustness checks are included. At last, an overview is present containing the results per hypothesis for the different tests.

4.1 Simple moderation used to generate the empirical evidence

Figure 4.1: Conceptual model representing moderation, source: (Baron and Kenny, 1986)



In the conceptual form of the moderation, presented in figure 4.1, (X) denotes the independent variable, (Y) the dependent variable, (W) the moderating variable, and (X * W) the interaction term between the independent variable and the independent variable argued to be a moderating variable (Baron and Kenny, 1986). To assess whether an independent variable behaves like a moderating variable, three paths need testing. In path a, the direct effect of the independent variable on the dependent variable is conceptually presented. The second path, path b, represents the direct effect of the independent variable moderating on the dependent variable.

The last path, path c, embodies the ramification of the interaction term between the independent variable in path a and the expected moderating variable in path b on the dependent variable. If path c is significant, the moderator hypothesis is supported (Baron and Kenny, 1986). The interaction term is the multiplication of two variables.

4.2 Regression methods used to generate empirical evidence

The variables included in the analysis are presented in table 4.1. As described, the regression analysis is based on hierarchical regression. The inverted U shape of the second hypothesis uses curvilinear regression. Before the provision of the regression results is the explanation of hierarchical regression and curvilinear regression.

Table 4.1: Independent (X) variables, dependent (Y) variables, and moderating (W) variables used for the analysis including used abbreviations

X variable	**W variable**	**Y Variable**
Shared Cognition Self (SCS)	*Entrepreneurial Orientation* (EO)	Subjective Performance (SP)
Shared Cognition Open (SCO)	*Risk Propensity* (RP)	Comparative Performance (CP)
	Innovativeness (In)	Performance Self (PS)
	Proactiveness (Pr)	
	Competitive aggressiveness (CA)	
	Autonomy (Au)	
	Entrepreneurial Passion (EP)	
	Entre. Passion Inventing (EPI)	
	Entre. Passion Founding (EPF)	
	Entre. Passion Developing (EPD)	

4.2.1 Hierarchical regression

Hierarchical regression is used to assess the validity of the hypotheses. In practice, hierarchical regression is a framework to compare different models rather than being a statistical method. The approach is a unique case of a multiple linear regression (Field, 2013). Linear regression is also desired as the majority of the hypotheses argue a linear relationship. Using the framework, multiple regression models are built through the addition of variables to the preceding model. This implies that the newer model includes the impact of the preceding model. Consequently, it is possible to determine if the addition of other independent variables significantly improves the model.

Mathematically, this hierarchical addition is conceptually presented by equations 4.1 and 4.2. Note: these formulas only illustrate the functioning of hierarchical regression, not the formulas for this research. In equation 4.1 two independent variables are thought to influence the criterion or dependent variable, that is X_1 and X_2. Variable A is the intercept which is the value of the dependent variable Y when the variables are equal to zero. The variable e represents the residual error. The variables for B are the coefficients resulting from the regression for each independent or predictor variable. Following hierarchical regression would then be the formula of the next model, that is equation 4.2, must include additional terms. The additional term in this case is an interaction between two variables (X_1 and X_2) as this research focuses on moderation (Field, 2013). If the variables have been established for both models, the regression can be instigated.

To analyze if the newer model can statistically predict the criterion variable the R-squared value (R^2), the change in the R-squared (ΔR^2), F-ratio or F-value, and the change in the F-ratio (Sig ΔF) can be used (Field, 2013). The F-ratio is used to determine if the change in R-squared is statistically significant. To statistically determine if the new model fit is improved significantly by the addition of new independent variables, researchers use the change in the F-ratio.

$$Y(1) = A + B_1 * X_1 + B_2 * X_2 + e \tag{4.1}$$

$$Y(2) = A + B_1 * X_1 + B_2 * X_2 + B_3 * (X_1 * X_2) + e \tag{4.2}$$

To determine whether certain variables have a significant relationship with one another the p-value is used. The p-value tests the null hypothesis that the regression coefficient is equal to zero for each independent term. To comply with the 95% confidence interval, the p-value has to be lower than 0.05 (< 0.05) to reject the null hypothesis. If the null hypothesis is rejected, there is a statistically significant relationship between the involved variables.

The last aspect that requires explanation is the interpretation of the regression coefficient *B*. In research, independent variables are often centered to make the regression coefficient *B* interpretable for lower-order terms when interaction terms are included in the model (Field, 2013). In this thesis, the variables are centered due to the presence of interaction terms and the argued quadratic influence of risk propensity. Following the centering of the variables is whether to standardize the regression coefficient *B* or not. For linear regression, the unstandardized *B* represents the amount of change in the dependent variable if the independent variable is changed with one unit while the other independent variables remain constant. The unstandardized coefficient is used often, as it is easier to interpret than the standardized coefficient β. The standardized coefficient uses the standard deviation, meaning that it can rank the influence of the independent variables on the dependent variable on a scale from -1 to 1 (Field, 2013). The standardized coefficient eliminates the differences in the units of measurement. As this research is mainly interested in whether significant relationships are found between variables, rather than ranking the different variables, it is decided to present the unstandardized coefficient.

4.2.2 Curvilinear regression

A said the hierarchical regression uses linear regression to determine the relationships between independent variables and dependent variables. However, a quadratic relationship is argued for the influence risk propensity on the relationship between shared cognition and new venture performance. Fortunately, curvilinear regression tests for quadratic terms and can be embedded within the hierarchical regression (Field, 2013). Curvilinear regression is based on the same assumptions as linear regression (Field, 2013). Mathematically, the addition of a quadratic term can be seen from the difference between equations 4.3 and 4.4. Hence, to test the quadratic term for risk propensity, both the linear as the quadratic term needs to be added. However, as this research focuses on moderation an interaction term needs to be created using the quadratic term (Haans et al., 2016). To test such curvilinear moderation an interaction term needs to be calculated between in this case X_1 and the quadratic term of the second variable, that is X_2^2.

$$Y(1) = A + B_1 * X_1 + B_2 * X_2 + e \tag{4.3}$$

$$Y(2) = A + B_1 * X_1 + B_2 * X_2 + B_3 * X_2^2 + e \tag{4.4}$$

$$Y(3) = A + B_1 * X_1 + B_2 * X_1^2 + B_3 * X_2^2 + B_4 * (X_1 * X_2^2) + e \tag{4.5}$$

4.2.3 Assumptions regression methods

It is mentioned that hierarchical regression and curvilinear regression have the same assumptions as linear regression (Field, 2013). Preceding the hypotheses assessment is thus the verification of the assumptions connected to hierarchical regression and curvilinear regression. The linearity assumption between independent and dependent variables, normality for all variables, and homoscedastic data, found in Field (2013), have all been satisfied for the variables specified in table 4.1. The no or little multicollinearity assumption is satisfied as a consequence of the centering of the independent variables.

4.3 Analysis of empirical evidence

The result regression models section will include the regression results following the hierarchical regression and curvilinear moderation. The first part of the results focuses on the regression used to obtain the answers for hypotheses 1 and 7. Hereafter, the results concerning subdimensions are provided. The third and last part of the model results section contains the robustness check.

4.3.1 Main relationships

There are three main relationships here: the relationship between shared cognition and new venture performance, the influence of entrepreneurial orientation on that relationship, and entrepreneurial passion on that relationship. However, first, the independent and dependent variables used for the main relationships need an introduction. The main independent (X) variable is *Shared Cognition Open* and *Performance Self* is the main dependent (Y) variable. *Shared Cognition Open* better represents shared cognition than *Shared Cognition Self*, as the open-scores are derived by assessing similarity in open answers whereas *Shared Cognition Self* is limited to the degree the participants considered shared cognition to be present. *Performance Self* is selected as the main variable as it includes the subjective and comparative performance of the participants. Hence, the main representation of the relationship between shared cognition and new venture performance uses the combination *Shared Cognition Open* and *Performance Self* (SCO & PS).

4.2 contains the results of the main relationships. As discussed in section 4.2.1, the hierarchical regression method requires the variables to be added to the model in steps. The first step is to derive the relationship between shared cognition and new venture performance as this thesis tries to determine if the interaction terms statistically significant account for the amount of variance of the dependent variable. Hence, model 1 from table 4.2 represents the direct effect of shared cognition on new venture performance. It can be seen that the direct of shared cognition is significant and positive for model 1 ($B = 0.196$, $p = 0.002$).

Having assessed the relationship between shared cognition and new venture performance allows for adding terms for entrepreneurial orientation and passion as to see their influence on the relationship. Models 2, tests the direct effects of *Entrepreneurial Orientation* and *Entrepreneurial*

Passion. There is a significant effect between *Entrepreneurial Orientation* and *Performance Self* ($B = 0.495$, $p = 0.019$) in model 2. To determine whether *Entrepreneurial Orientation* and *Entrepreneurial Passion* function as moderators, the interaction terms were computed and included in model 3. The effects of *Entrepreneurial Orientation* and *Entrepreneurial Passion* on the relationship between shared cognition and new venture performance are ($B = 0.028$, $p = 0.902$) and ($B = -0.030$, $p = 0.838$) respectively. These relationships are thus insignificant. Additionally, it is seen that adding the interaction terms does not increase the amount of variance in the dependent variable that is predicted from the independent variables. Hence, hypotheses 1 and 7 are not supported by the results.

Table 4.2: Regression results main analysis

Variable	Model 1		Model 2		Model 3	
	Y variable: PS		Y variable: PS		Y variable: PS	
	B	*p*	*B*	*p*	*B*	*p*
(Constant)	4.054	0.000	3.811	0.000	3.814	0.000
SCO	0.196	0.002	0.171	0.003	0.178	0.085
EO			0.495	0.019	0.473	0.060
EP			0.132	0.302	0.143	0.332
EO * SCO					0.028	0.902
EP * SCO					-0.030	0.838
R^2	0.125		0.299		0.299	
ΔR^2	0.125		0.173		0.173	
F	10.181		9.794		5.718	
Sig ΔF	0.002		0.000		0.979	

N = 73

4.3.2 Sub-dimensions

The direct results for the sub-dimensions of *Entrepreneurial Orientation* and *Entrepreneurial Passion*, see table 4.3, are presented in model EO-1 and model EP-1 respectively.

Table 4.3: Main regression results sub-dimensions

Variable	Model EO-1		Model EO-2		Variable	Model EP-1		Model EP-2	
	Y variable: PS		Y variable: PS			Y variable: PS		Y variable: PS	
	B	*p*	*B*	*p*		*B*	*p*	*B*	*p*
(Constant)	4.989	0.000	5.205	0.000	(Constant)	3.854	0.000	3.878	0.000
SCO	0.161	0.010	0.216	0.253	SCO	0.176	0.003	0.044	0.777
EP	0.090	0.510	0.087	0.595	EO	0.571	0.017	0.522	0.058
RP	1.831	0.393	2.230	0.340	EPI	-0.048	0.827	-0.026	0.910
RP^2	-0.234	0.362	-0.285	0.311	EPF	0.114	0.275	0.121	0.280
In	0.305	0.143	0.322	0.149	EPD	-0.039	0.811	-0.014	0.936
Pr	0.199	0.323	0.179	0.407	EO * SCO			0.324	0.372
CA	0.102	0.375	0.109	0.410	EPI * SCO			-0.294	0.322
AU	0.013	0.956	0.041	0.874	EPF * SCO			0.115	0.433
EP * SCO			-0.011	0.947	EPD * SCO			-0.130	0.640
RP^2 * SCO			-0.009	0.792					
In * SCO			0.210	0.489					
Pr * SCO			-0.069	0.795					
CA * SCO			0.076	0.588					
AU * SCO			-0.201	0.500					
R^2	0.323		0.332			0.305		0.319	
ΔR^2	0.198		0.009			0.179		0.014	
F	3.823		2.058			5.867		3.272	
Sig ΔF	0.017		0.993			0.004		0.860	

N = 73

Both models have a significant direct effect between *Shared Cognition Open* and *Performance Self* that is ($B = 0.161$, $p = 0.010$) and ($B = 0.176$, $p = 0.003$) for model EO-1 and model

EP-1 respectively. Model EP-1 also includes a positive significant effect of *Entrepreneurial Orientation* on *Performance Self* ($B = 0.571$, $p = 0.017$). However, it can be seen that none of the sub-dimensions has a significant direct effect. To determine whether the sub-dimensions function as moderators the interaction terms were calculated and inserted into models EO-2 and EP-2. The addition of the interaction terms causes the previously significant effect of shared cognition to become insignificant. However, essential to denote is that the interaction terms between the sub-dimensions of *Entrepreneurial Orientation* and *Entrepreneurial Passion* are insignificant also. Adding the interaction terms does not significantly improve the model. The change in R-squared is low compared to the reference models and there are insignificant changes for the F-ratio. Therefore, hypotheses 2 to 6 and hypotheses 8 to 10 are rejected.

Interesting, however, is that the results indicated that risk propensity concerning the relationship between shared cognition and new venture performance was better described using quadratic terms than linear terms. The regression significance of the quadratic term ($B =$ -0.243, $p = 0.362$) is closer to attaining significance than its linear counterpart ($B = 1.831$, $p = 0.393$). This can also be seen from figures 7.1 and 7.2, in appendix A, an inverted U-shape is not found during the regression analysis but a line that has a steep linear increase followed by a flattening curve as *Risk Propensity* moved to the 4-5 Likert scale region.

4.3.3 Robustness checks

Following the main analysis is the robustness check. The robustness checks determine if similar conclusions can be drawn if the models use alternative variables. The robustness check is divided into three parts; a regression where the independent variable is alternated, a regression where the dependent variable is alternated, and a regression where both the independent as the dependent variable is alternated. The alternate independent variable *Shared Cognition Self* is selected as only two variables are representing shared cognition. *Subjective Performance* was selected as the alternative dependent variable as *Subjective Performance* was operationalized using a measure of team's effectiveness (Andersson et al., 2017). Hence, there are three model variations embedded within the robustness check to test each hypothesis: models 4 to models 6 for the relationship between *Shared Cognition Open* and *Subjective Performance* (SCO & SP), models 7 to model 9 for the relationship between *Shared Cognition Self* and *Performance Self* (SCS & PS), and model 10 to model 12 for the relationship between *Shared Cognition Self* and *Subjective Performance* (SCS & SP).

Robustness checks main relationships

The robustness checks, see table 4.5, support the claim that shared cognition is indeed positively and significantly related to new venture performance. This can be seen from model 4 ($B =$ 0.230, $p = 0.001$), model 7 ($B = 0.407$, $p = 0.000$), and model 10 ($B = 0.365$, $p = 0.002$). The positive significant relationship between *Entrepreneurial Orientation* and new venture performance does not reoccur in the models for robustness check. In model 5, model 8, and model 11 the direct effect of *Entrepreneurial Orientation* and passion were added. No significant relations are present in one of the three models. Following is the addition of the interaction terms in model 6, model 9, and model 12. However, the same conclusion can be made as for the main analysis. Hence, the robustness check supports the rejection of hypotheses 1 and 7.

Table 4.4: Robustness checks results main analysis using Shared Cognition Open

Variable	Model 4		Model 5		Model 6	
	Y variable: SP		Y variable: SP		Y variable: SP	
	B	*p*	*B*	*p*	*B*	*p*
(Constant)	4.249	0.000	4.040	0.000	4.039	0.000
SCO	0.230	0.001	0.208	0.002	0.194	0.094
EO			0.384	0.102	0.382	0.173
EP			0.141	0.322	0.143	0.385
EO * SCO					0.015	0.953
EP * SCO					0.012	0.943
R^2	0.146		0.254		0.254	
ΔR^2	0.146		0.107		0.000	
F	12.148		7.813		4.558	
Sig ΔF	0.001		0.010		0.989	

N = 73

Table 4.5: Robustness checks results main analysis using Shared Cognition Self

Variable	Model 7		Model 8		Model 9		Model 10		Model 11		Model 12	
	Y variable: PS		Y variable: PS		Y variable: PS		Y variable: SP		Y variable: SP		Y variable: SP	
	B	*p*	*B*	*p*	*B*	*p*	*B*	*p*	*B*	*p*	*B*	*p*
(Constant)	3.896	0.000	3.789	0.000	3.769	0.000	4.112	0.000	4.018	0.000	3.992	0.000
SCS	0.407	0.000	0.242	0.062	0.297	0.076	0.365	0.002	0.229	0.120	0.301	0.115
EO			0.275	0.277	0.378	0.360			0.183	0.525	0.346	0.462
EP			0.152	0.252	0.163	0.365			0.165	0.274	0.161	0.433
EO * SCS					-0.136	0.786					-0.229	0.689
EP * SCS					-0.039	0.864					-0.015	0.956
R^2	0.182		0.244		0.248		0.124		0.166		0.170	
ΔR^2	0.182		0.062		0.004		0.124		0.042		0.005	
F	15.836		7.441		4.421		10.036		4.567		2.751	
Sig ΔF	0.000		0.066		0.850		0.002		0.185		0.829	

N = 73

Robustness checks sub-dimensions

Similarly to the main relationships, the results presented in 4.6 show that overall the robustness checks concur with the main analysis. For the sub-dimensions models EO-3, EO-5, EO-7 are used to represent the direct effect of the sub-dimensions of *Entrepreneurial Orientation* on the performance variable. There are no significant direct relationships for all of the sub-dimensions of *Entrepreneurial Orientation*. EP-3, EP-5, and EP-7 include the direct effects of the sub-dimensions of *Entrepreneurial Passion*. In model EP-6 ($B = 0.419$, $p = 0.041$) and EP-8 ($B = 0.546$, $p = 0.019$) a significant direct relation is found for *Entrepreneurial Passion for Founding* and *Performance Self* and *Subjective Performance* respectively. These significant direct relations are not in line with the results of the main analysis.

In models EO-4, EO-6, and EO-8 the interaction terms for the sub-dimensions of *Entrepreneurial Orientation* are added. Finding no significant relationships, the robustness checks support the results of the main analysis, implying that hypotheses 2 to 6 can be rejected indefinitely. In models EP-4, EP-6, and E-8 the interaction effects for the sub-dimensions of *Entrepreneurial Passion* are added. Model EP-8 includes a significant relationship between the interaction term for *Entrepreneurial Passion for Founding* and *Shared Cognition Self* with *Subjective Performance* ($B = -0.667$, $p = 0.043$). However, as a positive is argued for hypothesis 9, hypotheses 8 to 10 are also rejected following the robustness check. For models EP-5 to EP-8 the addition of interaction terms does increase the amount of variance explained by independent variables (R^2). However, the change itself is insufficient to attain a better

predictive model.

Table 4.6: Robustness checks results sub-dimensions

Variable	Model EO-3		Model EO-4		Model EO-5		Model EO-6		Model EO-7		Model EO-8	
	Y variable: SP		Y variable: SP		Y variable: PS		Y variable: PS		Y variable: SP		Y variable: SP	
	B	*p*	*B*	*p*	*B*	*p*	*B*	*p*	*B*	*p*	*B*	*p*
(Constant)	5.306	0.000	5.690	0.000	5.226	0.000	4.761	0.009	5.558	0.002	4.185	0.037
SCO	0.195	0.005	0.272	0.196								
SCS					0.247	0.066	0.583	0.218	0.230	0.133	0.930	0.082
EP	0.117	0.442	0.094	0.609	0.083	0.549	0.086	0.737	0.109	0.495	0.229	0.425
RP	2.175	0.366	2.813	0.270	2.410	0.277	1.890	0.558	2.750	0.277	0.814	0.822
RP^2	-0.266	0.355	-0.357	0.257	-0.311	0.240	-0.211	0.615	-0.345	0.255	-0.044	0.925
In	0.295	0.206	0.320	0.197	0.164	0.461	-0.292	0.541	0.160	0.529	-0.544	0.302
Pr	0.069	0.760	0.042	0.862	0.283	0.163	0.310	0.399	0.182	0.429	0.110	0.788
CA	0.184	0.156	0.214	0.148	0.066	0.583	0.039	0.846	0.157	0.259	0.088	0.696
AU	-0.161	0.536	-0.105	0.717	-0.073	0.757	0.002	0.996	-0.262	0.330	0.106	0.818
EP * SCO			0.038	0.840								
RP^2 * SCO			-0.021	0.585								
In * SCO			0.346	0.307								
Pr * SCO			-0.065	0.826								
CA * SCO			0.095	0.545								
AU * SCO			-0.337	0.311								
EP * SCS							-0.160	0.959			-0.154	0.659
RP^2 * SCS							-0.070	0.433			-0.129	0.198
In * SCS							0.845	0.279			1.299	0.139
Pr * SCS							-0.018	0.972			0.112	0.844
CA * SCS							0.109	0.726			0.246	0.481
AU * SCS							-0.267	0.641			-0.828	0.194
R^2	0.279		0.298		0.287		0.305		0.214		0.261	
ΔR^2	0.133		0.019		0.105		0.018		0.091		0.047	
F	3.097		1.758		3.225		1.819		2.183		1.416	
Sig ΔF	0.128		0.954		0.244		0.998		0.404		0.717	

Variable	Model EP-3		Model EP-4		Model EP-5		Model EP-6		Model EP-7		Model EP-8	
	Y variable: SP		Y variable: SP		Y variable: PS		Y variable: PS		Y variable: SP		Y variable: SP	
	B	*p*	*B*	*p*	*B*	*p*	*B*	*p*	*B*	*p*	*B*	*p*
(Constant)	4.079	0.000	4.089	0.000	3.827	0.000	3.770	0.000	4.056	0.000	3.975	0.000
SCO	0.215	0.001	0.100	0.563								
SCS					0.290	0.037	0.465	0.054	0.292	0.064	0.577	0.042
EO	0.482	0.068	0.473	0.122	0.338	0.203	0.401	0.326	0.246	0.414	0.344	0.458
EPI	0.001	0.996	-0.010	0.969	-0.051	0.824	-0.322	0.263	0.013	0.961	-0.246	0.450
EPF	0.155	0.185	0.153	0.221	0.161	0.155	0.419	0.041	0.197	0.128	0.546	0.019
EPD	-0.127	0.485	-0.070	0.715	-0.100	0.565	-0.247	0.329	-0.180	0.362	-0.434	0.132
EO * SCO			0.253	0.532								
EPI * SCO			-0.422	0.203								
EPF * SCO			0.079	0.629								
EPD * SCO			0.065	0.833								
EO * SCS							-0.391	0.463			-0.552	0.362
EPI * SCS							0.804	0.128			0.760	0.203
EPF * SCS							-0.505	0.080			-0.667	0.043
EPD * SCS							0.272	0.532			0.516	0.298
R^2	0.266		0.286		0.257		0.319		0.186		0.259	
ΔR^2	0.120		0.020		0.075		0.062		0.062		0.073	
F	4.857		2.797		4.641		3.286		3.057		2.445	
Sig ΔF	0.036		0.786		0.163		0.231		0.289		0.198	

N = 73

4.4 Linking empirical evidence to hypotheses

The hypotheses results section includes an overview of the hypotheses. The hypotheses overview is represented by table 4.7 whereas the results per hypotheses, that is support or rejection, can be found in table 4.8.

Table 4.7: Overview of hypotheses

No.	Hypothesis
1.	Entrepreneurial orientation positively affects the relationship between shared cognition and new venture performance
2.	There is an inverted u-shape between risk propensity and the relationship between shared cognition and new venture performance
3.	Innovativeness negatively affects the relationship between shared cognition and new venture performance
4.	Proactiveness positively affects the relationship between shared cognition and new venture performance
5.	Competitive aggressiveness positively affects the relationship between shared cognition and new venture performance
6.	Autonomy positively affects the relationship between shared cognition and new venture performance
7.	Entrepreneurial passion positively affects the relationship between shared cognition and new venture performance
8.	Entrepreneurial passion for inventing positively affects the relationship between shared cognition and new venture performance
9.	Entrepreneurial passion for founding positively affects the relationship between shared cognition and new venture performance
10.	Entrepreneurial passion for developing positively affects the relationship between shared cognition and new venture performance

Table 4.8: Overview of the results per hypothesis for main analysis and robustness checks

Hypothesis	Main analysis	Alternative X	Alternative Y	Alternative X, Y
X and Y variable	SCO & PS	SCO & SP	SCS & PS	SCS & SP
Hypothesis 1	Rejected	Rejected	Rejected	Rejected
Hypothesis 2	Rejected	Rejected	Rejected	Rejected
Hypothesis 3	Rejected	Rejected	Rejected	Rejected
Hypothesis 4	Rejected	Rejected	Rejected	Rejected
Hypothesis 5	Rejected	Rejected	Rejected	Rejected
Hypothesis 6	Rejected	Rejected	Rejected	Rejected
Hypothesis 7	Rejected	Rejected	Rejected	Rejected
Hypothesis 8	Rejected	Rejected	Rejected	Rejected
Hypothesis 9	Rejected	Rejected	Rejected	Rejected
Hypothesis 10	Rejected	Rejected	Rejected	Rejected

Before the interaction terms for entrepreneurial Orientation and entrepreneurial passion were analyzed, their direct effects are tested. Finding only a significant direct effect for entrepreneurial orientation, interest arose in the impact of its sub-dimensions. Counter-intuitively all the sub-dimensions are non-significant as well. Similar to passion, where no significant effects are found for the concept itself or its sub-dimensions. Continuing on the interaction terms; it can be seen from table 4.8 that none of the hypotheses are supported. This implies that the relationship between shared cognition and new venture performance cannot be explained via entrepreneurial orientation or entrepreneurial passion. Meaning that the team attributes do not seem to relate to the positive shared cognition new venture performance relationship.

5. Discussion: discussing what has been added to the understanding of the relationship

In the discussion chapter, several aspects are addressed. First, the regression results are discussed, followed by reasoning on hypotheses rejection and a link of the results to the literature provided in chapter 2. Second, this section will provide theoretical and practical implications of the research. Last, the limitations of this research and future research possibilities are stated.

5.1 Understanding the relationship using the attributes

The discussion on the hypotheses results will be divided into entrepreneurial orientation, the sub-dimensions of entrepreneurial orientation, and entrepreneurial passion and the sub-dimensions of entrepreneurial passion. Entrepreneurial passion and its sub-dimensions are included in a single section as the four concepts are discussed using the same arguments.

5.1.1 Entrepreneurial orientation

Hypothesis 1 argued a positive effect between entrepreneurial orientation and the relationship between shared cognition and new venture performance. Only model 2 contained a significant relation for entrepreneurial orientation concerning new venture performance. This relationship is inconsistent with a large part of existing literature. The interaction terms between shared cognition and entrepreneurial orientation were all insignificant. One argument for the results being insignificant, applicable to the dimensions of entrepreneurial orientation also, could be a misalignment of the goals. During the application of the framework for the open questions it is seen that team members often had variating goals. Known also is that the higher the norms, goals, and common culture, the more information is shared (Doh and Acs, 2010). Hence, with misaligned goals team members share less valuable information. Consequently, the team could select a strategy that is not beneficial to a new venture. This reduced information sharing is also in line (Nooteboom et al., 2007). Acquiring valuable knowledge that drives the entrepreneurial orientation of firms is difficult when firms do not share goals and values with their contacts (Nooteboom et al., 2007).

Another argument, also applicable to the dimensions, could be that if the group's attributes are too homogeneous, group-thinking can occur rather than the deliberation of a diversity of options. Homogeneity within the group is beneficial for exploitation, but heterogeneous groups are better for exploration (García-Villaverde et al., 2018). If the groups are homogeneous fewer options are considered that arguably have a lesser chance of including more optimal strategies. A similar argument is present in Mohammed and Ringseis (2001). Harnessing multiple perspectives is a benefit of the group context, but cognitive consensus, or shared cognition, is a potential liability when the individual contribution is not unique (Mohammed and Ringseis, 2001). Group thinking can thus occur if the compositional similarity between the group's individuals on how to conceptualize the underlying issues is too large.

5.1.2 Sub-dimensions of entrepreneurial orientation

The second hypothesis expected an inverted u-shape of risk propensity on the relationship between shared cognition and new venture performance. Even though the research showed a significant positive effect for shared cognition on new venture performance, thereby supporting Waardenburg et al. (2020), risk propensity does not affect the relationship. The results, therefore, add to the conclusion that risk propensity differs per situation (Keil et al., 2000) and that it is difficult to say how performance and risk propensity are related (Danso et al., 2016). An inverted U-shape is not found during the regression analysis but a line that has a steep linear increase followed by a flattening curve as risk propensity moved to the 4-5 Likert scale region. This flattening line suggests that overestimating a risk negatively impacts new venture performance but not as severely as underestimating.

One reason for the rejection could be that, in the pre-survey questions, risk perception was absent (Boermans and Willebrands, 2017). Before the competition, the participating teams could have substantially different risk perceptions as these perceptions are based on, but not limited to, personal experiences and their business environment. Consequently, the results could be biased. Another reason could be the limited number of cases compared to the number of variables inserted in the regression. For models EO-2, EO-4, EO-6, and EO-8, the general rule of having minimal 15 cases per independent variable is violated (Field, 2013). However, adding interaction terms did not lead to a significantly better model. The ΔR^2 value did not attain a higher value than the 0.047 in model EO-8, and the significance of ΔF also showed that the interaction terms did not improve the model. A third potential reason is that risk propensity is connected to goal understanding (Danso et al., 2016). Not all participating teams had a high degree of shared cognition, leading to the expectation that the goals of some teams are incorrect. Following the incorrect goals would then be that some teams perceive the risk as less or more risky than in reality, complicating the result interpretation.

Hypothesis 3 argued a negative effect of innovativeness on the relationship between shared cognition and new venture performance. The hypothesis found no support in both the main analysis as the robustness check due to a lack of statistical significance. However, regardless of statistical significance, only positive relations resulted from the regression. Interesting for innovativeness is that the variable is significantly related to entrepreneurial passion and its concepts. Entrepreneurial passion creates a internal motivation related to creativity (Amabile, 2012). Innovativeness is highest when teams are very creative, and thus entrepreneurial passion and innovativeness seem to be intertwined thoroughly. Innovativeness also relates to goal alignment as knowledge sharing when goals are aligned positively affects the innovativeness of the new venture (Nooteboom et al., 2007).

The regression results are in line with existing literature that denotes that innovativeness is positively related to new venture performance (Ketchen and Short, 2013). Similar to risk propensity, one reason for statistical insignificance could be the relatively small data set. A second reason could be that the positive effects of shared cognition overshadow the negative effects concerning innovativeness. Diversity is related to a difference in problem perception, poorer coordination, increased conflict, and less integrated information (Weingart et al., 2010). Even though fewer innovative products or services are considered following the presence of shared cognition (Mohammed and Ringseis, 2001), innovations can effectively be handled by teams with shared cognition. This especially in comparison to teams with fragmented cognition

trying to exploit a more promising innovation.

In hypothesis 4 it is argued that proactiveness enhances the positive effect of shared cognition on new venture performance. Similar to hypotheses 2 and 3, due to lack of statistical significance hypothesis 4 is rejected by all of the four model variations. The rejection of the fourth hypothesis contradicts the literature on proactiveness concerning new venture performance. In literature, mainly positive relations are argued (Lumpkin et al., 2006; Blesa and Ripollés, 2003), whereas in three of the four model variations (EO-2, EO-4, and EO-6) a negative effect is found for proactiveness. Innovativeness and proactiveness are often linked also, however, innovativeness provided positive relations. The positive relations only add to the contradictory findings in this research concerning existing literature. One reason for these findings is the size of the data set. Another argument could be that teams with shared cognition are too proactive. Proactive teams introduce new work methods, prevent problems rather than reacting to them, and scan the environment for potential opportunity (Erkutlu, 2012). It could be that proactive teams spend less time deliberating the positive and negative effects of new methods or opportunities but rather act directly. As a result, the team could have a load of semi-beneficial tasks or a misalignment concerning the goals.

The fifth hypothesis proposed that competitive aggressiveness positively enhances the effect of shared cognition on new venture performance. From the results, competitive aggressiveness was indeed positively related but lacked statistical significance. The regression results are corresponding with the available literature. The overview in Luo and Lin (2020) contains that aggressiveness only has positive relations with new venture performance for all model variations. The lack of statistical significance could again be due to the limited number of cases. One could also argue that teams with shared cognition can decide faster but not necessarily better. This considering the argument of the potency of shared cognition reducing options considered (Mohammed and Ringseis, 2001). Due to the relative absence of diversity, the expectation is that new venture teams consider fewer strategic options. An additional reason could be present in the research of Ketchen and Short (2013). Being too aggressive can be the undoing of a company as others might compete better than initially thought or, due to not being asked for joint ventures (Ketchen and Short, 2013). However, this would not cover why average levels of competitive aggressiveness are not beneficial. Hence, the results indicate that there could be another reason for the rejection of hypothesis 5.

Autonomy, embedded in hypothesis 6, expected a positive effect on the relationship between shared cognition and new venture performance. Also, here the results were statistically insignificant. The results oppose the hypothesis and entrepreneurial literature as mostly negative effects are found for autonomy with respect to new venture performance. All interaction terms are also negatively related to new venture performance.

Similar to the other variables, the ratio between the cases and independent variables is not desirable. Diversity can be addressed as a potential second reason for the rejection of the hypothesis. Autonomous teams make decisions themselves without asking for permission from higher management. Also, autonomous entrepreneurial decision-making stimulates the exploration of business opportunities (Lumpkin et al., 2009). However, shared cognition is a potential liability when the individual contribution is not unique (Mohammed and Ringseis, 2001). This liability leads to the expectation that autonomous teams focus on either a limited amount of strategic decisions or pursue a non-optimal one as there is no higher management to refuse strategic choices. One argument for the deviant results could be the level of autonomy

itself. In section 3.1 it is argued that regardless of teams having different autonomy levels outside of the competitions, the teams were fully autonomous during the competition. Consequently, participants could have considered the level of autonomy before the competition when filling in the survey.

5.1.3 Entrepreneurial passion and its sub-dimensions

As hypothesis 7 to hypothesis 10 are based on the same literature, reasons for the rejection of the hypotheses are combined. Hypothesis 7 addresses that entrepreneurial passion positively enhances the effect of shared cognition on new venture performance. The results showed no support for this hypothesis as the interaction terms for entrepreneurial passion were statistically insignificant.

Hypothesis 8 argued a positive effect of entrepreneurial passion for inventing on the relationship between shared cognition and new venture performance, but the results rejected it. For *Performance Self* as the dependent variable, positive regression coefficients were found but for *Subjective Performance* negative. Regardless, both lacked statistical significance.

Hypothesis 9 argued for a positive influence of entrepreneurial passion for founding on the relationship between shared cognition and new venture performance. The lack of statistical significance applies to three of the four model variations (EP-2, EP-4, and EP-6) results in the rejection of hypothesis 9. Interestingly, however, is that in model EP-8 contained a statistically significant but negative effect. Noteworthy to mention is that alternating the dependent variable resulted in a sign change for the regression coefficients.

At last, hypothesis 10 argued that entrepreneurial passion for developing enhances the relationship between shared cognition and new venture performance. The rejection of the tenth hypothesis is again due to statistically insignificant regression results. Only the main analysis (model EP-2) resulted in a negative relation for the interaction term. In the remaining model variations all there was a positive relationship between passion for developing with new venture performance influenced by shared cognition.

The rejection of hypothesis 7 to hypothesis 10 differs from the literature stating that passion positively influences new venture performance. Reasoning on why hypotheses 8, 9, and 10 are rejected again brings to mind the argument of a limited data set. A possible reason explaining all entrepreneurial passion hypotheses rejection is derived from the theory of componential creativity presented in (Amabile, 2012). The theory states that creativity is highest when people are passionate. However, under shared cognition members of the new venture team are very likely to agree. Hence, creativity is not expanded, but rather team members agree on each other creative ideas. Consequently, fewer options are considered, but existing ideas are more likely accepted regardless of thorough knowledge on whether the benefits outweigh the disadvantages. A third reason is a potential for harmonious passion. If a team has shared cognition, the team also agrees upon which activity to engage in. For harmonious passionate teams, the expectation is that teams pursue an activity the team enjoys rather than pursuing an activity beneficial to the goals of the new venture.

In terms of differences per identity, the regression results show that a positive or negative relation between passion and new venture performance depends on the identities but also the type of variables used in the main analysis and robustness check. One reason for the differences per identity is the differences in the distribution of values. The mean of entrepreneurial passion

for founding is lower than for the other identities, whereas the standard deviations are larger. Also, entrepreneurial passion for inventing has only negative relations. Here the mean is the highest for all identities. The sign variation for entrepreneurial passion for developing could then be explained by the fact that it's mean is positioned in between the mean of the other identities. As written, there were different teams present during the competition. The different team-types could be another reason why some teams are more passionate about certain identities than others.

5.2 Theoretical implications of the increased understanding

The research of Waardenburg et al. (2020) provided empirical evidence for the positive effect of shared cognition on the performance of new ventures. However, suggestions were made to explore what factors are at the roots of shared cognition. This thesis is designed to perform such exploration by investigating if the attributes provided in Lumpkin and Dess (1996) and Cardon et al. (2009) affected the relation between shared cognition and new venture performance. Even though the results show that entrepreneurial orientation, entrepreneurial passion, or their sub-dimensions do not explain why shared cognition positively affects the performance of new ventures, this research is novel in applying shared cognition to entrepreneurial attributes. Individual behavioral characteristics are embedded in team attributes rather than involving factors that are team-based per definition such as work coordination or focused team deliberation in Waardenburg et al. (2020). This is also desired entrepreneurial orientation (García-Villaverde et al., 2018) and entrepreneurial passion are researched in an individual context Cardon et al. (2017), whereas new ventures are represented by teams rather than individuals. Hence, a direction is given for further studies on how to research the relationship between shared cognition and new venture performance based on attributes individual from nature but at team-level.

5.3 Practical contributions of the increased understanding

Practically, entrepreneurial teams that experience shared cognition should consider that agreeing upon the included entrepreneurial attributes does not necessarily mean increased performance. Seeking team members that share the team's view on how passionate the new venture team should be or how much risk a team willing to take, for example, is rather useless considering the results of this research. Even though new ventures should strive to attain shared cognition, having shared cognition on individuals' attributes that comprise the team seems to be undesirable.

This research also has a practical contribution for investors. Investors search for new ventures where the team benefits from new venture success. Hence, investors do not have to search for teams that have attained shared cognition in entrepreneurial orientation, entrepreneurial passion, or their sub-dimensions as this does not improve new venture performance. In other words, this research aids in the choice of which new ventures investors should invest in through expanding knowledge on the optimal design of entrepreneurial teams.

In terms of entrepreneurial education, it can be said that shared cognition is indeed crucial for new venture performance but should also stress the importance of having a diversity of attributes in a team. Too much shared cognition can be as dysfunctional as being too diverse (Mohammed and Ringseis, 2001). The warning for too much shared cognition also holds for

business incubators training new venture teams. Hence, guidelines on what elements require some state of shared cognition can be established for aspiring entrepreneurs

This research also contributed to the framework found in table 3.1. Though the framework adds to objectively assessing shared cognition in open-ended questions, multiple iterations are needed to attain similar answers between the assessors. Additionally, the framework is only applicable to the 1-5 Likert scale, whereas in research 1-7 Likert scale is often suggested Cardon et al. (2013). Hence, for other researchers to apply this framework an adaptation needs to be created and extensively tested by multiple assessors.

At last, this thesis contributed practically by expanding the table of Waardenburg et al. (2020) including shared cognition terminology to add to the prevention of fragmented research directions.

5.4 Research limitations and future research connected to the increased understanding

In the following section, the limitations and future research possibilities of this thesis are provided. The limitations are based on design and methodological characteristics that influence the results.

The first research limitation was the available data compared to the number of variables tested. Per independent variable, the regression model requires about 15 cases (Field, 2013). As there were 73 teams in total, a reasonable limit of about five predictor variables is established. Models 1 to 16, EP-1, EP-3, EP-5, and EP-7 are therefore considered to be completely reliable. For the remaining models, one could argue that the number of cases is too limited. However, adding the interaction terms does not lead to significantly better models.

The second limitation of this research is that the context in which the technology-based competition occurred is influential. This because the context in which results are interpreted limit the applicability of the results to that context. In terms of the engineering context, embedded within the engineering context are the characteristics of the engineers. These characteristics are different compared to the characteristics of entrepreneurs from business (Jin et al., 2015). With different characteristics, the focus of the new venture teams is likely to change also, potentially leading to different outcomes. In terms of the framework placement, it would be interesting to research whether different framework placements are connected to similar conclusions. For example, if the teams have a low autonomy of strategic decision-making, it is known that job satisfaction decreases. Thus, new venture performance is influenced (Preenen et al., 2016). Also, if the entitativity is low, the team cohesion is low, leading to the expectation that less information is shared, impacting the relationship between shared cognition and new venture performance. In other words, readers must be aware that this research is not directly applicable to all types of new venture teams.

Following this limitation is that more studies should investigate whether shared cognition indeed positively affects new venture performance. An example of such a study would be to create another scientific experiment where teams are searched with and without shared cognition. During the experiment, teams are asked to, for example, take a risky move. Researchers can then compare the performance of both group types.

Besides increasing the literature base, more attributes and concepts should be tested for

their influence on the effect of shared cognition on new venture performance. Entrepreneurial passion, entrepreneurial orientation, and their dimensions did not significantly impact the shared cognition new venture performance relation but coordinated work did (Waardenburg et al., 2020). It was suggested to investigate if shared cognition emerges from individual factors (Waardenburg et al., 2020). This research includes attributes individual from nature but influential to the team-level. One could also think of creating team values for other individual attributes related to being entrepreneurial such as persistence, assertiveness, courage, social skills, eagerness to learn, flexibility, resilience, and trustworthiness.

However, there are also group-related concepts potentially affecting the shared cognition new venture performance relationship. It is argued that focused deliberation was not a sufficient replacement of shared cognition (Waardenburg et al., 2020). Following this statement, team cohesion, shared prior experience, and diversity in skills are identified as potential factors to shared cognition. Considering the results of this thesis, the future research suggested from Waardenburg et al. (2020) are recommended.

Also possible is to investigate if the design approach the new venture teams uses has any effect on the relationship (Ostergaard and Summers, 2009). An example, if the design approach focuses on providing a service this will be different from the design approach of a product. Additionally, it would be interesting to investigate the impact of task specialization (Ostergaard and Summers, 2009). Task specialization is explained best via an example. If one team member is highly specialized and the team discusses how to improve new venture performance in this person's field, this person will be seen as the expert. Consequently, it could be that other members are more likely to align with the arguments provided by this expert. Another topic is the structure of the team. If a team has a structure that counteracts information sharing this will impact the ability to reach some state of shared cognition. Leadership is also an interesting concept to the relationship between shared cognition and new venture performance. This partially because of the upper echelon theory denoting that the new venture performance is dependent on the prior experiences of executives but also the leadership style. The leadership style is crucial to the general atmosphere within the team. If there is a directive leader the impact of shared cognition may be lost as the leader makes decisions without fully considering points introduced by the team.

A third limitation was the framework used to value shared cognition via open-ended questions. Discovered is that becoming experienced with framework application is a prerequisite for attaining similar solutions between assessors. Hence, direct application of the framework is undesirable in future research.

The fourth limitation was that during the operationalization of Shared Cognition Self, the answers regarding the customers are not included. The customers are excluded due to the reliability coefficient alpha being too low. For this reason, Shared Cognition Open and Shared Cognition Self differ from nature.

A fifth limitation was the aggregation of the dimensions of entrepreneurial orientation. Entrepreneurial orientation is first seen as the combined effect of its dimensions (Covin and Slevin, 1989), however, the independent variation between dimensions is questioned (Wales et al., 2013). For this reason, the dimensions are tested separately from the concept itself. Nonetheless, one should be aware of the independent variation of dimensions in future research. Also, the other six sub-dimensions discussed in Covin and Slevin (1989) are excluded in this

research.

The last limitation is that of the assumptions for linear regression not being met for all variables. Contradictory to the research of Andersson et al. (2017), the variable representing observable assessment, Observable Performance Jury, was not usable. As a result, the variable used for the combined effect of observable assessment and self-assessment is excluded. Unfortunately, only the final scores were available for Observed Performance Jury rather than the scores per jury member. It was therefore not possible to investigate the reliability between jury scores.

Not related to the limitations but still relevant for future research, is whether replacing shared cognition with cognitive diversity results in significant interaction effects for the same variables. The data showed that having shared cognition, for example, on competitive aggressiveness does not mean better performance. For diversity, it could mean that individuals deliberating with different levels of competitive aggressiveness would positively affect performance.

Future research should focus more on the misalignment of the goals. During the discussion of entrepreneurial orientation, it is argued that goal misalignment is considered a viable reason for the hypothesis rejection. It would be interesting to see if the degree of goal misalignment impacts the shared cognition new venture performance relationship. Also, considering the arguments given during the discussion on hypothesis 1.

Lastly, it is recommended to include innovation in future studies regarding entrepreneurial passion. Innovativeness has strong correlations with entrepreneurial passion and its sub-dimensions supporting the theory of componential creativity Amabile (2012). Furthermore, the proactiveness innovativeness relationship makes innovativeness extra interesting for future studies. Additionally, finding valuable knowledge for innovation if the goals are misaligned can prove difficult (Nooteboom et al., 2007).

6. Conclusion: entrepreneurial orientation and entrepreneurial passion do not explain the relationship

This research aimed at increasing the understanding of the relationship between shared cognition and new venture performance by testing the influence of team attributes on that relationship. The team attributes of interest are entrepreneurial orientation and entrepreneurial passion. Entrepreneurial orientation uses five sub-dimensions. These sub-dimensions are risk propensity, innovativeness, proactiveness, competitive aggressiveness, and autonomy. Entrepreneurial passion used dimensions based on the entrepreneurial identities, that is entrepreneurial passion for inventing, entrepreneurial passion for founding, and entrepreneurial passion for developing. To test the effect of the given team attributes, the following research question has been formulated.

Research question: ***To what extent is the relationship between shared cognition and new venture performance influenced by entrepreneurial orientation and entrepreneurial passion***

From the resulting coefficient of the hierarchical regression, it can be concluded that the relationship between shared cognition and new venture performance seems to be almost unaffected by entrepreneurial orientation, entrepreneurial passion, or their sub-dimensions. The regression lacked statistical significance for all variables in the main analysis, and nearly all model variations used for the robustness check. However, the introduction of attributes, as a means to understanding the relationship, is still considered relevant, and thus additional attributes are recommended.

To conclude, this thesis adds to the understanding of the relationship between shared cognition and new venture performance by investigating the effect of attributes individual from nature on that relationship. Theoretically, this research is novel and marks a new direction for researchers interested in excellent new venture teams. In practice, new venture teams, investors, and entrepreneurial trainers are provided with the knowledge not to focus on finding similarities in the attributes of individual team members for the given variables as a means to increase new venture performance.

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7. Appendix A: figures for the difference between the linear and quadratic term of risk propensity

Figures 7.1 and 7.2 represent the scatter plots for the interaction terms with a linear risk propensity and quadratic term for risk propensity. The scale is not from from 1-5 as the variables have been centred.

*Figure 7.1: Scatter plot of Performance Self vs. Shared Cognition Open * Risk Propensity linear*

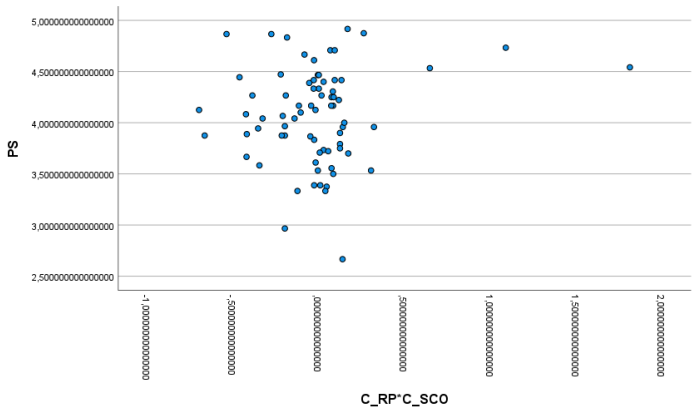
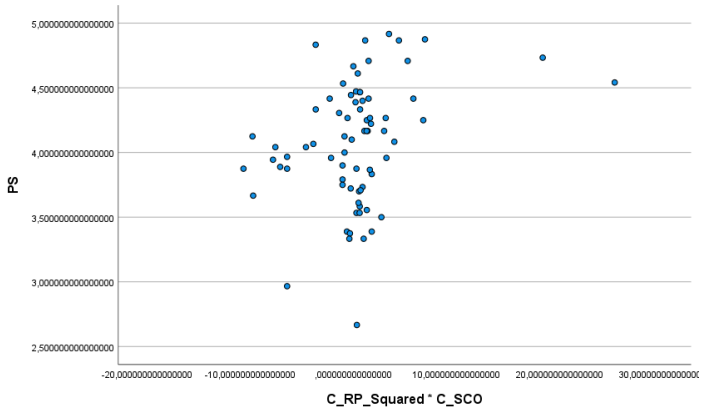


*Figure 7.2: Scatter plot of Performance Self vs. Shared Cognition Open * Risk Propensity quadratic*



8. Appendix B: survey questions used for variable operationalization

Appendix A includes the questions as formulated in the pre- or post-survey.

Figure 8.1: Sub-questions related to comparative performance using a five point Likert scale

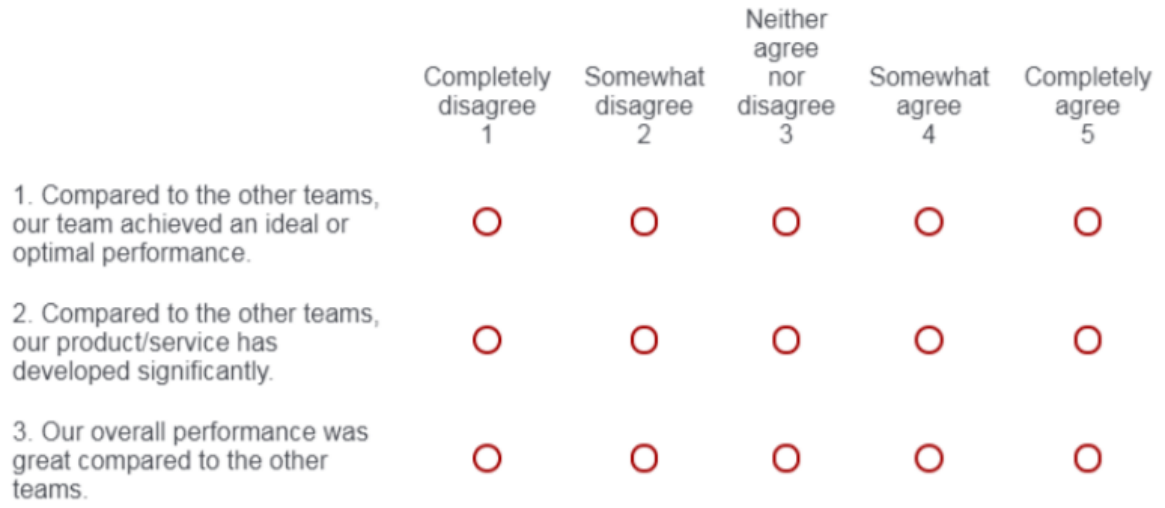


Figure 8.2: Questions related to subjective performance using a five point Likert scale

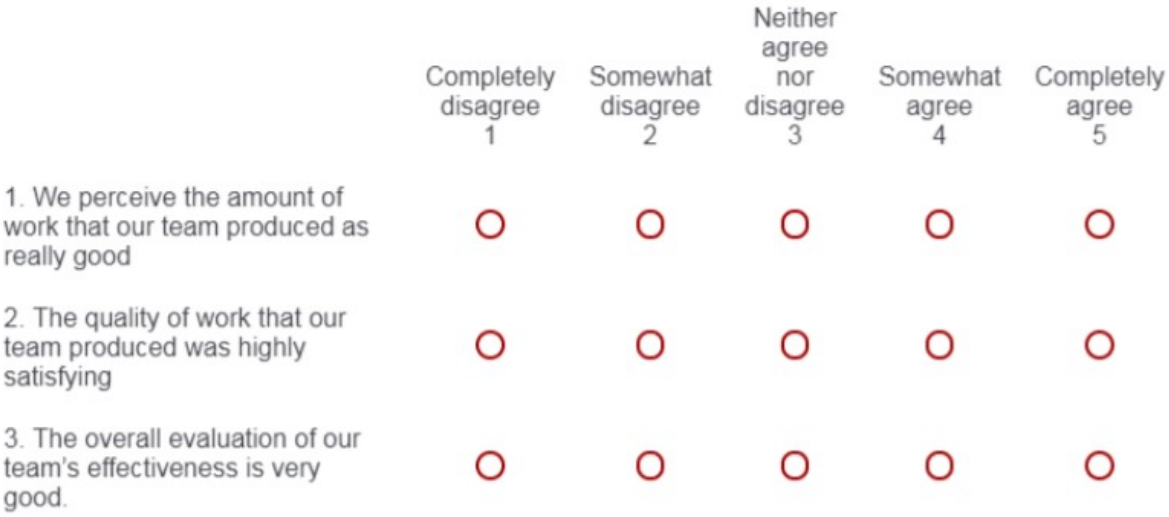


Figure 8.3: Questions related to shared cognition on problem definition using a five point Likert scale

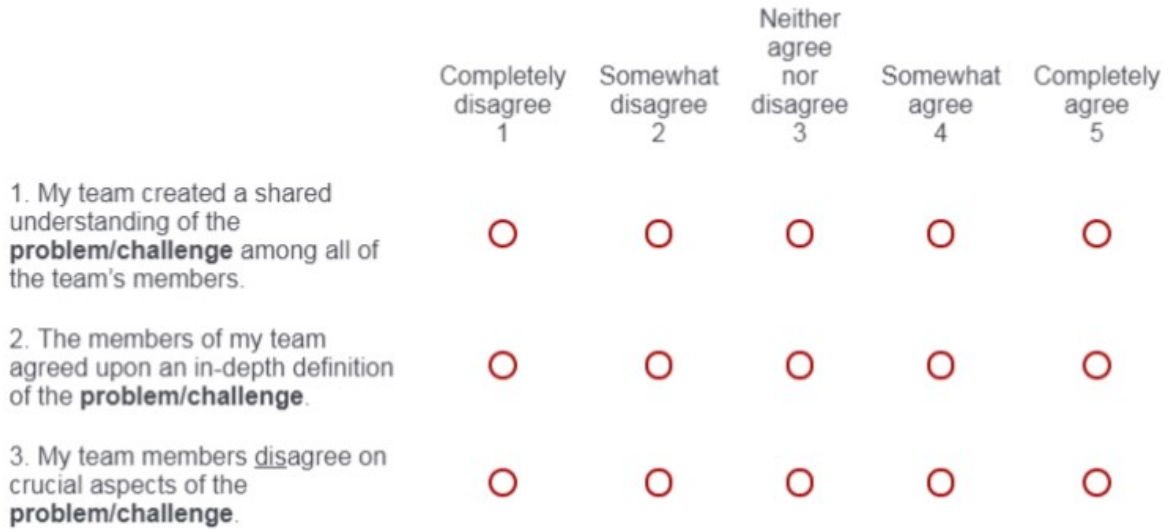


Figure 8.4: Questions related to shared cognition on the proposed solution using a five point Likert scale

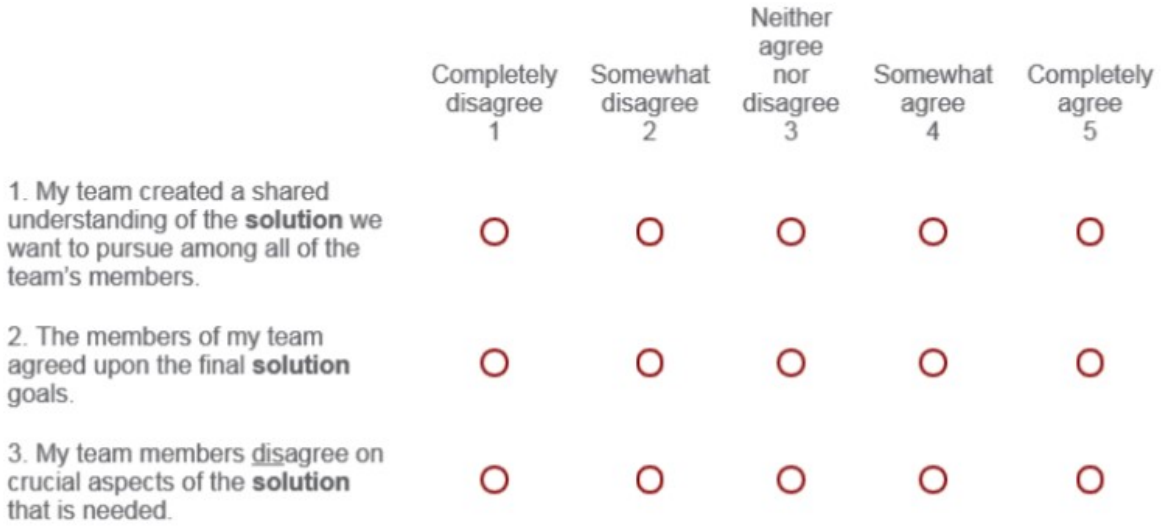


Figure 8.5: Questions related to risk propensity using a five point Likert scale

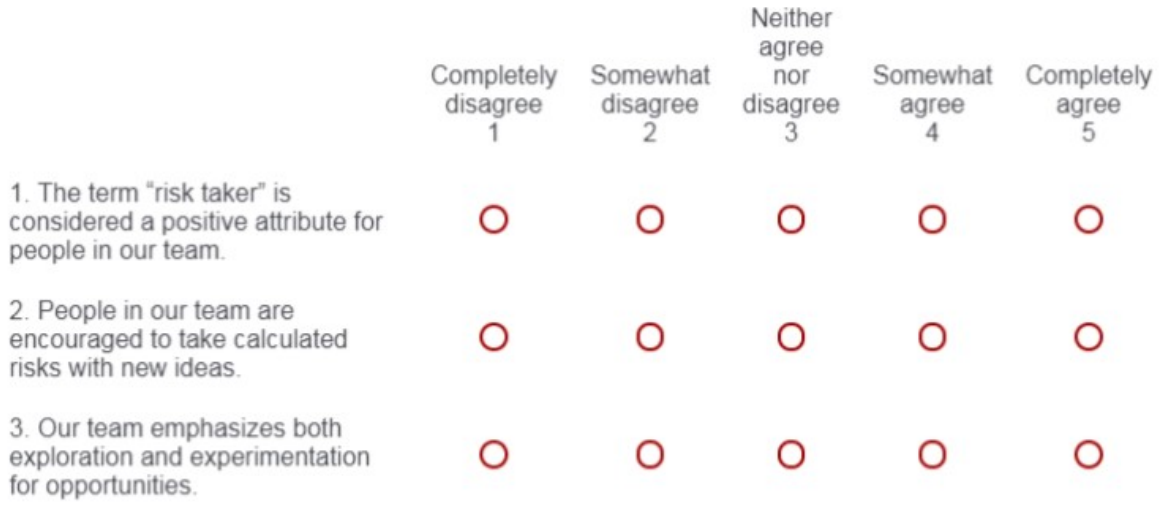


Figure 8.6: Questions related to innovativeness using a five point Likert scale

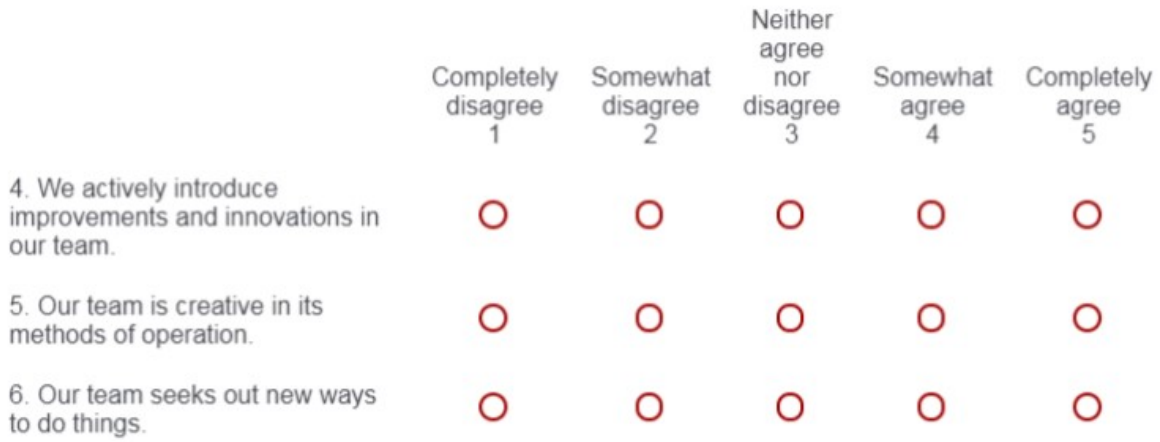
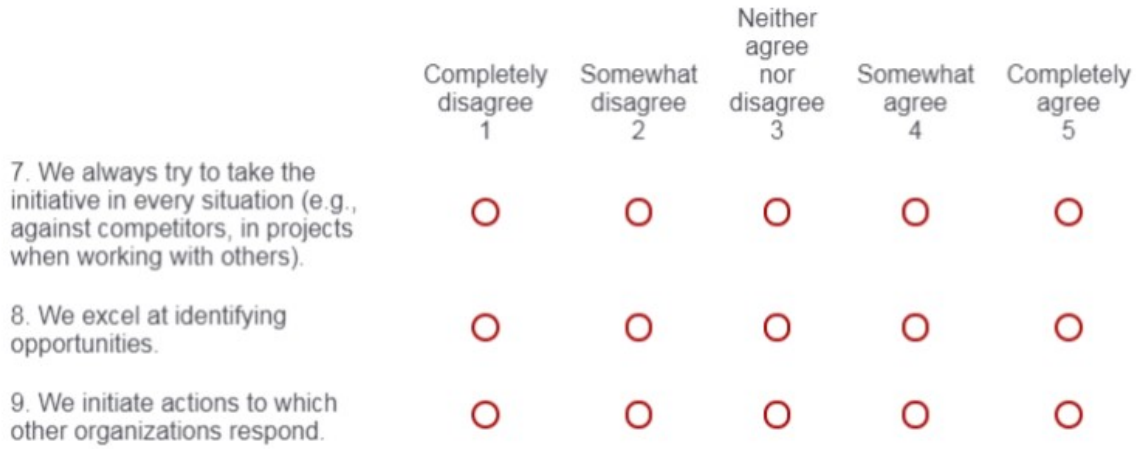
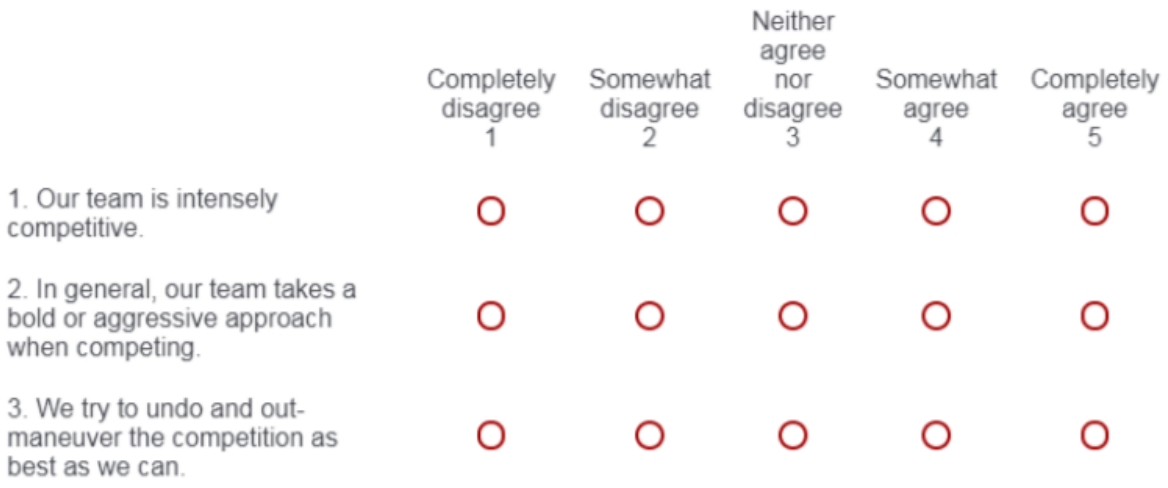


Figure 8.7: Questions related to proactiveness performance using a five point Likert scale



	Completely disagree 1	Somewhat disagree 2	Neither agree nor disagree 3	Somewhat agree 4	Completely agree 5
7. We always try to take the initiative in every situation (e.g., against competitors, in projects when working with others).	○	○	○	○	○
8. We excel at identifying opportunities.	○	○	○	○	○
9. We initiate actions to which other organizations respond.	○	○	○	○	○

Figure 8.8: Questions related to competitive aggressiveness using a five point Likert scale



	Completely disagree 1	Somewhat disagree 2	Neither agree nor disagree 3	Somewhat agree 4	Completely agree 5
1. Our team is intensely competitive.	○	○	○	○	○
2. In general, our team takes a bold or aggressive approach when competing.	○	○	○	○	○
3. We try to undo and out-maneuver the competition as best as we can.	○	○	○	○	○

Figure 8.9: Questions related to autonomy using a five point Likert scale

	Completely disagree 1	Somewhat disagree 2	Neither agree nor disagree 3	Somewhat agree 4	Completely agree 5
4. Team members are permitted to act and think without interference.	O	O	O	O	O
5. Team members perform jobs that allow them to make and instigate changes in the way they perform their work tasks.	O	O	O	O	O
6. Team members are given freedom and independence to decide on their own how to go about doing their work.	O	O	O	O	O
7. Team members are given freedom to communicate without interference.	O	O	O	O	O
8. Team members are given authority and responsibility to act alone if they think it to be in the best interests of the business.	O	O	O	O	O
9. Team members have access to all vital information.	O	O	O	O	O

Figure 8.10: Questions related to entrepreneurial passion for inventing using a five point Likert scale

	Completely disagree 1	Somewhat disagree 2	Neither agree nor disagree 3	Somewhat agree 4	Completely agree 5
1. For us, it is exciting to figure out new ways to solve unmet market needs that can be commercialized.	○	○	○	○	○
2. Searching for new ideas for products/services to offer is enjoyable to our team.	○	○	○	○	○
3. We, as a team, are motivated to figure out how to make existing products/services better.	○	○	○	○	○
4. Scanning the environment for new opportunities really excites my team.	○	○	○	○	○
5. Inventing new solutions to problems is an important part of who we are as a team.	○	○	○	○	○

Figure 8.11: Questions related to entrepreneurial passion for founding using a five point Likert scale

Figure 8.12: Questions related to entrepreneurial passion for developing using a five point Likert scale

9. Appendix C: research planning thesis

Table 9.1: Research planning

Week 1	Topic orientation, preliminary literature research
Week 2	Topic orientation, preliminary literature research, supervisory meeting 1
Week 3	Writing introduction, Literature research on shared cognition, new venture team, and new venture performance
Week 4	Literature research on entrepreneurial orientation and entrepreneurial passion, supervisory meeting 2
Week 5	finalization literature research, initial methodology
Week 6	Data manipulation, familiarizing with SPSS
Week 7	Data manipulation, question reliability, familiarizing with SPSS, supervisory meeting 3
Week 8	Data estimation, team value computation
Week 9	Finish methodology, writing methodology, begin results, supervisory meeting 4
Week 10	Familiarizing with hierarchical linear regression
Week 11	Familiarizing with curvilinear regression, supervisory meeting 5
Week 12	Initial result generation in SPSS
Week 13	Generating results for entrepreneurial orientation and entrepreneurial passion in SPSS
Week 14	Generating results for dimensions in SPSS, supervisory meeting 6
Week 15	Writing results chapter
Week 16	Start discussion and conclusion, supervisory meeting 7
Week 17	Discussion and conclusion
Week 18	Writing Discussion and conclusion, supervisory meeting 8
Week 19	Finalisation feedback discussion and conclusion, document design, abstract, document consistency, quality reflection
Week 20	Time supervisor for formulating feedback draft, concise writing, supervisory meeting 9
Week 21	Process feedback thesis draft, supervisory meeting 10, deadline