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Structural and Financial Constraints - Enabling or Inhibiting Creativity?

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Master Thesis, Ms in Economics and Business Administration,
Strategy and Management

NORWEGIAN SCHOOL OF ECONOMICS

This thesis was written as a part of the Master of Science in Economics and Business Administration at NHH. Please note that neither the institution nor the examiners are responsible – through the approval of this thesis – for the theories and methods used, or results and conclusions drawn in this work.

Abstract

Although creativity is a widely studied concept, the relationship between constraints and creativity is still a topic that offers a great deal of conflicting views. Moreover, constrained creativity processes seem to be widely implemented throughout the business sector. The aim of this thesis is therefore to provide insight and contribute to a deeper understanding of the relationship between constraints and creativity. This will be done by investigating whether financial and/or task structure constraints enable or inhibit creativity, measuring and comparing mean creativity scores (average effects) and the most creative ideas (extreme value effects). We will further examine whether the average and extreme value effects of a financial constraint is dependent on task structure, and whether bounded and unbounded creativity processes are moderated by approach and/or avoidance motivation. Approach motivated individuals are directed by positive and desirable opportunities, while avoidance motivated individuals are directed by avoiding negative and undesirable outcomes. To investigate these relationships, we have conducted an online ideation experiment. Creativity is measured through appropriateness and novelty, individually.

Our results indicate that constraints enable average creativity, while inhibiting extreme value creativity. Moreover, the effect of a constrained creativity processes depends on whether the inventor is approach or avoidance motivated. Our results will now be described in more detail. Financial and task structure constrains are found to have a significant, positive affect on mean novelty, and a zero effect on mean appropriateness. Financial and task structure constraints are found to have a significant, negative affect on both the appropriateness and the novelty extreme value score. Further, our findings suggest that the effect of a financial constraint on creativity is strengthened by a task structure constraint. Approach motivated individuals are found to be less creative when being constrained, while avoidance motivated individuals are found to be more creative in constrained conditions.

Acknowledgements

This study is part of our master's degrees in Strategy and Management (STR) and Marketing and Brand Management (MBM) at the Norwegian School of Economics (NHH). By writing this thesis the end of an era is over, but at the same time a new chapter of our lives lies ahead. The last five years have been a privilege; studying at one of the leading business institutions in Northern Europe. Although this research project has been challenging and overwhelming at times, it has given a greater understanding of one of the most interesting topics within the management literature; how to balance financial and creative goals.

We would like to direct an appreciation to our supervisor and Professor at NHH, Magne Supphellen, for the help and guidance along our research journey. His valuable input and motivation throughout this semester has led to the study we present to our readers. Furthermore, we would like to thank the business developers at Bergen Technology Transfer (BTO), Kari Øritsland and Steffen Boga, for their valuable contribution. We would also like to thank Lê Quang Nhật for contributing with valuable statistical input, used in our analyses.

Last but not least, we appreciate the support from our families and friends. Special thanks are directed to Mathilde for taking Philip swimming, and Ole for making Philippa laugh every day.

Oslo, June 2018

Philippa Kristina Tronstad and Philip Popescu Lindberg

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1. Introduction

1.1 Background

Creativity plays a central role to innovation processes as it generates the ideas that will initiate innovation and substantiate long-run business success. Creativity management is therefore a key management challenge, and business leaders who master creativity obtain significant competitive advantages. However, in a survey of business trends and challenges by Rothfeder (2015), business leaders across 16 sectors admits to not fully be prepared to meet the challenges of organizational innovation and creativity. In order to provide management with guidance along this road there is a growing body of research on how to effectively manage organizational creativity (Bjork, Boccardelli, & Magnusson, 2010; Girotra, Terwiesch, & Ulrich, 2010; Busacca, Cillo, Mazursky, & Scopelliti, 2013; Rosso, 2014; Cohendet & Simon, 2015).

A particular interesting topic within this management literature, is whether organizations benefit or lose from constraining their innovation processes. Looking at the present situation in organizational innovation we see an extensive use of constraints. An innovation process can often be described as a journey where a team of inventors follow certain goals and delivers based on specific sets of key performance measurements, from the early ideation rounds to the final product development stages (Cooper, 2008; Rosso, 2014). This can be further substantiated from a dialog we had with the largest Nordic FMCG company, disclosing aspects of their internal innovation processes. We see several potential threats to constrained innovation processes. Firstly, breakthrough ideas may be rejected in the early stages of the innovation process as these ideas at the rejection point were underdeveloped at the rejection point. Secondly, resource commitment may be allocated to ideas that seem profitable early on, but turn out to be failures in later stages. Lastly, the inventor's individual creativity may be inhibited, decreasing the creative quality of ideas and ultimately causing suboptimal products and services. This latter potential threat will be the main focus of this thesis.

1.2 Purpose

The literature on creativity presents conflicting views on whether constrained creativity enable or inhibit the creative outcome. The traditional school of theorists and researcher's claims that creative thinking is driven by unstructured, open-ended processes where the inventor is autonomous and has plenty of time, material and financial resources to explore, experiment and play with (Amabile, 1988, 1996; Davis & Gruber, 1988; Andrews & Smith, 1996; Shalley, Zhou & Oldham, 2004). An innovation is defined as the successful implementation of creative ideas (Hennessey & Amabile, 2010). The traditional creativity view indicates that constraints cause harm to creativity, and ultimately, the innovation itself. On the other hand, there is a growing body of research suggesting that constrained creativity processes can be beneficial to creativity as constraints may force the inventor to push beyond his or her usual thought patterns (Moreau & Dahl, 2005; Stokes, 2006; Weiss, Hoegl & Gibbert, 2012; Busacca, Cillo, Mazursky, & Scopelliti, 2013). A potential weakness to many of these bounded creativity studies is that they draw conclusion based on average effects, although it is the extreme values that often make the difference in the world of innovations (Dahan & Mendelson, 2001; Terwiesch & Loch, 2004). Moreover, the studies in mention make use of problem statements that are inherently structured, without discussing whether such structured problem statements may affect their test results.

Based on conflicting research evidence within the bounded creativity literature, and the growing use of constraints in innovation processes, we aim to investigate the relationship between constraints and creativity, looking at financial and task structure constraints. With the effort of contributing to a more nuanced understanding of bounded creativity we will conduct an ideation experiment measuring both average and extreme value effects. We believe a comparison between averages and extreme values is important as it is the extreme values that really matters in the world of innovations (Dahan & Mendelson, 2001; Terwiesch & Loch, 2004). Moreover, we aim to shed light on whether the degree of task specificity affects the relationship between constraints and creativity, as this topic is left out of several bounded creativity studies. Lastly, we will investigate whether the relationship between creativity and constraints is moderated by approach and/or avoidance motivation, following a relatively new and little empirically tested framework, put forward by Roskes (2015).

1.3 Structure

We will start by presenting a literature review related to creativity, constraints and motivation theory. Thereafter, we propose our research model and the related hypotheses, before describing the research methodology, including the independent, dependent, moderating, mediating and control variables used in our analyses. Following the methodology, we will present the results of our hypotheses testing before we discuss our findings in relevance to theoretical- and managerial implications. Finally, we will discuss our thesis' validity and reliability, limitations and contributions to further research.

2. Theory, Research Model and Hypotheses

2.1 Creativity

In this section, we will define creativity, looking at the main drivers to individual creativity processes, before investigating the effects of constrained creativity.

2.1.1 Defining Creativity

Amabile (1988; 1996) represent the traditional view within the creativity literature, defining creativity as “the production of ideas or solutions that are novel and useful.” Moreover, creativity is viewed as a trait presented by a selection of cognitive processes that are vital for human functioning (Dahl & Moreau, 2005). More recent, Georg (2008) described creativity as a source to competitive advantage and lasting stakeholder value for organizations who relies on innovative products and services.

Following the lines of Amabile’s (1988; 1996) creativity definition stated above, numerous studies have defined a creative idea as the separation of two key components, appropriateness and novelty (Deci & Ryan, 1987; Goldenberg, Mazursky, & Solomon, 1999; Dahl & Moreau, 2005; Busacca, Cillo, Mazursky, & Scopelliti, 2013). These two factors are considered to be critical components when evaluating creativity (Dahl & Moreau, 2005). The appropriateness of an idea distinguishes between sub-dimensions such as usefulness and effectiveness (Gardner, 1993; Sternberg & Lubart, 1999). The novelty of an idea includes sub-dimensions such as originality and uniqueness. Busacca et al. (2013) defines appropriateness of an idea as the adequacy of the idea in mention related to the task or problem it is intended to solve. The same authors define a novel idea as the originality displayed when combining the items or building blocks of that idea.

In the literature, creativity is also referred to as a case of problem solving (Isen, Daubman & Nowicki, 1987; Osborn, 1953; Treffinger, Isaksen & Dorval, 2000). A problem can be defined as “a matter or situation that needs to be resolved or overcome by identifying or inventing a solution” (Joyce, 2009).

Dahl and Moreau (2005) exemplifies this with cooking a dinner: if an individual shall have a meal ready within two hours, he or she can solve the problem by either using *previously constructed* solutions or by the construction of a *new plan*. When the creator decides to use a previously constructed solution or creating a new plan, creative processes are at work (Joyce, 2009).

Based on the current literature, this thesis defines a creative idea as an “idea, possessing appropriateness and novelty, aimed to solve a specific problem”. Before investigating the relationships between creativity and constraints, we will briefly present Amabile’s (1997) componential theory of creativity. Sub-section 2.1.2 is included, as the model’s three components to individual creativity often are referred to in the literature when discussing how constraints directly affect creativity, and how these relationships may be moderated and mediated. Following this, we will be shifting our focus to constraints on creativity.

2.1.2 The Componential Theory of Creativity

Amabile’s work on the componential model of creativity has been an important tool in understanding individual creativity. The model consists of three individual components, crucial to creative outcomes: domain-relevant skills, creativity-relevant skills and task motivation (Amabile, 1997):

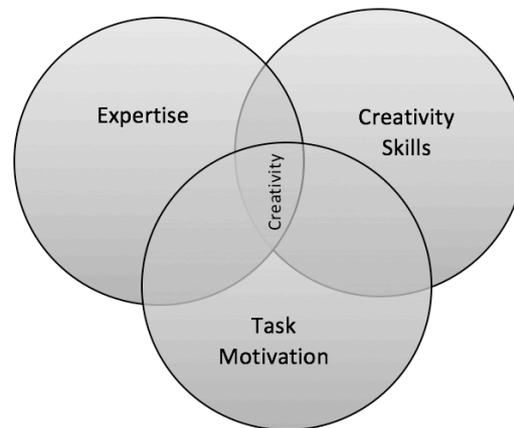


Figure 1: The Component Model of Creativity (Amabile, 1997)

Domain-relevant skills are defined as the individual's expertise in a relevant domain, while creativity-relevant skills consist of the cognitive processes and personality traits favorable to creative thinking. Task motivation focuses particularly on intrinsic motivation, the individual's motivation to engage in a task out of self-interest, enjoyment or by viewing the task as a personal challenge (Amabile, 2012).

Given domain-relevant skills the individual's expertise is dependent on the individual's memory for factual knowledge, technical proficiency, intelligence and special talent within the target domain (Amabile, 1997). Creativity-relevant skills are often associated with capabilities such as the cognitive processing style and personality traits (Romeiro & Wood, 2015). Cognitive style relates to how the individuals find new perspectives to problems by utilizing different cognitive pathways (Amabile, 1997).

Kirton (1994) claims that the individual's cognitive style is either innovative or adaptive. The innovative style is utilized when the inventor creates a solution, different from the norm, redefining the problem and solving it by integrating new and different pieces of information. The adaptive style is described as creating a solution which do not deviate greatly from expectations by using information from already known fields and following established patterns. Personality traits are related to the inventor's willingness to take risk, their independence and/or tolerance for ambiguity. Individuals who score high on these traits are seen as better equipped to be creative (Roskes, 2015). Amabile (1997) claims that it is possible to improve creativity-relevant skills by working with different methods to increase cognitive flexibility and intellectual independence.

In comparison to domain-relevant skills and creativity-relevant skills, task motivation is related to the inventor's attitude towards a specific task or problem. When the inventor is intrinsic motivated he or she solves the problem because it seems interesting, personally challenging or satisfying (Amabile, 2012). It is originated from the individual's inner wish to create and is often expected to improve creativity. Extrinsic motivation on the other hand, is driven by external factors such as fame, money or team recognition, and is often seen to undermine creative potential (Amabile, 1996). In the creativity literature, intrinsic motivation has been a center point for creativity research, investigating the potential mediating effects of intrinsic motivation on creativity. We will now shift our focus towards creativity and constraints, being the main focus point of this thesis.

2.2 Creativity and Constraints

In the following section, we will define constrained creativity from a review of existing literature. We will thereafter present an in-depth review of the research literature claiming constraints to enable or inhibit creativity. Time, input, financial and task structure constraints are discussed separately. In conclusion, the section's main findings are presented in Table 1.

2.2.1 Defining Constrained Creativity

As earlier stated, we define a creative idea as “an idea, possessing appropriateness and novelty, aimed to solve a specific problem”. A constraint to the creative process is therefore a restriction, limitation or confinement, imposed to the creation of ideas or solutions that are novel and appropriate. Such constraints are either due to variables in the external environment (Amabile, 1988; 1996), or internally by the organization, workplace or from the inventor himself (Rosso, 2014). Joyce (2009) defines rules, goals choice limitations, norms and scarcity as common constraints to creativity processes. Rosso (2014) presents time, product requirements, equipment, market demands and money as salient constraints to innovation processes. Moreover, constraints on creativity are conceptualized in the literature as the sum of the two following dimensions; limiting and channeling constraints (Stokes, 2006; Joyce 2009; Roskes, 2015). We will now define both dimensions.

A limiting constraint is defined as a restriction that *occupy* cognitive resources, such as time pressure or dual task demand (Roskes, 2015). A condition imposed by a limiting constraint therefore means that the inventor's search space is limited and narrowed, compared to an unbounded situation (Stokes, 2006). A channeling constraint on the other hand, is defined as a restriction that *asserts* focus on resources such as procedural instructions, strictly defined goals or task structure (Roskes, 2015). Compared to limiting constraints, the channeling constraints direct the inventors search space (Stokes, 2006) instead of occupying it.

Whether or not these constraints enable, or inhibit creativity is not straightforward. The research literature offers a great deal of conflicting evidence on the matter, and a variety of paradoxes arise when investigating bounded and unbounded creativity processes. We will now present the reader with an in-depth review of studies claiming constraints to be beneficial or damaging to creativity.

2.2.2 Constraints – Enablers to Creativity?

Historically, ideal creative processes have been described in the literature as unstructured, open-ended, and free from external limitations. Such unbounded processes give the inventor plenty of time, resources and space to reflect on and play with ideas (Amabile, 1988, 1996; Andrews & Smith, 1996; Shalley, Zhou & Oldham, 2004). In more recent publications, these traditional views on creativity are questioned. The “opponents” claim that creativity indeed can benefit from constraints such as time, inputs, money or the overall process itself (Baer & Oldham, 2006; Gilson, Mathieu, Shalley & Ruddy, 2005; Hargadon & Stutton, 1996; Moreau & Dahl, 2005; Stokes, 2006; Weiss, Hoegl & Gibbert, 2012; Busacca, Cillo, Mazursky, & Scopelliti, 2013 and Rosso, 2014).

The majority of research within bounded and unbounded creativity has focused on the limiting constraint of time pressure (Hennessey & Amabile, 2010). The research on channeling constraints is however growing, with a main focus on inputs, financial resources and task structure. We will therefore structure the following sections in the same way, presenting an overview of important studies proclaiming constraints as either enabling or inhibiting creativity. We will briefly present limiting constraints, before introducing an in-depth review of channeling constraint.

2.2.3 Limiting Constraints

The Effect of Time Pressure on Creativity

Given the traditional view of creativity as an unbounded process, several theorists agree that creativity in its natural state is a time-consuming process (Davis & Gruber, 1988; Amabile, 1998). A time constraint, which occupies the inventor’s cognitive processes, is therefore claimed to hamper problem solving, and labeled as an important, undermining factor to creativity (Amabile & Gryskiewicz, 1987). Time pressure forces the individual to take the simplest, most unoriginal direction, in addition to dissuading the inventor’s search space. It also increases the creator’s confidence for “status quo”-approaches (Amabile, 1996; 1998). Moreover, time pressure such as strict deadlines is claimed to destroy organizational creativity (Amabile, 1998) making it difficult to think outside planned routines and instructions (Britz, Ekvall & Lauer, 2013). However, other theorists have suggested the opposite.

Andrews and Farris (1972) conducted a laboratory study on scientists and engineers where they manipulated time pressure, and measured several aspects of performance such as usefulness, innovation and productivity. The study found a significant, positive relationship between time pressure and creativity. Through a group study, Kelly and McGrath (1985) found the same results, showing that groups working under a 10 minutes' time interval generated higher creativity scores compared to a group working under a 20 minutes' time interval. Burroughs and Mick (2004) found the same positive results when examining ideation treatments following a two minutes' time span and a three-hour time span.

Several other theorists and researchers have also investigated this relationship. West (2002) proposed a curvilinear relationship between time pressure and creativity on the individual level. Baer and Oldham (2006) investigated this proposition and found supporting evidence, meaning that moderate levels of time pressure had a positive effect on creativity. This curvilinear relationship has further been confirmed in other studies (Amabile, Hadley, & Kramer, 2002; Ohly, Sonnentag, & Plunkte, 2006). The explained reasons behind the observed positive effect of time constraints varies.

As previously mentioned, one of the driving forces behind creative outcomes is the individual's intrinsic motivation, and willingness to create. As a result, many theorists claim that both limiting and channeling constraints does not have a direct effect on creativity, but rather interact with underlying factors such as intrinsic motivation (Hennessey & Amabile, 1998; Amabile, Schatzel, Moneta, & Kramer, 2004; Zhang & Bartol, 2010). To exemplify, previous studies have shown that deadlines may result in experienced time pressure that lowers the employee's intrinsic motivation and thereby decreasing their creativity (Amabile, Hadley & Kramer, 2002; Andrews & Smith, 1996). However, Hennessey and Amabile (2010) found evidence showing that time constraints, although generally inhibiting creativity, may be beneficial if the inventors' feel that they are on a "mission", and are simultaneously protected from distractions. There are also other underlying factors which is suggested to moderate and mediate the outcomes of bounded creativity.

Burroughs and Mick (2004) observed that individuals with a more external locus of control yielded inferior creativity results compared to the ones with a more internal locus of control, when exposed to non-extreme time pressure. Roskes (2015) suggesting that limiting constraints such as time pressure undermines performance more under avoidance motivation than under approach motivation.

Dahl and Moreau (2005) have evaluated time pressure in consumption situations. They suggest that time restrictions indirectly cause input restrictions for the consumer, which in turn positively affect creativity. This notion is also supported by Ridgway and Price (1994).

As time pressure is suggested to have an indirect effect on creativity through input restriction, we will now review the literature on channeling constraints. The following sections will be divided into input, financial and structure constraints.

2.2.4 Channeling Constraints

The Effect of Input Constraints

As for time constraints, the traditional view in the creativity literature states that an abundance of resources is beneficial to creativity. Moreover, in order to secure that the inventor is comfortable when ideating it is necessary to secure sufficient resources (Amabile, 1988, 1996; Amabile & Gryskiewicz, 1987). Resources is here a collective definition of inputs or materials such as financial resources and staffing. This section will focus on input constraints, meaning the materials needed to create a product or generate an idea.

In line with the unbounded creativity view, a study by Amabile and Gryskiewicz (1987) found that lack of resources was among the top six most prominent environmental inhibitors. In addition, Amabile (1988) found that one third of the respondents in a case study emphasized insufficient inputs as an important inhibitor to creativity. Rosso (2014) found similar results when conducting a series of interviews with different innovation teams in a large American technology company. However, there are some limitations to these historic studies, which Rosso (2014) calls "*The Paradox of Creativity*". This paradox states that creative teams do not like to be bounded and may therefore believe that constraints are negatively affecting their work. However, when measuring the outcome of bounded creativity, one observes that constraints may indeed be beneficial to both provoke and structure the creative process. As with time constraints, multiple creativity studies show that input restrictions and requirements offer significant, positive effects.

Shalley and Gilson (2004) suggest that employees may be stretched to find more innovative approaches and solutions when they do not have all resources readily at hand. This argument is supported by a series of experiments on college students, where the ones that could not choose freely among inputs to use when conducting a creative task were rated more

creative (Finke, 1990; Finke, 1992). Along the same lines, Tidd (2006) discuss how input prices affect creativity and innovation. The author claims that the relatively high gasoline prices, representing an input constraint in Europe compared to the U.S., stimulated the production of fuel efficient cars in Europe compared to USA. Given these findings, we see research evidence contradicting one of the main theories within the traditional creativity view, namely that autonomy is beneficial to creativity. Another influential study on the effect of input constraints on creativity, separates between input restrictions and input requirements (Dahl & Moreau, 2005). The findings of this study show that both input restrictions and input requirements must be active to observe a significant, positive effect on creativity. Moreover, the authors evaluate creativity based on the two earlier discussed sub-dimensions; appropriateness and novelty. Their result show that input constraints and restrictions only have a positive, significant effect on novelty, while there is zero effect on appropriateness.

The leading explanation in the research literature to why input constraints are beneficial to creativity, relates to the concept known as “the path of least resistance”, shortened POLR (Ward, 1994). POLR suggests that input constraints cause the inventor to not generate the “easiest” top of mind ideas by routing the individual off the path of least resistance. Being forced off this path is claimed to result in positive creative outcomes (Ward, 1994). This suggestion is also supported by Busacca et al. (2013). Busacca et al., (2013) builds on the findings by Dahl and Moreau (2005), claiming that the inventor is taken off the POLR through a “bottom-up approach” when inputs are limited. Thus, input restrictions drive the creative process by focusing on resource allocation and exploitation, compared to a focus on the end goal, referred to as a “top-down approach”. The “bottom-up approach” is in turn the catalyst to novelty, while the “top-down approach” stimulates appropriateness.

In addition to the effect on POLR, researchers claim that input constraints stimulate creativity by being perceived as challenging, which in turn affect intrinsic motivation (Amabile & Gryskiewicz, 1987; Dahl & Moreau, 2005; Rosso; 2014; Caniels & Rietzschel, 2015). As one of Google’s top manager’s states “the engineers thrive on constraints, they love to think their way out of that little box” (Salter, 2008). Whether constraints are perceived as challenging or threatening is however dependent on the inventor’s personality traits (Roskes, 2015). Such traits will be further discussed in sub-section 2.3.1 of this chapter. We will now continue by examining the research literature, investigating the effects of financially constrained creativity.

The Effect of Financial Constraints

Compared to time and input constraints, the relationship between financial constraints and creativity is a fairly little examined domain in the research literature. There are, however, some studies related to the topic, most of them focusing on budget constraints. Among these, a well-known view is that sufficient financial resources support creativity and innovations as it offers autonomy and freedom which in turn intrinsically motivates the creator (Amabile, 1996; Damanpour, 1991; Boronat-Navarro, Camison-Zornoza, Lapiedra-Alcami, & Segarra-Cipres, 2004). As with time and input constraints, there are evidence contradicting the importance of an abundant of financial resources.

We have previously stated that the inventor needs sufficient resources at hand to feel comfortable and generate creative ideas (Amabile, 1988, 1996; Amabile & Grysiewicz, 1987). Csikszentmihalyi (1997) contradicts this claim, arguing that an abundance of financial resources has a negative effect on creativity, as too many resources at hand make the inventor too comfortable. Along these lines, Rosso (2014) found that employees within a medical innovation unit in a large American technology firm, imposed financial constraints on themselves in order to increase creativity. As one of the inventors put it: *There was a significant cost constraint placed on our development team because we were kind of in skunkworks mode*. In other words, the innovation unit restricted its own autonomy in order to increase creativity. Other studies have found the same results, indicating that a lack of financial resources stimulates individuals to create unique services (Baker & Nelson, 2005).

Looking again to situations where financial constraints restricts autonomy and positively affected creativity, Busacca et al. (2013) found that financial constraints, in a laboratory environment, resulted in more appropriate solutions. The study was a replicate of the previously discussed study by Dahl and Moreau (2005), but with a budget constraint as an additional manipulation factor. The authors show that financial constraints take the inventor off the POLR, through a “top-down approach”, not a “bottom-up approach”, as was the case for input constraints (Dahl & Moreau, 2005). The “top-down approach” is claimed to direct the inventor’s search space in a way which emphasizes the end goal over resource usage. This focus is claimed to make the inventor imagine and imitate existing solutions. As the solutions imagined are already existent, the approach yields ideas that were appropriate, not novel (Busacca, Cillo, Mazursky, & Scopelliti, 2013).

Looking at the market environment, Katila and Shane (2005) explored whether there exists a relationship between market characteristics and the firm's ability to innovate. The authors found that small markets, with high competition and limited resources could indeed stimulate and facilitate innovation at a higher rate than the markets with low competition, high demand and plentiful of resources. There are also other relevant studies in the innovation literature providing evidence that financial scarcity may positively affect innovation on the individuals (Garud & Karnoe, 2003), teams (Hoegl, Gibbert, & Mazursky, 2008; Weiss, Hoegl, & Gibbert, 2012), and at an organizational level (Mone, McKinley, & Barker, 1998; Mishina, Pollock, & Porac, 2004). The authors do however examine and explain the observed relationships differently.

Although many theorists claim that constraints undermine intrinsic motivation, there are other researchers suggesting the opposite. Previous studies in the literature claims that bounded creativity may be positively mediated by intrinsic motivation, but that this effect is dependent on whether the individual is approach or avoidance motivated (Roskes, 2015). Busacca et al. (2013) found another personality trait that positively moderated financial bounded creativity, namely novelty seeking. This finding is in line with earlier research, claiming that novelty seekers have a wider knowledge domain, hence are able to access a wider stock of experiences and perspectives (McCrae & Costa, 1997). Moreover, novelty seekers are expected to experience constraints as challenging (Kornai, 1979; Shostack, 1988), which in turn should result in positive creative outcomes. Weiss et al. (2012) observed another moderating effect when investigating team level creativity, namely that the effect of "team climate for innovation" positively moderated the relationship between financial constraints and creativity.

The Effect of Task Structure Constraints

The term task structure constraint may be less familiar than the other, previously discussed constraints. We will therefore start by briefly define the implication of a task structure constraint, before presenting a review of the relevant literature.

According to McGrath (1984) we differ between two main types of tasks when generating new ideas and plans, planning or creative tasks. Given the focus of this thesis we will focus on the latter. In addition to separating between planning and creative tasks, one can further define a task based on its degree of specificity (Kirkpatrick & Locke, 1996; Charness & Grieco, 2014). A structured task is characterized by some specific direction to follow, while an unstructured task is more autonomous. This thesis defines a constrained task as a creative task which is structured, meaning that it contains a high degree of specificity. An unconstrained task, is therefore unstructured, containing a low degree of specificity.

Given the traditional view on creativity, creative tasks should have a low task specificity, as such tasks offer the inventor the greatest degree of autonomy (Amabile, 1996; Hill & Amabile, 1993; Hennessey & Amabile, 2010). Reducing the task autonomy results in a lack of choice which in turn may reduce the inventor's intrinsic motivation and therefore negatively affect creativity (Amabile, 1983; Amabile & Gitomer, *Children's Artistic Creativity: Effects of Choice in Task Materials*, 1984). Nouri et al. (2013) conducted a laboratory study investigating the effect of task specificity on the creativity performance in groups. The results showed that low task specificity had a positive effect on creativity in both homogeneous and heterogeneous groups.

In the previously mentioned field study by Rosso (2014), they also found that employees working with innovation on a daily basis delivered the best creative results when they felt free, flexible and empowered with relevance to their tasks and goals. As we can see, these findings are in line with the traditional creativity view. There was however a catch, the inventors described that they almost always worked under management restrictions. Common restrictions were time, input, and financial limitations. In addition, they almost always had clearly defined goals and objectives. As two of the inventors Rosso (2014) interviewed said, "There is still a lot of leeway for us to get our job done", and "There is certain goals they want, but they're not necessarily tied down to how you do it".

Connecting these findings to the traditional creativity view, we observe that one may work in constrained environments and still feel autonomous, be intrinsically motivated and creative.

The notion that task structure constraints can enable creativity, is supported by Joyce (2009). Her research even suggests that intrinsic motivation may be reduced when the inventor experience too much autonomy, as too much freedom may reduce the individual's inner wish to be creative. Moreover, she finds that moderate constraints lead to a deeper engagement with new information, and greater certainty about the appropriateness of creative search strategies. Schwartz (2004) also supports the claim that task constraints may be damaging to creativity, as too much choice can be paralyzing and tend to undermine good judgement and intrinsic motivation.

As briefly touched upon, the inventors in the field study by Rosso (2013) mentioned clearly defined goals as important to their creative work. As a structured task is characterized by some specific directions to follow, we see goal setting as part of a structured task. Shalley (2008) has examined the effect of goal setting on creativity and found that it is beneficial as it encourages employees to undertake creative activities. Moreover, Roskes (2015) suggests that goals may help the inventor to channel his or her cognitive resources towards a given task. Goals may however also be experienced as limitations to the inventor's free and flexible way of cognitive processing. Hence, the effect of a structured task may depend on the creator's processing style. This will be further discussed in the next section, where we introduce Roskes' (2015) framework on how bounded creativity may be moderated by approach and avoidance motivation.

Table 1: A Summary of the Literature review on Creativity and Constraints

Constraints	Enabling	Inhibiting
Limiting Time Constraints (<i>Occupying cognitive resources</i>)	A moderate amount of time pressure cause sig. higher creativity scores, as the relationship between time constraints and creativity is curvilinear (West, 2002; Baer and Oldham, 2006)	Creativity is a time-consuming process. Time pressure is therefore an important undermining factor to creativity (Amabile & Gyskiewicz, 1987). Time constraints cause status-quo solutions (Amabile, 1998), making it difficult for the inventor to think outside planned instructions and routines (Britz, Ekvall & Lauer, 2013).
Channeling Input Constraints (<i>Asserting focus to cognitive resources</i>)	When input restrictions and input requirements are active, mean novelty is sig. improved. Mean appropriateness is not sig. affected. Input constraints cause this sig. positive affect as the inventor is forced off the POLR, meaning "top of mind ideas" are not generated, asserting his or her focus on resource allocation (Dahl & Moreau, 2005).	Input constraints reduces the inventor's creative autonomy, hence negative affecting creativity (Amabile, 1988, 1996; Andrews & Smith, 1996). Moreover, input constraints are among the most prominent environmental inhibitors to creativity (Amabile and Gyskiewicz 187)
Channeling Financial Constraints (<i>Asserting focus to cognitive resources</i>)	Financial constraints sig. positive affect average appropriateness, when the underlying task is structured. Average novelty is unaffected. Financial constraints cause this sig. affect by routing the inventor of the POLR, asserting cognitive resources to the final solution and not resource allocation.	Sufficient financial resources are needed to support and secure the inventor's ability to be creative, as a lack of financial resources restricts the inventor's autonomy, and reduces his or her intrinsic motivation (Amabile, 1996; Damanpour, 1991; Boronat-Navarro, Camison-Zornoza, Lapiedra-Alcami, & Segarra-Cipres, 2004).
Channeling Task Structure Constraints (<i>Asserting focus to cognitive resources</i>)	Moderate levels of task specificity may result in more appropriate search strategies (Joyce, 2009). Too much choice can paralyze and undermine good judgement (Schwartz, 2004). Moreover, clearly defined goals may encourage creative behavior (Shalley, 2008)	Low task specificity secures autonomy, hence creative results (Amabile, 1996; Hill & Amabile, 1993; Hennessey & Amabile, 2010). Reducing the task autonomy results in a lack of choice which in turn may reduce the inventor's intrinsic motivation and therefore negatively affect creativity (Amabile, 1983; Amabile & Gitomer, Children's Artistic Creativity: Effects of Choice in Task Materials, 1984).

2.3 Creativity and Motivation

A range of theorists and researchers has defined intrinsic motivation as the catalyst to creativity (Amabile, 1988; Amabile, Hadley & Kramer, 2002; Andrews & Smith, 1996), see sub-section 2.1.2. When the inventor experiences the problem or task as interesting, personally challenging and/or satisfying (Amabile, 2012), the inventor gets intrinsically motivated, and is therefore fairly well equipped in terms of creative thinking. In a recent publication on bounded creativity and motivation, Roskes (2015) elaborates on this notion by suggesting that constraints may affect intrinsic motivation and therefore creativity differently, depending on whether the individual is approach or avoidance motivated. The framework put forward by Roskes (2015) will now be further reviewed. A summary of the main takeaways from Roskes' (2015) theoretical framework is presented at the end of this section, in Figure 2.

2.3.1 Approach and Avoidance Motivation

Although intrinsic motivation is one of the leading motivational concepts within creativity there are studies claiming that approach and avoidance motivation also affect creativity (Friedman & Forster, 2000; Mehta & Zhu, 2009; Liechtenfeld, Elliot, Maier, & Pekrun, 2012). Moreover, a new framework on creativity performance suggest that the effect of bounded creativity depends on whether the inventor is approach or avoidance motivated (Roskes, 2015). This personality trait may in turn direct the inventor's experienced intrinsic motivation given a problem-solving scenario. As a result, we will look deeper into the literature of approach and avoidance motivation, connecting it to creativity and constraints.

The distinction between approach and avoidance motivation has been attended to in psychology since its inception (James, 1890). Elliot (1999) describes the concepts as following: Both approach and avoidance motivation are integral to successful adaption; avoidance motivation facilitates surviving, while approach motivation facilitates thriving. In other words, approach motivated individuals are directed by positive and desirable possibilities, while avoidance motivated individuals are directed by negative and undesirable possibilities. To exemplify, approach motivated behavior could be to work harder to achieve a bonus, while avoidance motivated behavior could be to work harder in order to not lose a job. However, individuals do also differ in approach and avoidance motivation by nature (Roskes, 2015).

An extensive body of research has associated approach motivated individuals with explorative behavior and high-risk tolerance (Friedman & Forster, 2002), abstract and holistic thinking (Forster & Higgins, 2005; Forster, Friedman, Ozelsel, & Denzler, 2006; Kuschel, Forster, & Denzler, 2010), and the ability to offer great flexibility in cognitive processes, switching between different ideas and approaches (Friedman & Forster, 2005; Roskes, De Dreu, & Nijstad, 2012). These associations, and especially the ability to offer flexibility when processing information, is claimed to improve creativity (Friedman & Forster, 2000; Mehta & Zhu, 2009; Cretenet & Dru, 2009). The importance of cognitive flexibility is also in line with Amabile's componential theory of creativity, previously discussed in sub-section 2.1.2. Avoidance motivated individuals are on the other hand often associated with diminished creativity (Friedman & Forster, 2000; Liechtenfeld, Elliot, Maier, & Pekrun, 2012).

As stated, avoidance motivated individuals are driven by avoiding negative outcomes, which in turn leads to anxiety, stress and fear of failure. Moreover, such individuals are seen as risk averse (Elliot, 2006) and detail oriented, with a narrow attention scope (Mikulincer, Kedem, & Paz, 1990; Maier, Elliot, & Lichtenfeld, 2008). The literature also describes them as less flexible given information processing, usually focusing on a few ideas and approaches (Roskes, De Dreu, & Nijstad, 2012). Avoidance motivated individuals are also more reliable on the availability of cognitive resources when being creative compared to approach motivated individuals (Roskes, 2015). Based on these findings, it seems logical to assume that approach motivated individuals perform better in creative processes. This is however not necessarily always the case.

Avoidance motivated individuals may also score high on creativity scales, the difference is just how they go about their creativity process (Roskes, 2015). Avoidance motivation is connected to less flexible information processing, which in turn demands more intensity and energy from creative thinking (Elliot, 2006; Roskes, De Dreu, & Nijstad, 2012). The key to creativity among all is therefore to identify how different cognitive styles affect creativity, define which cognitive styles the inventor utilizes, and ultimately structuring the process thereafter (Thaler & Sunstein, 2008).

2.3.2 Limiting Constraints and Approach and Avoidance Motivation

As earlier stated, a limiting constraint is defined as a restriction that *occupy* cognitive resources. As avoidance motivated individuals are more dependent on the availability of resources when being creative (Roskes, 2015), it is logical to expect that limiting constraints negatively affect these individuals' creative abilities. Empirical studies on limiting constraints, such as stressors, noise, cognitive overload, time pressure and dual task demand, support this assumption. This indicates that avoidance motivated individuals are affected negatively by limiting constraints when solving creative problems (Sacramento, Fay, & West, 2013; Roskes, Elliot, Nijstad, & De Dru, 2013).

Roskes (2015) suggests that although limiting constraints negatively affect avoidance motivated individuals, the same constraints may actually positively affect approach motivated individuals. The logic behind this assumption is that approach motivated individuals demand fewer cognitive resources when solving problems, and may therefore experience limiting constraints as challenging, not threatening. Experiencing constraints as challenging should intrinsically motivate the inventor (Roskes, 2015), assert his or her focus toward gains, and finally generate a positive creative outcome (Smith & Lazarus, 1993; Drach-Zahavy & Erez, 2002; Lowe & Benette, 2003). The benefits from a focus on gains are further supported in a recent study where individuals focusing on positive outcomes generated more ideas under the limiting constraints: time pressure and workload. However, as found in multiple studies the level of limiting constraints should not be too high, as high levels of limiting constraints tend to mostly undermine creativity (Baer & Oldham, 2006; Byron, Khazanchi, & Nazarian, 2010).

2.3.3 Channeling Constraints and Approach and Avoidance Motivation

As previously stated, a channeling constraint directs rather than occupies cognitive resources. Such constraints may be task procedures, strictly defined goals or specific task structures. In comparison to limiting constraints, these constraints may be experienced as restricting the inventor's autonomy and freedom. With relevance to intrinsic motivation theory it is logical to expect that channeling constraints therefore will inhibit creativity by reducing the inventor's intrinsic motivation for the task at hand. Roskes (2015) suggests otherwise, discussing that extrinsic constraints can support one's sense of competence.

As avoidance motivated individuals prefer systematic thinking and their creative performance depends strongly on the availability of cognitive resources, Roskes (2015) suggests that channeling constraints like task structure and goal clarity should be particularly beneficial for avoidance motivated individuals. This suggestion is also supported by other theorists. Slijkhuis, Rietzschel and Van Yperen, (2013) found that individuals high in need for structure performed better at creative tasks when following specific instructions. Moreover, people with a high need of structure were found to choose task structure over autonomy when choosing freely among different work scenarios. Preferring structure over autonomy has also been found among individuals in fear of doing mistakes in their work (Rietzschel, De Dreu, & Nijstad, 2007).

Given approach motivation, the study by Rietzschel et al. (2013) found that individuals low in need for personal structure experienced a drop in intrinsic motivation when being provided feedback in a controlling way. This indicates that channeling constraints may not be beneficial for approach motivated individuals, as autonomy is important for their motivation. This is also what Roskes (2015) suggest, namely that channeling constraints have a positive impact on avoidance motivated individuals, not approach motivated individuals.

The main takeaways from the theoretical framework put forward by Roskes (2015), is summarized in Figure 2.

Figure 2: A Summary of Roskes' (2015) Theoretical Framework

		Type of motivation	
		Approach motivation	Avoidance motivation
Type of constraint	Limiting constraints	Limiting constraints mildly undermine creativity or have a positive effect when interpreted as a positive challenge, increasing intrinsic motivation	Limiting constraints strongly undermine creativity due to cognitive overload, and they are experienced as a negative threat
	Channeling constraints	Channeling constraints undermine creativity because they misfit a flexible and explorative way of thinking, thwart the need for autonomy and undermine intrinsic motivation	Channeling constraints boost creativity because they fit a need for structure, provide clarity and focus attention and resources on task-relevant efforts.

2.4 The Research Model

In the following section, we will present our proposed research model and hypotheses used to answer our thesis' research question, defined as:

RQ: *How do financial and task structure constraints in ideation processes affect individuals' creative thinking, and when do the observed relationships hold?*

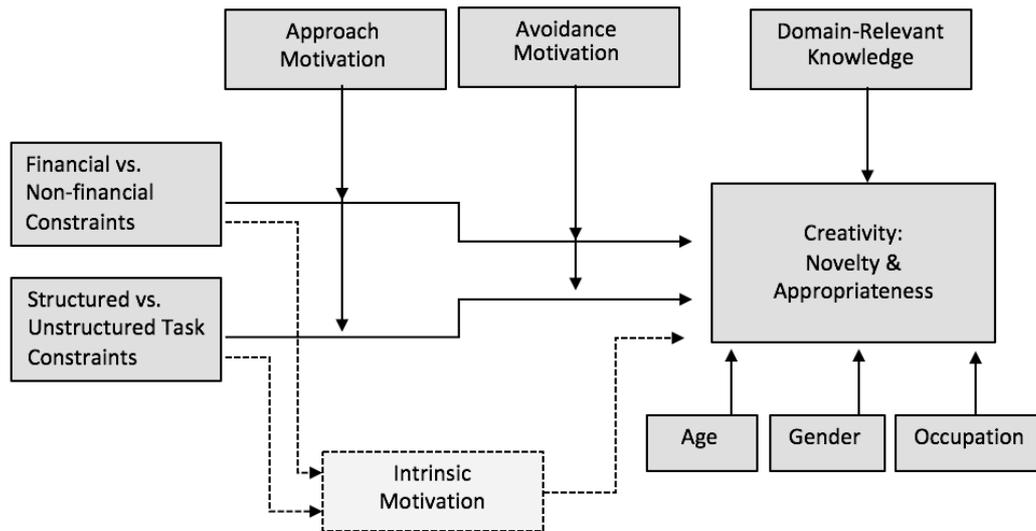


Figure 3: The Research Model

All direct and moderating relationships in Figure 3, are hypothesized. The possible mediating effect of intrinsic motivation will be tested. Intrinsic motivation is, however, not part of this thesis main focus. Potential mediating results will therefore be presented in “Additional findings”, in sub-section 4.1.2. Domain-relevant knowledge, age, gender and occupation are controlled for.

2.5 Hypotheses

As discussed in the literature review, researchers and theorists have challenging views on whether constraints are enabling or inhibiting creativity. We will therefore propose rivalry hypotheses on the effect of bounded and unbounded creativity, investigating both average and extreme value effects. Moreover, we will propose a set of moderating relationships based on whether the inventor is approach or avoidance motivated.

2.5.1 Average Effects from Financial and Task Structure Constraints

The traditional view within the creativity literature describes the ideal creative state as unstructured, open-ended and free from external limitations, where the inventor has plenty of time, material and financial resources to explore, experiment and play with (Amabile, 1988, 1996; Davis & Gruber, 1988; Andrews & Smith, 1996; Shalley, Zhou & Oldham, 2004). Moreover, creative tasks should have a low degree of specificity, meaning that little direction and structure is placed on the task itself (Hill & Amabile, 1993, Kirkpatrick & Locke, 1996, Nouri et al, 2013). Constraints which limit, restrict or direct this autonomous process are therefore seen as inhibitors to creative endeavors (Amabile, 1996, 1998; Hennessey & Amabile, 2010). As Hennessey and Amabile (2010) puts it:

In fact, the undermining effect of extrinsic constraints is so robust that it has been found to occur across the entire lifespan, with preschoolers and seasoned professionals experiencing the same negative consequences of expected reward and other extrinsic motivators and constraints.

Given the traditional creativity view, and our constraints being extrinsic by definition, we propose to see a negative effect on creativity in our constrained treatment groups. Our first hypothesis is therefore as following:

Hypothesis 1: The mean appropriateness score and the mean novelty score will be negatively affected by a) a financial constraint, b) a task structure constraint, and c) a financial and task structure constraint.

Although there is a strong belief in the creativity literature stating that creativity requires an unbounded and undemanding environment, there are also experimental evidence suggesting the opposite. As presented in the literature review, researchers like Csikszentmihalyi (1997), Baker and Nelson, (2005), Katila and Shane (2005), Busacca et al. (2013) and Rosso (2014), have all found evidence suggesting that an abundance of financial resources may have a negative effect on creativity. Findings by Rosso (2014) show that inventors may impose financial restrictions on themselves in order to improve creativity when the innovation process is too autonomous. As these findings are based on case interviews and the inventors are biased towards the result of their personal efforts, it is difficult to suggest whether or not these constraints predominantly affected appropriateness or novelty. It does however, support the claim that financial constraints may improve creativity.

In the laboratory study conducted by Busacca et al. (2013) the researchers found evidence suggesting that financial constraints positively affect the mean appropriateness of ideas, as financial resources route the inventor of the POLR. This implies that “top of mind” ideas are excluded, forcing the inventor to assert more cognitive resources to the ideation process. Moreover, financial boundaries channel the inventor’s focus towards the end-result, which means that existing solutions are imagined and thereafter modified to meet the imposed financial demands. The result of this cognitive process is a positive effect on the mean appropriateness score and a zero effect on mean novelty score. This because the inventor’s main focus is on existing solutions and not the underlying resources and materials (Busacca, Cillo, Mazursky, & Scopelliti, 2013)

Suggesting that constraints may lead to the imitation of existing solutions is also discussed by Amabile (1996) who states that time pressure leads to “status quo” solutions, killing creativity. Time pressure is however a limiting constraint, while financial constraints are channeling. Theorists like Joyce (2009) and Roskes (2015) suggest that limiting and channeling constraints affect creativity differently. The effect of “status quo” thinking may therefore have been differently if the constraint was channeling, which Busacca et al. (2013) prove through their laboratory experiment. Based on these findings we propose the following rivalry hypothesis to hypothesis 1:

Rival H1a: The mean appropriateness score will be positively affected by a financial constraint. The mean novelty score will not be affected by a financial constraint.

As with financial constraints, there are theorists claiming that task structure can be positive to creativity. Joyce (2009) suggests that moderate constraints may lead to a deeper engagement with new information and positively affect the appropriateness of creative search strategies. Moreover, the author states that although some amount of choice is important to encourage creativity, too much autonomy can be counterproductive. Along these lines, Schwartz (2004) suggests that too much choice can be paralyzing and tend to undermine good judgement. We suggest that a task structure constraint will reduce the inventor’s amount of choice. Following Joyce (2009) and Schwartz (2004), task structure constraints may therefore be beneficial to creativity.

Rosso (2014) found that certain inventors reported structure, clarity and goal specificity as important to creative processes at work. Moreover, clarity and goal structure did not automatically affect these inventor's autonomy as previously mentioned in the theory literature. Two of the inventors Rosso (2014) interviewed stated; "Here is still a lot of leeway for us to get our job done" and "There is certain goals they want, but they are not necessarily tied down to how you do it."

In a review of goal theory and creativity Shalley (2008) suggest that employees need role expectations such as goal setting to secure that creative activities are undertaken. With regards to task structure we suggest that goal setting is part of what defines a structured task, since clearly defined goals implies a higher degree of task specificity. We therefore propose to see a positive average effect on creativity when imposing a task structure constraint on our sample population. Moreover, we expect to see the same effect as with financial constraints, namely that channeling constraints improve the appropriateness dimension of creativity, as Joyce (2009) claim task structure to positively affect the appropriateness of creative search strategies. We therefore propose a second rivalry hypothesis to hypothesis 1, this time related to the task structure constraint:

Rival H1b: The mean appropriateness score will be positively affected by a task structure constraint. The mean novelty score will not be affected by a task structure constraint.

2.5.2 Extreme Value Effects from Financial and Task Structure Constraints

Theorists claim that extreme effects might be more relevant than average effects in an innovation context (Dahan & Mendelson, 2001; Terwiesch & Loch, 2004; Terwiesch & Ulrich, 2009). Looking to the literature, we have not found many studies that measure extreme values when discussing the effect of bounded creativity. Most studies focus on average effects, and constraints have thus proven to improve creativity. We propose that this might be because constraints reduce the variance in the set of generated ideas by excluding many bad and some “genius” ideas. The average effect is therefore improved as the ratio of “bad to genius” ideas is likely to be high.

We cannot prove this proposition as variance is not part of the statistical function for mean scores. We do however know that creativity is driven by flexible and explorative cognitive search processes (Amabile, 1997; Kirton, 1994; Hennessy & Amabile, 2010; Roskes, 2015). Given an explorative and flexible search process, the variance should increase as a larger part of the search space is explored. A low variance may therefore indicate less flexible information processing, hence inferior creative outcomes. This statement can partly be supported in the literature.

Kornish and Ulrich (2009) claim that when two ideas address a similar need or embody a similar solution, they are likely to be of similar quality, hence reducing the variance in the pool of generated ideas. When being imposed by constraints, the need becomes clearer. Following the claim by Kornish and Ulrich (2009) it is therefore likely that the solutions become more similar. This assumption is also supported by Girotra et al. (2010) stating that “Ideas that are similar in content and approach are likely to also be similar in quality”. We therefore suggest that unconstrained processes increase the variance of the generated ideas, as cognitive exploration stands stronger, positively affecting the extreme value scores. We therefore propose the following hypothesis:

Hypothesis 2: The highest appropriateness and novelty extreme value scores are observed in the group with the unconstrained treatment.

2.5.3 Task Structure and The Effect of a Financial Constraint

The following two hypotheses relates to whether the observed effect from a financial constraint is strengthened by a task structure constraint. This is important as multiple bounded creativity studies have failed to recognize this possible effect in previous studies. The two hypotheses presented in this section can therefore be seen in relation to Rival H1a and H2. As discussed in the introductory chapter and in the literature review, a multiple bounded creativity studies are using fairly structured tasks in their experiments. In the studies by Dahl and Moreau (2005) and Busacca et al. (2013), the researchers asked their respondents to “Design a toy, anything a child (age 5-11) can use to play with”. The task was held constant among all test groups, manipulating financial and input constraints between the different treatment groups. The authors never discussed whether their decision to keep the task structure constant could have affected their results.

Following studies by Joyce (2009), Schwartz (2004), Shalley (2008), Rosso (2014) and Roskes (2015) we know that task specificity and the degree of goal structure affect creativity. Moreover, we find the task in the study of Dahl and Moreau (2005) and Busacca et al. (2010) to be fairly structured as they contain both a target group (age 5-11) and a specific solution to the problem, a “toy”. We propose that the results from these studies may have been different given a constant, unstructured task. This assumption is further strengthened by the fact that Dahl and Moreau (2005) only find significant average effects when multiple constraints are active simultaneously. As we are investigating financial and task structure constraints, and proposed in Rival H1a that only the mean appropriateness score is positively affected by a financial constraint, we propose the following hypothesis:

H3a: The positive effect of a financial constraint on mean appropriateness is strengthened by a task structure constraint.

In addition to averages, we also investigate extreme values. As discussed in hypothesis 2, we propose that constraints negatively affect extreme value scores. We therefore propose an additional extreme value hypothesis related to how the negative extreme value effect from a financial constraint can be strengthened by task structure.

H3b: The negative effect of a financial constraint on the appropriateness and novelty extreme values, is strengthened by a task structure constraint.

2.5.4 Approach and Avoidance Motivation as Moderators to Creativity

As stated in the literature review, Roskes (2015) has created a conceptual framework suggesting how channeling and limiting constraints affect creativity differently depending on whether the inventor is approach or avoidance motivated. To our understanding her framework has been little empirically tested. We therefore aim to test her framework to investigate possible moderation effects.

An avoidance motivated individual is commonly described as risk averse (Elliot, 2006), detail oriented with a narrow attention scope (Mikulincer, Kedem, & Paz, 1990; Maier, Elliot, & Lichtenfeld, 2008), and inflexible when processing information (Roskes, De Dreu, & Nijstad, 2012). Moreover, such individuals are more reliant on the availability of cognitive resources when being creative, compared to approach motivated individuals (Roskes, 2015). Roskes (2015) therefore suggests that it is helpful for avoidance motivated individuals to have structure and clear goals in order to be creative.

In a review on how feedback affects creativity, Zhou (1998) writes that feedback may be beneficial when it is focused on the task and provides additional information that is helpful to the inventor. As avoidance motivated individuals often are in need of additional cognitive resources to be creative, and channeling constraints may offer just this, we believe such constraints will help these individuals in their creative efforts. We therefore propose that channeling constraints which provides clarity by defining a specific goal such as a budget frame and reduces ambiguity by providing additional cognitive resources for the inventor to work with, such as a specific target audience, should improve creativity for avoidance motivated individuals. As a result, we propose the following hypothesis:

Hypothesis 4a: Avoidance motivation is positively moderating a) mean appropriateness, b) mean novelty, c) extreme value appropriateness and d) extreme value novelty, in channeling constrained treatments.

Approach motivation may affect creativity differently compared to avoidance motivation. Approach motivated individuals are commonly described as explorative and risk taking (Friedman & Forster, 2002), flexible in the way they process information (Friedman & Forster, 2005; Roskes, De Dreu, & Nijstad, 2012), and relatively little dependent on the availability of cognitive resources when solving creative problems (Roskes, 2015). Given this open, explorative and unstructured approach to creativity, Roskes (2015) suggests that channeling constraints, which structure and restrict the inventor from a free and autonomous process, may damage or at least have a zero effect to the creative outcome for approach motivated individuals. Such individuals are highly flexible in their cognitive processing and channeling constraints may therefore restrict the individual from his or her preferred flexibility. We therefore propose that channeling constraints such as a budget frame and a specific target group, may negatively affect the creative outcome of approach motivated individuals. This is because these constraints are experienced to deprive instead of challenge the inventor's flexible and explorative cognitive processes. This gives us the following hypothesis:

*Hypothesis 4b: Approach motivation is negatively moderating **a**) mean appropriateness, **b**) mean novelty, **c**) extreme value appropriateness and **d**) extreme value novelty, in channeling constrained treatments.*

3. Research Design and Methodology

In the following chapter, we will present and describe our research method and design. As our research question seek to study how financial and task structure constraints in ideation processes affect individuals' creative thinking differently, our thesis attempts to find a causal connection. We make use of a causal research design, meaning that we aim to isolate and explain different causes, and their effects on the appropriateness and novelty dimensions of creativity. We will further investigate the moderating effects of avoidance and approach motivation (Roskes, 2015). When conducting the research design, one can separate between a deductive and an inductive research orientation. The former being that one draws conclusions from logical reasoning based on cause and effect relationships from quantitative data, the latter being that one that seek to explore new discoveries and/or theories from observations or qualitative data (Ghauri & Grønhaug, 2010). A causal research design, like the one we make use of, implies a deductive research orientation. We are anchoring our hypotheses in existing literature and thereafter testing them based on quantitative data. We start by presenting our data collection, before going into detail about our experiment, procedures and measurements. Lastly, we will conduct different methods used to measure validity, reliability and to test assumption.

3.1 Data Collection

As the framework of Roskes (2015) is fairly little examined, we will conduct the data collection by gathering primary data through an experiment, testing for structural relationships. Our web-based experiment took place through Qualtrics, which is the standard platform for surveys at NHH. We aim to study the relationship between constraints and creativity thorough four test groups. Conducting an online experiment facilitates the data collection process as it is more convenient for the respondent, increasing the possibility of a large sample. Moreover, the experimental environment is fairly controlled making it is easier to manipulate what we intend to manipulate. We did not want to conduct a classical field experiment, as it is more difficult to keep factors constant, and because it is normally conducted over a longer time period. In section 3.2 we will further describe the methods used in the data collection.

3.2 Experiment

3.2.1 Design

Our hypotheses are tested on three different treatment groups, and one control group. Therefore, our experiment need four test groups, resulting in a two by two metric. Our test design is as following: (1) a financial constrained treatment group, (2) a task structure constrained treatment group, (3) financial and task structure constrained treatment group, and (4) a control group with no constraints.

Respondents in the financial constrained treatment group will be presented with a case assignment reflecting a financial constrained scenario, while respondents in the task structure constrained treatment group will be presented with a case assignment reflecting a task structure constrained scenario. The respondents in the financial and task structure constrained treatment group will be presented with both the financial and task structure constrained scenarios simultaneously. The control group will be presented with a case assignment reflecting the underlying problem statement of the already mentioned scenarios, with no constraints. The only difference between our test groups is therefore the treatments. The scenarios for all case assignments may be read in its full in B.2 in Appendix B.

We have chosen a between-subject design, as this experimental design is suitable to identify and measure both direct and indirect effects of stimuli given in a controlled environment. Moreover, the reason for choosing a between-subject design over a within-subject design is to avoid order effects. We do also reduce the chance for non-response error, as within-subject design probably could have caused respondent fatigue. Moreover, we believe it could have been difficult to motivate full-time employees to devote multiple hours to our experiment. However, there could have been benefits from using a within-subject design as we could easily have controlled for individual differences, such as intelligence. This could have strengthened our study as one can discuss that our sample is not the most homogenous, since we have recruited both full-time employees and students (Breivik, 2017). The sampling procedures will be further discussed in the next section.

Sample

An important goal of an experiment is to describe characteristics in the population, and it is therefore important to be able to generalize from the sample to the target population (Breivik, 2017). To obtain this goal, the respondents in our experiment should reflect the chosen target population of the Norwegian business sector. As a result, employees working within Norwegian companies focusing on innovation became our sampling frame. Given limited time, we decided on a convenience sample approach, which will be further discussed in sub-section 3.3.2.

Our final sample consisted of multiple CEOs, CFOs, middle managers, project managers, consultants and other employees. The respondents worked in companies such as Orkla, DNB, DNVGL, Posten and Bring, Schibsted, Sparebank1 Gruppen, Statkraft, Aschehoug, Intility, EY, Deloitte and Quartz. To secure a large enough sample size, we also recruited some master students from different business schools in Norway.

Since our research design consisted of one control group and three treatment groups, and Ghauri & Grønhaug (2010) suggests a minimum of 30 participants in each group, we aimed at a total of 120 respondents. Our total sample size was 136 respondents, with 34 respondents in the control group, 33 respondents each in the financial constrained treatment group and the task structure constrained treatment group, and 34 respondents in the financial and task structure constrained treatment group as illustrated in Table C.3 in Appendix C. Two participants were omitted from the sample due to unserious ideas. With a total sample size of 134 respondents, and with the use of randomization, as discussed further in sub-section 3.3.3, we believe the potential problems with the between-subject design should be minimal (Breivik, 2017).

Developing the Experimental Cases

In the progress of developing the experimental cases, we decided to use a fictitious case from the Norwegian fish farming industry. The case assignments were based on a medium sized Norwegian fish farming company facing recession as its costs were steadily increasing, while its revenues were expected to drop in near future. The respondents were told that they were working in the company's innovation team. Further, they were told that the board of directors had asked them to present a list of potential actions that could be initiated to get the company back on track.

In the control group, no more additional information was presented. In the financial constrained treatment group, an idea could cost the company no more than NOK 5 million. In the task structure constrained treatment group, all ideas had to focus on increasing sales within the target group of Norwegians, age 18-25. In the financial and task structure constrained treatment group, all ideas had to focus on increasing sales in the target group of Norwegians, age 18-25, and no idea could cost the firm more than NOK 5 million. By having the identical underlying problem in all case assignments, we aim to increase the likeliness of an experimental design where we can investigate isolated effects on our dependent variables being the appropriateness and novelty of ideas.

We chose the Norwegian fish farming industry because we consider employees within Norwegian businesses to know the sector, as it is one of our largest industries and regularly discussed in the media. Moreover, we could say that the fishing industry is an important part of the Norwegian heritage, and we therefore assumed our cases to be of interest for our target population.

Developing the Experimental Questionnaire

In addition to the idea generation experiment, we made use of an experimental questionnaire, as part of our post-study. This was mainly done to check for potential moderating effects, and to control for certain variables in the analyses. The details around the moderating and control variables will be further discussed in section 3.4.

As small differences in the response format can produce significant effects on the responses collected (Breivik, Questionnaire Design, 2017) we were careful and precise when developing the experimental questionnaire. The post-study consisted of two parts. First, the respondents were to answer some questions about their background, such as age, gender and occupation. Further, they completed a set of statements that aimed to measure their self-reported level of approach, avoidance and intrinsic motivation. We also asked a question with regard to their pre-knowledge to the Norwegian fish farming industry, to control for domain-relevant knowledge. An overview of the questions asked in the questionnaire is presented in Table B.3.

We made use of seven-point Likert scales from “Strongly disagree” (1) to “Strongly agree” (7) throughout the questionnaire. The respondent could also answer “Neither agree nor disagree” (3) as a neutral reference point. All the questions in the questionnaire were inspired or directly taken from validated tests such as Carver and White ’s (2013) BIS/BAS scale, McCrae and Costa’s (2005) NEO Five-Factor Inventory and The Temperament and Character Inventory (Cloninger, Przybeck, M., & Wetzell, 1994).

3.3 Procedure

3.3.1 Pre-test

We conducted pre-tests and manipulation checks on a selected test group to ensure that the experiment was evident to our respondents, and to confirm that we manipulated what we were supposed to manipulate. Manipulation checks were conducted by asking the respondents in the test groups to answer if the financial and/or task structure constraint gave them specific boundaries that would affect their search space. The questions asked gave us a prediction of whether the ideas generated under the constrained treatment groups were consequences of the manipulations (Breivik, Experiments, 2017).

The test group consisted of a selection of business people, that each completed the experiment once. The respondents were divided into one control group and three treatment groups and gave us a good fundament for comparison. The financial constrained treatment group was assigned a case with a budget frame of NOK 1 million, the task structure constrained treatment group was assigned with a with a target group consisting of Norwegians, age 18-25, and the financial and task structure constrained treatment group was assigned both constraints. The control group was free from constraints.

We observed that the budget constraint of NOK 1 million figured as unrealistically low to many of the respondents in the test group. As we were told by one respondent:

If their operating revenues are NOK 400 million and their margin 20 % (NOK 50 - NOK 40), the budget for resolving this potentially catastrophic situation, is 1/80 of their operating margin.

Taking this statement into consideration, we increased the budget frame to NOK 5 million. We decided on this amount, as we felt a budget above this point could be experienced as too autonomous, hence reducing the effect of the independent variable. We conducted a new pre-testing session with the budget constraint of NOK 5 million and observed an absence of the previous concern. The constraint was still limiting.

In addition to examining the constraints on the test group, we presented the same test sample with our experimental questionnaire to check whether the questions were understandable. We also controlled whether the total test length, being the ideation case and the questionnaire, was experienced as too long. All questions were rated as clearly understandable, and the total test length reported as fitting for the experiment. Given our pre-testing, we believe that the non-response error will not be a significant problem.

In order to prevent that the validity of the experiment was contaminated by pre-experimental knowledge, and thus avoid any testing threat, we excluded those who participated in the pre-testing, from the actual experiment. Testing threat only occurs in pre-tests and can affect how participants solve the case. Another threat, only existing in the pre-test design, is the instrumentation threat (Breivik, Experiments, 2017). To avoid this, we made use of the same design for all participants in the second round of the pre-testing, and in the actual experiment. To eliminate any technical errors, we ran the ideation experiment numerous of times in the pre-testing phase before launching it to our respondents in the sample group.

3.3.2 Recruitment

In order to recruit 120 employees within the Norwegian business sector in a limited amount of time we decided to use a convenience sample approach, meaning that our sample “do not rely on an equal or known probability of picking a population element from a sampling frame” (Breivik, Survey Design and Sampling, 2017). In order to reach out to our potential respondents we established dialog with companies that matched our criteria, mostly through our personal network by the use of e-mail, telephone and Facebook.

In addition to wanting respondents working in the Norwegian business sector focusing on innovative problem solving, we wanted to include employees working across different industries and sectors. This to increase the variance in our data set, hoping to study possible relationships with greater precision. We therefore reached out to companies like Orkla, DNB, Posten & Bring and Schibsted to name a few.

Given the anonymity of our experiment we did not ask questions that directly disclosed the identity of our respondents. Given email, Facebook and telephone confirmations we do know that we have respondents varying from CEOs and CFOs to “juniors” in our data set.

After contacting potential respondents, we invited them to an event on Facebook where they could make a final decision on whether they wanted to participate. They were further encouraged to invite other colleges or associates, fitting with our sample frame. The Facebook group was established weeks before the actual experiment took place. In addition, we called and e-mailed managers within a selection of Norwegian businesses. This figured as a convenient way to collect numerous responses over a short time period. However, a possible limitation of conducting a convenience sample approach, is that the respondents are self-selected, which in theory indicate problems with generalizing to the target population. Nevertheless, as we recruited employees at innovative, Norwegian firms, we were confident that the respondents in our final sample was representative of the target population. This will be further discussed when examining the validity and reliability of our thesis in section 5.4. A summary of our participants is presented in Table 2.

Table 2: The Sample Population

		Frequency	Percent
Number of respondents		N = 134	N = 134
Gender	Female	59	44,0
	Male	75	56,0
Occupation	Student	33	24,6
	Full-time employee	101	75,4
Job Title	Student	33	24,6
	Associate	35	26,1
	Manager	24	17,9
	Director	21	15,7
	Chief Financial Officer	5	3,7
	Chief Executive Officer	9	6,7
	Other	7	5,2
Industry	FMCG	9	6,7
	Sales	10	7,5
	Service & Recruitment	9	6,7
	Insurance	3	2,2
	Health	4	3,0
	Consultant	9	6,7
	Finance	28	20,9
	Real Estate	3	2,2
	Energy	12	9,0
	IKT & Telecommunication	9	6,7
	Other	5	3,7
	Student	33	24,6

From Table 2, we observe that 26 % of the respondents are associates, while 33,6 % said they were with a manager or director in the firm. In addition, our sample consisted of CFOs and CEOs. A few also answered that they had another title in the firm, labeled as “Other”.

Given our recruitment process it is likely that we could experience coverage error. As we made use of Facebook as a channel for recruitment, we risk losing fitted respondents that either do not have an account on this platform or rarely use it. This is an example of potential under-coverage (Breivik, Survey Design and Sampling, 2017). We aimed to reduce this threat, by also making use of e-mail, telephone and direct company contact.

3.3.3 Randomization and Anonymization

Randomizing the participants shall in theory eliminate any difference between the control group and the three treatment groups. This is the case for both observable and unobservable differences. With this said, the only difference between our control group and treatment groups is the level of the different constraints given. Moreover, we attempt to attempt to find a causal effect, not only correlations as discussed in sub-section 4.1.2. In order to ensure randomization in our experiment, we made use of the “Randomizer”-function in Qualtrics. This allowed us to evenly distribute respondents between the control group and the treatment groups. As every respondent could take the experiment once, we had good control over the participant distribution among the treatment groups at all times. Moreover, we informed our participants that their attendance would be anonymous, and we never asked for any direct privacy information. Our purpose with the collection of background information, as discussed in sub-section 3.2.1, was to be able to use them as control variables in our data analysis.

3.3.4 Briefing and Debriefing

The briefing took place through the Facebook event and/or by e-mail, depending on where we first established contact. The information in the briefing was the same for the control group and the three treatment groups as shown in B.1 Instructions, in Appendix B. In line with the research study of Girotra et al. (2010), we did not offer any financial incentives, as such extrinsic incentives are known to limit creative behavior (Amabile, 1996). Before being presented with the case assignments, the respondents had to give their consent as shown in A.2 Consent Form, in Appendix A.

When developing the briefing session, we took a conscious decision not to present a too detailed description of the true purpose of our experiment. When O'Hara and Sternberg (2001) investigated the effect of clear experimental instructions on creativity in laboratory experiments, they found that when the respondents were well informed about what the researchers really are probing for, and for instance were presented with "ideal responses" as part of the experiment briefing, the creativity scores increased. As we aim to measure the effect of constraints on creativity, and not the effect of experimental instructions, we decided to keep the experiment briefing fairly open. We did however, ask the respondents to generate as many ideas as possible.

Given the questionnaire, there was no specific briefing related to how the respondents were supposed to answer. The design of the experimental questionnaire was found to be highly intuitive in our pre-test. We did not conduct any debrief other than thanking the respondents for taking part in our experiment.

3.4 Measurements

In the following section, we will define and present the different measurements used in our research design. We will start out by describing our dependent variables and how they are measured, before presenting our moderating, mediating and control variables.

3.4.1 Dependent Variables

To analyze the creativity of the ideas generated in our experiment, we need to measure its underlying creativity dimensions. This is done by measuring for appropriateness and novelty, in accordance with previous creativity studies (Amabile, 1988, 1996; Dahl & Moreau, 2005; Busacca, Cillo, Mazursky, & Scopelliti, 2013).

A common way to measure appropriateness and novelty in the literature is by the use of a seven-point Likert scale, where "1" equals the lowest value, the score of "3" is a neutral reference point and "7" is the highest value possible value (Amabile, 1996; Dahl & Moreau, 2005; Busacca, Cillo, Mazursky, & Scopelliti, 2013). Moreover, when deciding on the method for measuring appropriateness and novelty, we followed the standard procedure in the literature, asking an expert panel of two business developers to rate all the collected ideas in our data set.

This was done in line with studies by Dahl and Moreau (2005), Girotra et al. (2010) and Busacca et al. (2013). Following Dahl and Moreau (2005), the expert panel measured novelty based on “*Not at all new/Very new*” and “*Not at all original/Very original*”. Given appropriateness we extended the design of Dahl and Moreau (2005) having the experts measure based on: “*Very difficult to realize/Not at all difficult to realize*”, “*Not at all realistic/Very realistic*”, “*Not at all suitable to solve the problem/Very suitable to solve the problem*” and “*Not at all relevant/Very relevant*”.

In accordance with research from Goldenberg et al. (1999), our two expert judges from Bergen Technology Transfer (BTO), were blind to the identity of the respondents and the exact purpose of our experiment. They were only presented with the case assignments and thereafter asked to evaluate the ideas based on the already discussed creativity criteria. As our judges were colleagues they were not blind to each other. They were therefore asked to conduct the work individually without discussing the process with each other, or anyone else at BTO. Thus, we do not see this as a considerable problem for further analyzes.

3.4.2 Moderating Variables

The questionnaire answered by the respondents was used to investigate possible moderating effects, checking for approach and avoidance motivation. These personality traits are claimed by Roskes (2015) to have moderating effects on the creative outcome, as discussed in sub-section 2.3.1.

It is important to state that we are aware of the complexity connected to personality trait measurements in general (Elliot & Thrash, 2002, Carver & White, 1994; Costa & McCrae, 1992). From the statistical research literature, we know that too extensive experiments often lead to respondent fatigue and increase the likelihood of non-response error (Breivik, Survey Design and Sampling, 2017). We therefore chose to use a small subset of questions to measure approach and avoidance motivation in our experimental questionnaire. We will now elaborate on the questions asked to our respondents, related to each of our moderators.

Approach Motivation

The moderator was measured based on three questions. We asked one extraversion question being *“I usually prefer to do things alone”*, one behavioral activation question being *“When I want something I usually go all-out to get it”* and one last questions being *“I am always on the lookout for positive experiences and opportunities”*. The extraversion question was flipped.

All questions were answered based on a seven-point Likert scale, from “strongly disagree” (1) to “strongly agree” (7). For the flipped questions, we made a new variable where all the scores were subtracted from a number one higher than the maximum number on the Likert scale (Grace-Martin, 2018). The approach motivation questions were chosen from sources such as Carver and White ’s (2013) BIS/BAS scale and McCrae & Costa’s (2005) NEO Five-Factor Inventory.

Avoidance Motivation

The second moderator was measured based on one neuroticism question being *“Too often, when things go wrong, I get discouraged and feel like giving up“*, one anticipatory worry question being *“It is easy for me to expect that negative outcomes will happen to me”* and one behavioral inhibition question being *“I worry about making mistakes”*.

All questions were answered based on a seven-point Likert scale, from “strongly disagree” (1) to “strongly agree” (7). The questions were picked from McCrae and Costa’s (2005) NEO Five-Factor Inventory, Wilson et al. (2011) publication on harm avoidance and Carver and White’s (2013) BIS/BAS scale.

3.4.3 Control Variables

We also measured a number of control variables to use in our analyses. The variables of age, gender and occupation was used to check for randomization between the control group and the three treatment groups. This will be further explained in sub-section 3.5.1 and is therefore only explained briefly in this section. In our analyses, we also controlled for domain-relevant skills. By controlling for variables which are not the main focus of our study we may actually be better suited to establish the relationships we are focusing on (Breivik, Experiments, 2017).

Age

As we ensured full anonymity, discussed in sub-section 3.3.4, we did not ask the respondents for their exact age, however this was measured by the use of the following categories: “20-29”, “30-39”, “40-49”, “50-59” and “Over 60”. An overview of the frequency of age is stated in Table C.1 in Appendix C.

Gender

We asked the respondents to report their gender being male, female or if the respondent considered themselves as none of the above. An overview of the frequency of gender is stated in Table C.2 in Appendix C.

Occupation

We measured occupation by first asking whether the respondents first and foremost considered themselves as a student or full-time employees. Based on their answer they would have to specify with study direction, or industry of business and job title. These questions, being part of the experimental questionnaire, could be reviewed in B.3 Experimental Questionnaire in Appendix B. An overview of the frequency of gender is stated in Table C.4 in Appendix C. We are pleased to see that 75% of our sample group considering themselves as full-time workers

Domain-Relevant Skills

As stated in Amabile’s (1997) componential model of creativity, domain-relevant skills are defined as expert knowledge within the industry of ideation, being one of three main factors for creative thinking. We will therefore control for this variable in order to see whether the observed relationships hold when we adjust for the respondents’ specific in-depth knowledge of the Norwegian fish farming industry. To measure the respondent’s domain-relevant skills, we asked the following question: “*I have in-depth knowledge of the Norwegian fish farming industry*”.

3.5 Methods used to Measure Validity and Reliability

In the following section, we will check for randomization, and measure the validity and reliability of our data set. The methods used are randomization, one-way ANOVA, factor analysis and scale reliability check. To conduct the different tests, we made use of the IBM SPSS Statistical Software, a platform used in statistical analysis.

3.5.1 Randomization

By asking the participants about their age, gender and occupation, we can statistically check for randomization across these variables between the control group and the treatment groups. This was done by conducting a one-way ANOVA analysis with the following results:

		Sum of Squares	df	Mean Square	F	Sig.
Age	Between Groups	2.076	3	.692	.319	.812
	Within Groups	281.962	130	2.169		
	Total	284.037	133			
Gender	Between Groups	.708	3	.236	.949	.419
	Within Groups	32.315	130	.249		
	Total	33.022	133			
Occupation	Between Groups	.017	3	.006	.029	.993
	Within Groups	24.857	130	.191		
	Total	24.873	133			

Table 3: Randomization

When testing the three control variables in a variance analysis, the results showed that the p-value of age was .81, .42 for gender, and for occupation .99. The three p-values, all above 5 percent, indicated no significant differences between our test groups. We can therefore conclude that we have achieved within-group randomization.

3.5.2 Factor Analysis

To analyze the validity of our collected questionnaire data, we measured the participants level of approach, avoidance and intrinsic motivation, in addition to their domain-relevant knowledge. This was done by conducting the Kaiser-Meyer-Olkin Measure of Sampling Adequacy and Bartlett's Test of Sphericity to ensure that the factor analysis was an appropriate method to analysis our data.

The Kaiser-Meyer-Olkin Measure & The Bartlett's Test of Sphericity

The value for the Kaiser-Meyer-Olkin (KMO) differ from “0” to “1”. The closer to “1”, the more suitable a factor analysis is as a method for data evaluation (IBM, 2018). Any value above .60 is acceptable for further testing. From Table D.1 in Appendix D we can see that the KMO value in our experiment was .72. Thus, we did not need to conduct an anti-image test for each individual variable. The value of the Bartlett’s Test of Sphericity should be lower than .05 as this indicates that factor analysis may be a useful method (IBM, 2018). In our experiment, the value was .00 as seen in Table D.1.

The Rotated Component Matrix

The results from the Total Variance Explained, resulted in four factors with an Eigenvalue greater than 1, shown in Table D.2, and illustrated in Table D.3 in Appendix D. Following this result, we conducted the factor analysis with varimax rotation, an orthogonal rotation method that tends to produce factor loadings that makes it easier to match each item with a single factor (Hair, 2006). We considered any factor loadings between .40 - .50 as medium strong, and greater than .60 as strong. Any factor loadings below .30 were suppressed. As seen from the results in Table D.4, approach, avoidance and intrinsic motivation and domain-relevant skills were extracted.

3.5.3 Scale Reliability Check

When conducting the scale reliability check, we study the value of the Cronbach’s alpha (α). This value can be considered in the following categories: $\alpha \geq .90$ as excellent, $.70 \leq \alpha < .90$ as good, $.60 \leq \alpha < .70$ as acceptable, $.50 \leq \alpha < .60$ as questionable and an $\alpha < .50$ is seen as unacceptable (Pallant, 2010). The results from Table D.5, Table D.6 and Table D.7, in Appendix D, show approach motivation with an (α of .62.) and avoidance motivation with an (α of .79), and intrinsic motivation with an (α of .81.). To sum up, all of the values of the Cronbach’s alpha scored above .60 and are seen as acceptable for further analyses. As we only used one question to measure for domain-relevant skills, as stated in 3.4.4, we did test its Cronbach’s alpha. Moreover, we did not consider this as problematic, as this is only used as a control variable in our study. Another reflection from the scale reliability check is the fact that we achieved a strong value of .82 for intrinsic motivation. However, we will not examine this mediating variable in our main analysis as intrinsic motivation within the creativity field has been widely examined by previous studies, presented in chapter 2.

3.6 Computing the Index Variables

In the following section, we will describe and discuss how we computed our index variables used to test our hypotheses in chapter 4. We begin by presenting a brief résumé of the idea ratings gathered from our expert panel, as seen in Table 4. Thereafter, we will present our dependent index variables, appropriateness and novelty, for both mean and extreme values. Further, we present our moderating variables, approach and avoidance motivation, before presenting our mediating variable, intrinsic motivation. Intrinsic motivation is not part of our hypotheses but tested for, as it may potentially mediate the relationship between constraints and creativity.

Table 4: Creativity Scores from Experts and Indexes

	N	Minimum	Maximum	Mean	Std. Deviation
Appropriateness expert 1	134	1.00	6.50	3.8323	.84468
Appropriateness expert 2	134	1.00	7.00	5.3249	.88272
Index Appropriateness	134	1.75	6.38	4.5695	.69470
Novelty expert 1	134	1.00	5.00	2.2806	.80680
Novelty expert 2	134	1.00	6.61	3.7364	1.08460
Index Novelty	134	1.00	5.25	2.9788	.74199
Valid N (listwise)	134				

3.6.1 Dependent Variables: Mean Appropriateness and Mean Novelty

Before initiating the hypotheses testing, we checked whether our expert panel agreed on their creativity ratings. In accordance with similar creativity studies, this was done by testing if the expert's individual creativity ratings were significantly correlated (Moreau & Dahl, 2005; Busacca, Cillo, Mazursky, & Scopelliti, 2013). The correlation results are presented in Table 5 and Table 6.

Table 5: Correlation Table for Mean Appropriateness

		Appropriateness Expert 1	Appropriateness Expert 2
Appropriateness Expert 1	Pearson Correlation	1	.341**
	Sig. (2-tailed)		.000
	N	134	134
Appropriateness Expert 2	Pearson Correlation	.341**	1
	Sig. (2-tailed)	.000	
	N	134	134

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

Table 6: Correlation Table for Mean Novelty

		Novelty Expert 1	Novelty Expert 2
Novelty Expert 1	Pearson Correlation	1	.292**
	Sig. (2-tailed)		.001
	N	134	134
Novelty Expert 2	Pearson Correlation	.292**	1
	Sig. (2-tailed)	.001	
	N	134	134

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

As the correlations between our judges were significant for both appropriateness ($p = .34$) and novelty ($p = .29$), we can confirm that our judges agreed on the creativity of the ideas at a satisfactory level (Moreau & Dahl, 2005). We do however acknowledge that the correlation coefficients are on the lower to medium end of the scale. Following these significant results, we created the mean appropriateness and mean novelty indexes by averaging the idea scores of our independent judges. As we focus on isolating the effect of appropriateness and novelty, in line with similar creativity studies (Moreau & Dahl, 2005; Busacca, Cillo, Mazursky, & Scopelliti, 2013), we did not compute an aggregated creativity index by summing the appropriate and novelty indexes. The reason being that creativity is not a simple linear function of appropriateness and novelty (Moreau & Dahl, 2005).

3.6.2 Dependent Variables for the Extreme Value Appropriateness and Extreme Value Novelty

To measure extreme values, we followed the same procedure as Girotra et al. (2010). We decided to follow their computing method as they also analyzed the quality of the best generated ideas in an ideation experiment. To measure extreme value scores, we therefore grouped the five highest evaluated ideas for appropriateness and novelty into two separate indexes. We could do this as the experts' ratings correlated significantly, seen in Table 7 and Table 8 below. The indexes were computed in the same way as for the average index, presented in sub-section 3.6.1. Moreover, we did not create indexes for the bottom end, meaning the lowest rated ideas, as we were interested in measuring and testing for the best generated ideas.

Table 7: Correlation Table for Extreme Value Appropriateness

		Appropriateness Expert 1	Appropriateness Expert 2
Appropriateness Expert 1	Pearson Correlation	1	.482*
	Sig. (2-tailed)		.032
	N	20	20
Appropriateness Expert 2	Pearson Correlation	.482*	1
	Sig. (2-tailed)	.032	
	N	20	20

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

Table 8: Correlation Table for Extreme Value Novelty

		Novelty Expert 1	Novelty Expert 2
Novelty Expert 1	Pearson Correlation	1	.628**
	Sig. (2-tailed)		.003
	N	20	20
Novelty Expert 2	Pearson Correlation	.628**	1
	Sig. (2-tailed)	.003	
	N	20	20

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

3.6.3 Moderator Variables: Approach and Avoidance Motivation

As discussed earlier in sub-section 3.5.3 and presented in Table D.5 and Table D.6, in Appendix D, approach and avoidance motivation had Cronbach's alphas of respectively .62 and .79, indicating a good correlation. We therefore averaged the underlying scores of the moderators in order to assign each personality trait with its own index. In Table 9 and Table 10 the results of the correlation between the questions depicting approach and avoidance motivation are presented. As seen from the tables, the questions for each personality trait correlated significantly, further substantiating the significant Cronbach's alphas and our choice to compute indexes.

Table 9: Correlation Table for Approach Motivation

		When I want something I usually go all-out to get it	I am always on the lookout for positive experiences and opportunities	I usually prefer to do things alone
When I want something I usually go all-out to get it	Pearson Correlation	1	.564**	.219*
	Sig. (2-tailed)		.000	.011
	N	134	134	134
I am always on the lookout for positive experiences and opportunities	Pearson Correlation	.564**	1	.304**
	Sig. (2-tailed)	.000		.000
	N	134	134	134
I usually prefer to do things alone	Pearson Correlation	.219*	.304**	1
	Sig. (2-tailed)	.011	.000	
	N	134	134	134

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

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

Table 10: Correlation Table for Avoidance Motivation

		It is easy for me to expect that negative outcomes will happen to me	Too often, when things go wrong, I get discouraged and feel like giving up	I worry about making mistakes
It is easy for me to expect that negative outcomes will happen to me	Pearson Correlation	1	.515**	.580**
	Sig. (2-tailed)		.000	.000
	N	134	134	134
Too often, when things go wrong, I get discouraged and feel like giving up	Pearson Correlation	.515**	1	.605**
	Sig. (2-tailed)	.000		.000
	N	134	134	134
I worry about making mistakes	Pearson Correlation	.580**	.605**	1
	Sig. (2-tailed)	.000	.000	
	N	134	134	134

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

3.6.4 Mediation Variable: Intrinsic Motivation

As discussed earlier in sub-section 3.5.3, and presented in Table D.7, in Appendix D, intrinsic motivation had Cronbach's alpha of respectively .81, indicating a good correlation. Moreover, the five questions depicting intrinsic motivation significantly correlated, as seen in Table 11. Following these results, we computed an intrinsic motivation index following the same procedure as previous index computations explained in this section.

Table 11: Correlation Table for Intrinsic Motivation

		I enjoy creative thinking and idea development	I spend a lot of my spare time on innovative work	On a daily basis, I work with or study at a place with innovative tasks	I enjoyed working with this task	It was natural for me to work with this task
I enjoy creative thinking and idea development	Pearson Correlation	1	.360**	.398**	.393**	.439**
	Sig. (2-tailed)		.000	.000	.000	.000
	N	134	134	134	134	134
I spend a lot of my spare time on innovative work	Pearson Correlation	.360**	1	.612**	.319**	.388**
	Sig. (2-tailed)	.000		.000	.000	.000
	N	134	134	134	134	134
On a daily basis, I work with or study at a place with innovative tasks	Pearson Correlation	.398**	.612**	1	.427**	.530**
	Sig. (2-tailed)	.000	.000		.000	.000
	N	134	134	134	134	134
I enjoyed working with this task	Pearson Correlation	.393**	.319**	.427**	1	.708**
	Sig. (2-tailed)	.000	.000	.000		.000
	N	134	134	134	134	134
It was natural for me to work with this task	Pearson Correlation	.439**	.388**	.530**	.708**	1
	Sig. (2-tailed)	.000	.000	.000	.000	
	N	134	134	134	134	134

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

3.7 Test of Assumptions

To run our analyses in chapter 4, there are several assumptions that needs to be met. These assumptions are independent observations, a normal distributed sample and homogeneity of variance (Hair, 2006; Pallant 2010).

3.7.1 The Independence of Observations

The assumption of the independence of observations states that we are in need of data that are not influenced by each other. We tested for randomization across age, gender and occupation in sub-section 3.5.1 and conclude that the assumption of independent observations is met.

3.7.2 The Normality of Distribution

We tested for normal distribution by checking the skewness and kurtosis values as a part of the descriptive statistics. Values between -1 and 1 indicate that the data collection is normally distributed (Pallant, 2010). In order to tell whether data is clustered to either side of the distribution, we study the value of the skewness. The results from our testing shows a value for approach motivation of -.94, .32 for avoidance motivation, and -.48 for intrinsic motivation. The negative skewness value indicates clustered data at low levels. Even though the score for avoidance motivation was positive, indicating clustering of data, we recall that values between -1 and 1 are seen as normal distribution. The positive kurtosis value indicates a peaked distribution. The results of our testing showed that the values of the indexes were .49 for approach motivation, -.64 for avoidance motivation and .49 for intrinsic motivation. All values are within the interval of -1 and 1. The results are presented in Table E.1, in Appendix E, and confirm that the assumption of normal distribution is satisfied.

3.7.3 The Homogeneity of Variance

To test for the homogeneity of variance, we conducted the Levene's Test. Any p-value above .05 indicates that the variance of the groups is equal, and that the assumption is satisfied (Pallant, 2010). As presented in Table E.2, in Appendix E, approach motivation has a score of .10, .85 for avoidance motivation and .74 for intrinsic motivation. These scores indicate that there is homogeneity of variance in all of our indexes. We confirm that the assumption of homogeneity of variance is satisfied.

4. Analyses and Results

In the following chapter, we will present a more in-depth table of our index variables presented in section 3.6, before we test our eight hypotheses. The chapter ends with a brief presentation of additional findings, consisting of results that were not directly tested against our hypotheses.

To test for significant differences in appropriateness, novelty and extreme values we have conducted a series of one-way analyses of variance (ANOVA) in line with previous studies on bounded and extreme value creativity (Moreau & Dahl, 2005; Girotra, Terwiesch, & Ulrich, 2010; Busacca, Cillo, Mazursky, & Scopelliti, 2013). To test for moderating effects, we conducted a series of multivariate linear regressions with interaction effects, in line with previous studies on moderating effects (Dards & Ahmad, 2013).

4.1 Results: Test of Hypotheses

In the following section, we will present the final data used in our analyses, before testing our eight hypotheses and presenting their respective test results.

4.1.1 Final Index Data for Analyses

In Table 12 the final data of our average value indexes used to test our hypotheses, are presented across our control group and treatment groups. In Table 13, the descriptive statistics of the final data for the extreme value indexes are presented. All index variables have been previously described in section 3.6.

Table 12: Descriptive Statistics of Final Data Average Values for Main Analyzes

Group	Control Group				Financial Constrained Treatment Group				Task Structure Constrained Treatment Group				Financial- and Task Structure Constrained Treatment Group			
Dependent variable	N = 34				N = 33				N = 33				N = 34			
Appropriateness	Mean	St. d.	Min	Max	Mean	St. d.	Min	Max	Mean	St. d.	Min	Max	Mean	St. d.	Min	Max
	4,37	0,92	1,75	6,38	4,60	0,66	3,48	6,00	4,71	0,71	2,50	5,81	4,60	0,36	3,63	5,38
Novelty	Mean	St. d.	Min	Max	Mean	St. d.	Min	Max	Mean	St. d.	Min	Max	Mean	St. d.	Min	Max
	2,78	0,82	1,50	4,22	2,74	0,68	1,42	4,17	3,16	0,80	1,00	6,08	3,23	0,53	2,00	4,50

Table 13: Descriptive Statistics of Final Data Extreme Values for Main Analyzes

Group	Control Group				Financial Constrained Treatment Group				Task Structure Constrained Treatment Group				Financial- and Task Structure Constrained Treatment Group			
Dependent variables	N = 5				N = 5				N = 5				N = 5			
	Mean	St. d.	Min	Max	Mean	St. d.	Min	Max	Mean	St. d.	Min	Max	Mean	St. d.	Min	Max
Appropriateness	6,23	0,10	6,13	6,38	6,16	0,21	6,00	6,50	5,90	0,06	5,88	6,00	5,75	0,36	5,50	6,38
Novelty	5,00	0,54	5,25	6,50	4,75	0,31	4,50	5,25	5,55	0,62	4,75	6,50	4,95	0,33	4,75	5,50

4.1.2 Hypotheses Testing

In the following section, we will test our eight hypotheses presented in section 2.5. All analyses are based on a 95 % confidence interval, meaning that hypotheses will be rejected when the p-value is below .05. It is important to state that although we do not find significant results, and therefore rejecting some hypotheses. This does not necessarily mean that there is no effect in the population. This only means that it is not sufficient evidence in our data set to conclude that there is an effect in the population. Moreover, all analyses are controlled for domain-relevant knowledge, as this is defined as an important criterion for individual creativity (Amabile, 1983; 1988). Before presenting our analyses and results, we will restate each hypothesis.

Testing Hypothesis 1

The mean appropriateness score and the mean novelty score will be negatively affected by a) a financial constraint, b) a task structure constraint, and c) a financial and task structure constraint.

We started by testing whether there were any differences in the mean index scores of our dependent variables appropriateness and novelty, between the four test groups. In line with statistical experiment theory (Breivik, Experiments, 2017) and similar creativity studies (Moreau & Dahl, 2005; Girotra, Terwiesch, & Ulrich, 2010; Busacca, Cillo, Mazursky, & Scopelliti, 2013) these tests were done by conducting a one-way analysis of variance (ANOVA). From our test results, mean novelty of ideas was found to differ significant across our groups ($M_{control} = 2,77$, $M_{financial} = 2,74$, $M_{task} = 3,16$ $M_{financial\&task} = 3,23$, $F(3,130) = 4,24$, $p < .01$).

Mean appropriateness of ideas did not differ significant across our test groups, ($M_{control} = 4,37$, $M_{financial} = 4,60$, $M_{task} = 4,70$, $M_{financial\&task} = 4,60$, $F(3,130) = 1,43$, $p > .20$). Based on these initial results we established that there were significant differences in the mean novelty scores across our test groups. To further elaborate on this result, we conducted the Tukey HSD post hoc test to investigate which of the test groups that differed significantly. The post hoc test was chosen as it offers a statistically reasonable tradeoff between type one and type two error (Breivik, Research Design, 2017).

From the Tukey HSD results, we only found a significant difference in mean novelty between the unconstrained control group and the financial and task structure constrained treatment group ($M_{difference} = -.45$, $p < .05$). The result suggests that our respondents will generate higher novelty average scores when ideating in an environment with an active financial and task structure constraint. Mean novelty between the control group and the financial constrained treatment group ($M_{difference} = .04$, $p > .99$), or the control group and the task structure constrained treatment group ($M_{difference} = -.38$, $p > .13$) did not differ significantly.

In sum, the test results indicate that there were no significant, negative effects on mean appropriateness or mean novelty in our data set. This lead us to reject hypothesis 1, meaning that that mean appropriateness and novelty scores are not negatively affected by **a)** a financial constraint, **b)** a task structure constraint and **c)** a financial and task structure constraint.

Testing Rival Hypothesis 1a

The mean appropriateness score will be positively affected by a financial constraint. The mean novelty score will not be affected by a financial constraint.

Following the results from the one-way analysis of variance (ANOVA) conducted in H1a, we found no significant differences in mean appropriateness between our four test groups ($M_{control} = 4,37$, $M_{financial} = 4,60$, $M_{task} = 4,70$, $M_{financial\&task} = 4,60$, $F(3,130) = 1,43$, $p > .20$). This can be further confirmed by conducting a Tukey HSD test comparing the mean appropriateness score between our control group and the financial constrained treatment group ($M_{difference} = -.22$, $p > .52$). Moreover, we know from the Tukey HSD results in H1a that there was no significant difference in the mean novelty score between the control group and the financial constrained treatment group ($M_{difference} = .04$, $p > .99$).

In sum, our tests show that the mean appropriateness score is not significant positively affected by a financial constraint. Moreover, mean novelty was not significant affected by a financial constraint. Following these results, we reject the first sentence of the rival hypothesis 1a, stating that the mean appropriateness score is positively affected by a financial constraint. We keep the second sentence of hypothesis 1a, stating that the mean novelty score is not affected by a financial constraint.

Testing Rival Hypothesis 1b

*The mean appropriateness score will be positively affected by a task structure constraint.
The mean novelty score will not be affected by a task structure constraint.*

Following the results from the ANOVA conducted in H1, we know that there was not a significant difference in mean appropriateness scores between our test groups ($M_{control} = 4,37$, $M_{financial} = 4,60$, $M_{task} = 4,70$, $M_{financial\&task} = 4,60$, $F(3,130) = 1,43$, $p > .20$), or a significant difference in mean novelty score between the control group and the task structure constrained treatment group ($M_{difference} = -.38$, $p > .13$).

In sum, our tests show that neither the mean appropriateness or the mean novelty score will be significant, affected by a task structure constraint. We therefore reject the first sentence of hypothesis 1b, stating that the mean appropriateness score will be positively affected by a task structure constraint. We keep the second sentence of hypothesis 1b, stating that the mean novelty score will not be affected by a task structure constraint.

Testing Hypothesis 2

The highest appropriateness and novelty extreme value scores are observed in the group with the unconstrained treatment.

To begin with, we tested whether there were any differences in the appropriateness and novelty extreme value indexes between our four test groups. In line with statistical experiment theory (Breivik, Experiments, 2017) and the extreme value study by Girotra et al. (2010) we conducted one-way analysis of variance based on the five best ideas in each test group. The extreme value score for novelty was found to differ significant across the test groups ($M_{control} = 5,80$, $M_{financial} = 4,75$, $M_{task} = 5,55$, $M_{financial\&task} = 4,95$, $F(3,16) = 5,26$, $p < .01$). This was also the case for the appropriateness extreme value score ($M_{control} = 6,28$, $M_{financial} = 6,16$, $M_{task} = 5,90$, $M_{financial\&task} = 5,75$, $F(3,16) = 6,02$, $p < .01$).

To analyze which of the test groups that differed significantly, we conducted the Tukey HSD test for multiple comparisons. From the Tukey HSD results, we found a significant difference in the novelty extreme value score between the control group and the financial constrained treatment group ($M_{\text{difference}} = 1.05, p < .01$) and the control group and the financial and task structure constrained treatment group ($M_{\text{difference}} = .85, p < .05$). Looking at the appropriateness extreme value score, we found a significant difference between the control group and the financial and task structure constrained treatment group ($M_{\text{difference}} = .05, p < .01$).

In sum, our tests show that the unconstrained control group has significantly higher novelty extreme value scores, compared to the financial constrained treatment group and the financial and task structure constrained treatment group. For appropriateness, the control group did only have significantly higher scores compared to the financial and task structured treatment group. Following these results, we reject hypothesis 2, as there are treatment groups without significant differences in appropriateness and novelty extreme values, compared to the control group. However, we observe that the extreme values are higher in the control group than in the financial constrained treatment group, and the financial and task structure constrained treatment group.

Testing Hypothesis 3a

The positive effect of a financial constraint on mean appropriateness is strengthened by a task structure constraint.

Following the initial ANOVA results from H1, we know that there was no significant difference in mean appropriateness scores across our test groups ($M_{\text{control}} = 4,37, M_{\text{financial}} = 4,60, M_{\text{task}} = 4,70, M_{\text{financial\&task}} = 4,60, F(3,130) = 1,43, p > .20$), hence the mean appropriateness score of the financial constrained treatment group was not positively affected by a task structure constraint. However, we know that there is a significant difference in mean novelty across our four test groups ($M_{\text{control}} = 2,77, M_{\text{financial}} = 2,74, M_{\text{task}} = 3,16, M_{\text{financial\&task}} = 3,23, F(3,130) = 4,24, p < .01$). By further analyzing these results with the Tukey HSD test, we see a significant difference in mean novelty between the financial constrained treatment group and the financial and task structure treatment group ($M_{\text{difference}} = -.49, p > .03$). The result suggests that the mean novelty score in the financial constrained treatment group is significantly strengthened by a task structure constraint.

In sum, our test results lead us to reject hypothesis 3a since the mean appropriateness score in the financial constrained treatment group was not strengthened by a task structure constraint. The result does however show that the positive effect of a financial constraint on mean novelty can be strengthened by a task structure constraint.

Testing Hypothesis 3b

The negative effect of a financial constraint on the appropriateness and novelty extreme values, is strengthened by a task structure constraint.

Following the results from hypothesis 2, we know there was a significant difference in extreme value scores across the four test groups for both appropriateness ($M_{control} = 6,28$, $M_{financial} = 6,16$, $M_{task} = 5,90$, $M_{financial\&task} = 5,75$, $F(3,16) = 6,02$, $p < .01$), and novelty ($M_{control} = 5,80$, $M_{financial} = 4,75$, $M_{task} = 5,55$, $M_{financial\&task} = 4,95$, $F(3,16) = 5,26$, $p < .01$). From the Tukey HSD tests, we did not find any significant differences in the appropriateness extreme value score between the financial constrained treatment group and the financial and task structure constrained treatment group. However, looking at novelty, there was a significant difference in extreme values between the financial constrained treatment group and the financial and task structure constrained treatment group ($M_{difference} = .04$, $p < .05$). Following this result, we see that the novelty extreme value score in the financial constrained treatment group significantly decreased when introducing a task structure constraint.

In sum, our test results show that we reject the statement in hypothesis 3b, proposing that the negative effect of a financial constraint on the appropriateness extreme value score is strengthened by a task structure constraint. We keep the statement in hypothesis 3b proposing that the negative effect of a financial constraint on the novelty extreme value score is strengthened by a task structure constraint.

Testing Hypothesis 4a

Avoidance motivation is positively moderating a) mean appropriateness, b) mean novelty, c) extreme value appropriateness and d) extreme value novelty, in channeling constrained treatments.

As we test for moderation and not mediated moderation, we conducted our analysis through a series of multivariate linear regressions with interaction effects, instead of using the Process model. This because both the Process model and linear regression use the ordinary least squares method of estimation. The results would therefore be the same in our case.

Our independent variables consisted of a set of three dummy variables, the avoidance motivation index and three interaction variables, being each dummy multiplied with the avoidance motivation index. To test all possible combinations of our four test groups, we changed our dummies and interaction variables between the regression tests. All test results are presented in Table 14.

Table 14: Results from Multivariate Linear Regression with Interaction Effects

Main Effect of Moderating Variables on Dependent Variables		Control Group		Financial Constrained Treatment Group		Task Structure Constrained Treatment Group		Financial- and Task Structure Constrained Treatment Group	
Dependent Variables	Omitted Group	B	Sig.	B	Sig.	B	Sig.	B	Sig.
Appropriateness									
Approach Motivation	Control			0,26	0,14	0,37	0,05*	0,19	0,32
	Financial Constraint	-0,26	0,14			0,11	0,42	-0,07	0,60
	Task Structure Constraint	-0,37	0,05*	-0,11	0,42			-0,18	0,22
	Financial- and Task Structure Constraint	-0,19	0,32	0,07	0,60	0,18	0,22		
Avoidance Motivation									
Approach Motivation	Control			0,25	0,04*	0,06	0,58	0,25	0,04*
	Financial Constraint	-0,25	0,04*			-0,18	0,10	-0,01	0,92
	Task Structure Constraint	-0,06	0,58	0,18	0,10			0,17	0,11
	Financial- and Task Structure Constraint	-0,25	0,04*	0,01	0,92	-0,17	0,11		
Novelty									
Approach Motivation	Control			0,08	0,67	0,19	0,29	-0,23	0,23
	Financial Constraint	-0,08	0,67			0,12	0,38	-0,30	0,03*
	Task Structure Constraint	-0,19	0,29	-0,12	0,38			-0,42	0,01**
	Financial- and Task Structure Constraint	0,23	0,23	0,30	0,03*	0,42	0,01**		
Avoidance Motivation									
Approach Motivation	Control			-0,17	0,16	-0,21	0,09	-0,15	0,23
	Financial Constraint	0,17	0,16			-0,03	0,78	0,03	0,82
	Task Structure Constraint	0,21	0,09	0,03	0,78			0,06	0,59
	Financial- and Task Structure Constraint	0,15	0,23	-0,03	0,82	-0,62	0,59		

Significance level: * 5%; ** 1%

Having the control group as the omitted dummy variable, our results showed no significant moderation effects from avoidance motivation on the mean novelty score, the novelty extreme value score nor the appropriateness extreme value score. When testing for moderation effects on mean appropriateness we found a significant, positive moderating effect on the financial constrained treatment group ($effect = .25, p < .04$), and the financial and task structure constrained treatment group ($effect = .24, p < .05$). These positive, significant effects suggest that avoidance motivated respondents are increasing their average appropriateness scores when they are financially constrained or financially and task structured constrained, compared to free from constraints.

In sum, the test results lead us to keep statement **a)** in hypothesis 4a proposing that avoidance motivation, positively moderate mean appropriateness in channeling constraints. We reject statement **b)** being that avoidance motivation, positively moderate mean novelty in channeling constraints. Further more, we reject statement **c)** and **d)** being that avoidance motivation, positively moderate the extreme value scores for appropriateness and novelty.

Testing Hypothesis 4b

Approach motivation is negatively moderating a) mean appropriateness, b) mean novelty, c) extreme value appropriateness and d) extreme value novelty, in channeling constrained treatments.

Following the same method of analyses as in hypothesis 4a, all tests were conducted through a series of multivariate linear regressions with interaction effects. We did not find any significant, moderation effects from approach motivation in our extreme value analyses. In the mean value analyses, we found two significant, negative moderating effects on novelty. Firstly, when financial constraint was omitted, the financial and task structure constrained treatment group gave the following result: (*effect* = $-.30$, $p < .03$). Secondly, when task structure constraint was omitted, the financial and task structure constrained treatment group resulted as following: (*effect* = $-.42$, $p < .01$). Looking at mean appropriateness we found a significant, negative moderating effect in the control group when the task structure constraint was omitted (*effect* = $-.37$, $p < .05$). The significant, negative results indicate that approach motivated individuals may improve their mean appropriateness scores by being free from constraints and their mean novelty scores by being less constrained.

In sum, our test results lead us to keep statement **a) and b)** in hypothesis 4b proposing that approach motivation negatively moderate mean appropriateness and mean novelty in channeling constrained treatment groups. We reject statement **c) and d)** in hypothesis 4b proposing that approach motivation negatively moderate appropriateness and novelty extreme value scores.

Additional findings

In addition to our hypotheses, we tested for the mediating effect of intrinsic motivation, between our independent variables and our dependent variables. To test for mediation, we ran the Preacher and Hayes Multiple Mediation (indirect) test. None of the test scores indicated significant mediating effects from intrinsic motivation as seen in Table F.1 Preacher and Hayes (2008) SPSS Macro for Multiple Mediation, in Appendix F.

In Table F.2 in Appendix F, we have presented an overview of the idea which scored the highest on both appropriateness and novelty within each test group. This is included to give the reader an understanding of the type of ideas that were generated in our experiment.

5. Discussion

The main goal of this thesis was to investigate whether financial and/or task structure constraints enable or inhibit creativity, by measuring and comparing average and extreme value effects. We further wanted to examine whether the mean and extreme value effects of a financial constraint was dependent on task structure, and whether bounded and unbounded creativity processes were moderated by approach and/or avoidance motivation. Creativity was measured through appropriateness and novelty, individually.

To investigate these relationships, we conducted an online ideation experiment with 134 respondents, consisting of an unconstrained control group, a financial constrained treatment group, a task structure constrained treatment group, and a financial and task structure constrained treatment group. All generated ideas were evaluated by an expert panel of creativity judges from Bergen Technology Transfer (BTO). The main findings, theoretical and practical implications, validity and reliability, limitations and further research derived from our experimental results, will be discussed in the following sections.

5.1 Main Findings and Contribution

We did not find any significant effects suggesting that financial and/or task structure constraints inhibited creativity when measuring average effects. On the contrary, we found that respondents generated significantly higher mean novelty scores when they ideated in the financial and task structure constrained treatment group compared to the respondents who ideated in the unconstrained control group. We further found that respondents in the financial and task structure constrained treatment group generated significantly higher mean novelty scores compared to the respondents in the financial constrained treatment group. This indicates that constraints do not inhibit average effects. Moreover, the effect of a financial constraint may depend on task structure. Mean appropriateness did not give any significant results.

Conducting the same analyses on extreme values showed that constraints also could act as a significant inhibitor to creativity. Respondents generated significantly lower appropriateness extreme value scores when they ideated in the task structure constrained treatment group, and in the financial and task structure constrained treatment group, compared to the

unconstrained control group. Respondents also generated significantly lower novelty extreme value scores when they ideated in the financial constrained treatment group, and in the financial and task structured treatment group, compared to the respondents in the control group. Moreover, respondents in the task and financial constrained treatment group generated significantly lower appropriateness extreme value scores compared to the respondents in the financial constrained treatment group. In addition to inhibiting creativity, these results indicate that a financial constraint can be dependent on the task structure when measuring extreme values.

In addition to significant direct effects we found significant moderating effects between our test groups and the mean creativity scores. We did not find any significant moderating effects in our extreme value analyses. Avoidance motivation positively moderated the performance of respondents in the financial constrained treatment group, and in the financial and task structure constrained treatment group, compared to the respondents in the unconstrained control group, when measuring for mean appropriateness. In addition, approach motivation negatively moderated the performance of the respondents in the task structure constrained treatment group, compared to the control group, when measuring for mean appropriateness. Approach motivation negatively moderated the performance of the respondents in the task structure constrained treatment group compared to the financial constrained treatment group, and the financial task constrained treatment group, when measuring for mean novelty. The results indicate that constraints may positively affect the average creativity for avoidance motivated individuals, while negatively affecting the average creativity for approach motivated individuals.

5.2 Theoretical Implications

The results of our research bring forward several theoretical implications. First, the creativity research provides contradicting claims when it comes to creativity and constraints. The traditional creativity view describes the ideal creative state as unstructured, open-ended and free from external limitations, where the inventor should act as an autonomous agent (Amabile, 1988, 1996; Davis & Gruber, 1988; Andrews & Smith, 1996; Shalley, Zhou & Oldham, 2004). On the other hand, there is a growing body of research claiming that bounded creativity can be beneficial as constraints are found to increase the average effect of creativity.

Our research provides a more nuanced picture to the relationship between constraints and creativity as we measure and compare both average and extreme value effects. Our results suggest that constraints may act as both an enabler and an inhibitor to creativity depending on how one measure it and whether the inventor is inherently approach or avoidance motivated.

Given an extreme value perspective, meaning the best generated ideas, we find experimental evidence supporting the traditional creativity view. In other words, the significant, highest rated ideas on both appropriateness and novelty are found in conditions free from financial and task structure constraints. This result suggests that creativity at its best is reached when the inventor is autonomous, free from external restrictions, limitations or confinements. Given an average creativity perspective, meaning the ideas that on average are rated the highest, we find experimental evidence supporting the bounded creativity view as the mean novelty rating increase significantly when the inventor ideates under financial and task structure constraints. This finding indicates that there are flaws to the traditional, unbounded creativity view as novel solutions on average benefit from financial limitations and a high degree of task specificity, hence reducing the inventor's autonomy. In addition to these direct effects, our research suggests that the strength and direction of the relationship between channeling constraints and creativity may depend on whether the inventor is approach or avoidance motivated.

Our results, indicate that avoidance motivated individuals seem to benefit from channeling constraints such as financial and task structure constraints. This supports the proposition put forward by Roskes (2015) stating that avoidance motivated individuals are less flexible when processing information and therefore need a greater pool of information when conducting creative thinking processes. Avoidance motivated individuals are therefore dependent on a greater amount of information in order to be creative. This need seems to be at least partly met by introducing financial and task structure constraints. Roskes (2015) does however not discuss whether appropriateness and novelty are affected differently. Through our research we find evidence suggesting that avoidance motivation only moderates the mean appropriateness dimension of creativity in constrained conditions. In light of the commonly used connection between avoidance motivation and risk aversion in the research literature, this finding seems logical and contribute to a deeper understanding of this moderating relationship. Risk aversion relates to safer options, and appropriateness relates to idea feasibility and relevance.

Our moderating result may therefore indicate that when the avoidance motivated individual is offered sufficient cognitive resources to conduct creative thinking processes, the inherent risk aversion behavioral trait of these individuals is activated. This in turn can assert the avoidance motivated inventor's attention towards reducing risk of failure by proposing solutions that are feasible and relevant instead of incurring risk and proposing something original, associated with a higher degree of uncertainty.

Our research has also uncovered that approach motivation, in contrast to avoidance motivation, negatively moderates the relationship between constraints and creativity. This finding supports the proposition put forward by Roskes (2015) stating that approach motivated individuals may be negatively affected by channeling constraints as additional directing information may restrict their autonomy and limit their flexible and explorative cognitive processing. By measuring the moderating effect on both appropriateness and novelty we offer a contribution to the theory put forward by Roskes (2015). Our results indicate that financial and task structure constraints mostly affect the mean novelty of the approach motivated individuals. Elaborating on the existing research literature, our result may suggest that financial and task structure constraints reduces the approach motivated individual's ability to conduct flexible cognitive processing which in turn reduces the inventor's motivation to incur risk, culminating in a loss of average novelty. Further, our finding indicates that the average novelty scores in unconstrained creativity process may benefit from an approach that emphasizes flexible and explorative cognitive processing and risk taking. Moreover, the decrease in average novelty for approach motivated individuals under constraints can be seen in light of Amabile's componential theory of creativity (1997).

Amabile (1983) defines creativity-relevant skills as an important component to individual creativity. Creativity-relevant skills are defined as being flexible when processing information, independent, risk-taking and tolerant to ambiguity (Amabile, 2012). Looking to approach motivation, we see many of the same characteristics; flexible information processing, risk-taking, and fairly independent of cognitive resources. This may suggest that financial and task structure constraints negatively affect the average efficiency of creativity-relevant skills for approach motivated individuals, and that creativity-relevant skills are skewed towards mean novelty. Moreover, our results may suggest that approach motivated individuals are more likely to poses creativity-relevant skills than avoidance motivated individuals.

Finally, our study revealed that the impact of a financial constraint is dependent on the degree of task specificity in the underlying problem statement. This is an important contribution to the creativity literature, given the experimental designs used in several bounded creativity studies.

Two commonly cited articles throughout this thesis are the creativity studies by Dahl and Moreau (2005) and Busacca et al. (2013). The theorists present findings suggesting that input restrictions and requirements improve the average effect of novel thinking while financial budget constraints improve the average effect of appropriate thinking. Both studies use a highly specified task as the constant, underlying problem statement in their experiments, without discussing how this task structure in itself may affect and direct the results from their imposed constraints. Following our experiment results, we see that task specificity can significantly affect both the average- and extreme value score of a financial constraint. Although we do not find the same results as Busacca et al. (2013), our findings clearly indicate that the performance of a financial constrained condition depends on the underlying task structure.

5.3 Practical Implications

The results of our research have several managerial implications. First, it is important for company managers and employees to be aware that the relationship between constraints and creativity is not as straight forward as some theorists and researcher's claims. With this in mind, our research results indicate that companies may want to structure their creativity processes differently according to their creativity goals, and the inherent personalities of the employees working on a specific project. For companies or projects that aim to bring forward breakthrough innovations, unconstrained ideation processes with little to no financial restrictions and a low degree of task specificity, seem to be beneficial. Through such processes, the most appropriate and novel ideas are most likely to occur. In light of innovation process theory, the score card procedure at the initial ideation gate of the Stage-Gate model (Cooper, 2008) may be parted from. For companies or projects that aim to compete or deliver on average performance, due to for example the fact that they are continuously innovating, conducting several innovation processes simultaneously, or incrementally innovating where "genius ideas" are sidelined by efficiency, financial and task structure constrained ideation seems beneficial.

In light of Cooper's (2008) Stage-Gate model, a gate evaluation based on financial metrics and strictly defined goals may be wise. The employees assigned to the different processes' personality traits should however be taken into account.

Financial and task structure constraints seem to improve the average creativity performance for avoidance motivated individuals. However, financial and task structure constraints seem to decrease the average creativity performance for approach motivated individuals. This negative result may be derived from their experience of a creative deprivation, reducing their cognitive exploration and willingness to take risk when ideating. Following the research by Roskes (2015), this negative effect can be reversed if the approach motivated employees instead experienced the constraints as challenging. Moreover, Rosso (2014) present case study evidence suggesting that innovators who work under constraints can both appreciate constraints and be creative under their influence. The finding seems true for inventors who at the same time acknowledge the importance of constraints. In light of theory put forward by Rosso (2014) and Roskes (2015), managers may want to secure that approach motivated individuals experience the constraints they work under as challenging and at the same time acknowledge the importance of them. A way of doing this may be to structure the ideation and innovation process together with the employees assigned to the specific processes, focusing on how approach motivated employees experience challenges in relevance to the focus project. If possible these challenges could be embedded in the ideation and innovation process. Moreover, it may be beneficial to clearly communicate the firm's need for constraints and the benefits derived from them.

Another implication of our research is related to the type of constraint that may be appropriate, given the financial means of the firm, whether they work with highly specified problems and their creativity performance goals. For companies with limited budgets it may seem strategically wise to focus on a high average creativity performance, asserting the focus toward incremental innovation where the need for that one, genius idea may be limited. Financially strong companies may however assert more attention to radical innovation through unconstrained creativity processes. These companies should, however, also conduct several incremental, financial and task structure constrained processes, to increase average performance. Moreover, companies that work with highly structured problems may want to ideate in accordance to specific budgets if they seek strong average performance, but without financial budgets if they seek those rare and truly genius ideas.

Although these recommendations seem logical given our findings, the real world shows us time and time again, that it is often the small and financially weak firms who are truly innovative, disrupting industries (Christensen, Raynor, & McDonald, 2015). The reason for this may be that these firms allow themselves to be unconstrained although they may not overcome such autonomy, partly explaining why nine out of ten startups fail (Patel, 2015). The managerial implication from this may therefore be that financially strong companies should invest in a stream of continuous, unconstrained creativity processes given the aim of one day generating that truly unique idea which disrupt industries for the better.

5.4 Validity and Reliability

The quality of our study depends on the two factors of validity and reliability (Ghauri & Grønhaug, 2010). In this chapter, we will discuss these concepts, in relevance to whether our research obtained valid and reliable results. While the concept of validity is concerned with the influence of systematic error, reliability addresses whether the measurements used in the study are subject to random effects or random errors (Breivik, Measurements, 2017).

5.4.1 Validity

To ensure valid measurements, we made sure that our research design was measuring what it was supposed to measure. In other words, checking that our data were true and could be trusted (Ghauri & Grønhaug, 2005; 2010). This cannot be proven, but as researchers we can develop support for validity in our work (Breivik, Measurements, 2017). Statistical literature distinguishes between several forms of validity (Ghauri & Grønhaug, 2005; 2010). In the following sub-section, we will discuss different forms of validity, namely conclusion, internal, construct and external validity.

Conclusion validity

Conclusion validity relates to whether the conclusions we draw based on our underlying data are reasonable (Breivik, Research Design , 2017). As previously discussed in section 3.7, assumptions related to independent observations, a normal distributed sample and homogeneity of variance were met. Furthermore, our sample size was sufficiently large, containing more than 30 participants in each test group. We therefore expect to have a fairly strong conclusion validity, meaning we can draw statistically satisfactory conclusions.

Internal validity

Another form of validity is the internal validity, addressing whether we can infer causality, and be sure that the relationships from our independent to dependent variables, are not explained by third variable effects (Breivik, Research Design, 2017). We therefore want the findings from our research to be true for the internal setting we are testing for. An important concern is how well we can manage to control the internal setting of the process of data collection. In our experiment, we did this by obtaining both randomization and anonymization within the target group (Ghauri & Grønhaug, 2010). We discussed the findings of the one-way ANOVA conducted in sub-section 3.5.1, indicating that there were no significant differences between the control group and the treatment groups. This, in addition to the anonymity, suggests an acceptable level of internal validity.

As our data were collected by the use of Qualtrics, it was challenging to control all the internal factors in our design. Even though we gave the respondents instruction, we were not able to control whether or not they followed them. We exemplify this further; as we had not given our respondents specific user IDs due to anonymity, we could not directly control for whether the respondents only took the test once. We did however clearly state in the experimental test rules, that each respondent was only allowed to participate once. However, we did receive an e-mail from a participant who had generated more ideas after submitting her answers, asking us if we could add these to her answer. We see this as an indication that the participants took our experiment rules seriously, as she could have retaken the experiment if she wanted.

Moreover, we recall that all of the ideas were rated by an expert panel of two business developers from Bergen Technology Transfer (BTO). Although we place great trust in the knowledge and judgment of our judges, as BTO is a corporation partner with NHH, the possibility of systematic scale factor error is still present. It may therefore be that one, or both of our judges, consistently measured idea quality higher or lower than their true values. If this should have been the case, both judges would have conducted the same error, as our judges' creativity scores correlated significantly, discussed in section 3.6. As the judges' creativity scores correlated significantly, we see the probability for systematic scale factor error as low.

Construct validity

Construct validity relates to whether we measure what we think we are measuring (Breivik, Research Design, 2017). To secure construct validity we have used established measurements within the creativity literature, following the same measurement procedures as previous, validated studies (Dahl & Moreau, 2005; Girotra, Terwiesch, & Ulrich, 2010; Busacca, Cillo, Mazursky, & Scopelliti, 2013). As previously discussed in this sub-section we have also used a fairly controlled experiment setting, which should reduce the probability for mono-operation bias. We therefore expect to have a strong construct validity.

External validity

When measuring the external validity, we aim to look at the generalization of the findings in our study (Ghauri & Grønhaug, 2010). The term generalization is defined as *to what extent the research result in a study can apply to individuals' other than those that participated in the study*” (Bryman & Bell, 2003). To ensure such results from our research, we had to verify that our data gathering took place in a realistic setting, and from a representative and randomized population. As our experiment took place through an online platform, the setting may be seen as not the most realistic, and we therefore expect to experience some challenges with the external validity (Ghauri & Grønhaug, 2010). As mentioned in sub-section 3.2.1, our sample overwhelmingly consisted of full-time employees working in innovative Norwegian companies. As we approached firms and employees by the use of personal contact through Facebook, e-mail or telephone, we feel confident that we reached out to a representative group of respondents. However, the use of personal contacts and social media in our recruitment process may have distorted the samples' reflection of our target population. Moreover, our sampling approach resulted in a fairly heterogeneous sample, meaning that our external validity should be expected as strong.

5.4.2 Reliability

The reliability in our study tells us whether or not our choice of data collection and analysis techniques would produce consistent findings if any other researchers replicated our study (Ghauri & Grønhaug, 2010). To generate reliable results, we need strong internal validity. We conducted the scale reliability check, as discussed in sub-section 3.5.3. This is an often-used method to evaluate the reliability of our data, calculated by the Cronbach's Alpha. This measurement is influenced by the number of measures used in the study, and the inter-correlation among them.

The more measures we include, the higher the Cronbach's Alpha becomes (Breivik, Measurements, 2017). As the number of questions used to measure each of our moderating-, mediating- or control variables are no higher than five, we did not expect high values of the Cronbach's Alpha. As we recall from Table D.5, Table D.6 and Table D.7 in Appendix D, all of our Cronbach's Alpha was between .60 and .80 which is seen as acceptable/good. However, none were above .90 which is considered as excellent. Although, our Cronbach Alphas indicate that our findings, derived from our measurements, can be replicated.

Other potential threats to the reliability of our measures, could be the reliability of the dependent variables, which is a result of the rating by the two business developers from BTO. For instance, the work load of the evaluation process may have led to the developers feeling stressed or that they would have rated the ideas differently in another, calmer environment. Other examples, are the judges' mood, and/or the fact that they conducted the idea ratings alongside their everyday work, possible making the idea evaluations a burden. It is also important to consider potential errors, such as the business developers checking off the wrong number on the seven-point Likert scale or forgetting to rate one or more ideas. All of these situations could have affected the measurements. We have tried to minimize these negative effects by establishing good communication with the business developers through e-mail and telephone.

Many of the factors mentioned above for the business developers also apply for the respondents, and figure as a threat to the reliability of the ideas generated in our experiment. Moreover, mistakes made by us, the researchers, could also cause problems with reliability. To exemplify, one of us manually sorted all the ideas generated in Qualtrics into two identical excel files, which were distributed to the experts from Bergen Technology Transfer (BTO). One or more ideas may have been lost, or assigned to the wrong respondent, during this process. However, all data was imported from Qualtrics as an excel file, and all data points were doubled checked by our other researcher before delivering the evaluation forms to BTO. We believe this reduced the probability for doing mistakes.

5.5 Limitations

There are several potential limitations to how our research experiment was conducted. First, our experiment was conducted online, meaning that we were not able to have full control over our test setting. This could have affected our internal validity. To exemplify, respondents can have taken the test several times, as discussed in sub-section 5.4.1, and several respondents may have collaborated before submitting their answers. We could have obtained a stronger control over our respondents by conducting a traditional lab experiment. Given the limited time of a master thesis, such an approach would have led us to strictly sample students at NHH. Such a sample would not have reflected our target population as well as our final sample, and a homogenous sample consisting solely of NHH student, would have weakened our external validity. We therefore decided on a small loss in experiment control, but improved representation of our target population, and stronger external validity.

Another possible limitation to our research is the limited amount of questions used to depict approach and avoidance motivation. Following the research literature, conducting full-scale personality tests often consist of a large number of questions and is a highly complex procedure (Elliot & Trash, 2002; Carver & White, 1994; Costa & McRae, 1992). We only used three questions to measure approach motivation and three questions to measure avoidance motivation. As discussed in sub-section 3.4.2 this was done, first, because we do not have the expertise needed to conduct and measure full-scaled personality tests, and secondly because such a test design would be too overwhelming for the respondents resulting in extensive non-response error.

A third factor that limited the strength of our relationship was the fact that we only used two judges in the expert panel. Although previous studies have done the same (Girotra, Terwiesch, & Ulrich, 2010, Busacca, Cillo, Mazursky, & Scopelliti, 2013) we believe a panel of three judges would have contributed to more reliable index measures. A fourth limiting factor is our sample size. A larger sample could have resulted in insignificant relationships becoming significant.

A last possible limitation, is that we only tested for one specific problem, related to the fish farming industry. It is therefore not possible for us to say with certainty whether our findings hold in other industries, or given other problem scenarios. However, due to our versatile sample, consisting of Norwegian business employees working in innovative companies, we expect some degree of generalizability.

5.6 Further Research

Despite a substantial amount of research on creativity, only a limited number of studies investigates the mean and extreme value effect of constrained creativity. Moreover, the current literature on the effect of bounded creativity is divided. More research is therefore needed in this field. An interesting research approach could be to replicate previous bounded creativity studies that present conflicting views to whether constraints enable or inhibit creativity. Such studies could measure both average and extreme value effects and test whether our findings hold, namely that constraints enable averages, but inhibits extreme values. Such studies would contribute to a more nuanced picture of the relationship between constraints and creativity. Moreover, it would contribute to a deeper understanding of the relationship between autonomy and creativity.

Another interesting study would be to investigate whether the relationships we found hold in group ideation. We know from the literature, that there may be significant differences in ideation between individuals and groups, among other due to a group of people's abilities to build on each other's ideas. It could therefore be interesting to test whether the effect of building on each other's ideas would weaken, strengthen or have a zero effect to the relationships found in our study. In addition, further research should be conducted on the relationship between task structure and constraints. An interesting starting point would be to replicate the studies of Dahl and Moreau (2005) and Busacca et al. (2010), with an additional manipulation factor, high and low task specificity. In such experiments, researchers could test our proposition, that the findings of Dahl and Moreau (2005) and Busacca et al. (2010) may have been affected by their experimental task structure.

As discussed in section 5.3, the negative observed relationship between approach motivated individuals and constrained creativity may be reduced when designing the constrained creativity process together with the approach motivated individuals. A study, empirically testing this effect would therefore contribute to a deeper understanding of the moderating relationship between approach motivation and constraints. Moreover, it would contribute to a clearer understanding of how managers may structure their creativity processes for approach motivated individuals. Along these lines, research studies focusing on limiting constraints, would also contribute to a further understanding of the interplay between motivation, constraints and creativity.

Lastly, further research pushing beyond the barriers of ideation, investigating the average- and extreme value effect of constrained creativity in idea development and idea implementation, would contribute greatly to both the creativity and the innovation literature at large.

References

- Amabile, T. M. (1982). Social psychology of creativity: A consensual assessment technique. *Journal of Personality and Social Psychology*, pp. 997–1013.
- Amabile, T. M. (1983). *The social psychology of creativity*. New York: Springer-Verlag.
- Amabile, T. M. (1988). A model of creativity and innovation in organizations. I L. L. Cummings, & B. M. Staw, *Research in Organizational Behavior*, pp. 123–167. Greenwich: CT: JAI Press.
- Amabile, T. M. (1993). Motivational Synergy: Toward New Conceptualizations of Intrinsic and Extrinsic Motivation in the Workplace. *Human Resource Management Review*, pp. 185–201.
- Amabile, T. M. (1996). *Creativity in Context*. Boulder, Colo: Westview Press.
- Amabile, T. M. (1996). *Creativity and Innovation in Organizations*. Cambridge, MA.: Harvard Business School.
- Amabile, T. M., & Gryskiewicz, S. S. (1987). *Creativity in the R&D laboratory*. Greensboro: NC: Center for Creative Leadership.
- Amabile, T. M., Hadley, C., & Kramer, S. (2002). Creativity under the gun. *Harvard Business Review*, 80(8), pp. 52-61.
- Amabile, T. M., Schatzel, E. A., Moneta, G. B., & Kramer, S. J. (2004). Leader Behaviors and the Work Environment for Creativity: Perceived Leader Support. *Leadership Quarterly*, 15, pp. 5-32.
- Andrews, F. M., & Farris, G. F. (1972). Time pressure and performance of scientists and engineers: A five-year panel study. *Organizational Behavior and Human Performance* (8), pp. 185-200.
- Andrews, J., & Smith, D. C. (1996). In search of the marketing imagination: Factors affecting the creativity of marketing programs for mature products. *Journal of Marketing Research*, pp. 174–187.

-
- Baer, J. (1994). Performance assessments of creativity: Do they have long-term stability? *Roeper Review*, pp. 7–11.
- Baer, M., & Oldham, G. R. (2006). The Curvilinear Relation between Experienced Creative Time Pressure and Creativity: Moderating Effects of Openness to Experience and Support for Creativity. *Journal of Applied Psychology*, *91*, pp. 963-70.
- Baker, T., & Nelson, R. N. (2005). Creating something from nothing: Resource construction through entrepreneurial bricolage. *Administrative Science Quarterly*, *50*, pp. 329-366.
- Bell, E., & Bryman, A. (2007). *Business research methods (2th ed.)*. Oxford: Oxford University Press.
- Bjork, J., Boccadelli, P., & Magnusson, M. (2010). Ideation Capabilities for Continuous Innovation. *Creativity and Innovation Management*, *19*(4), pp. 385-396.
- Boronat-Navarro, M., Camison-Zornoza, C. R., Lapedra-Alcami, M., & Segarra-Cipres. (2004). A meta-analysis of innovation and organizational size. *Organization Studies*, pp. 331–61.
- Breivik, E. (2017). *Questionnaire Design*. Bergen: The Norwegian School of Economics.
- Breivik, E. (2017). *Survey Design and Sampling*. Bergen: The Norwegian School of Economics.
- Breivik, E. (2017). *Experiments*. Bergen: The Norwegian School of Economics.
- Breivik, E. (2017). *Measurements*. Bergen: The Norwegian School of Economics.
- Breivik, E. (2017). *Research Design*. Bergen: The Norwegian School of Economics.
- Britz, A., Ekvall, G., Isaksen, S. G., & Lauer, K. J. (2001). Perceptions of the best and worst climates for creativity: Preliminary validation evidence for the situational outlook questionnaire. *Creativity Research Journal*, pp. 171–184.
- Bouchard, T. J., & Hare, M. (1970). Size, performance, and potential in brainstorming groups. *Journal of Applied Psychology*, *54*(1), pp. 51-55.

Burroughs, J. E., & Mick, D. G. (2004). Exploring antecedents and consequences of consumer creativity in a problem-solving context. *Journal of Consumer Research*, 31, pp. 402-411.

Busacca, B., Cillo, P., Mazursky, D., & Scopelliti, I. (2013). How Do Financial Constraints Affect Creativity? *. *Journal of Product Innovation Management*, pp. 880–893.

Caniels, M. J., & Rietzschel, E. F. (2015). Organizing Creativity: Creativity and Innovation under Constraints. *Creativity and Innovation Management*, 24(2), pp. 184-195.

Carver, C. S., & White, T. L. (2013). *Behavioral avoidance/inhibition (BIS/BAS) scales*. Retrieved from Measurement Instrument Database for the Social Sciences: <http://www.midss.org/content/behavioral-avoidanceinhibition-bisbas-scales>

Charness, G., & Grieco, D. (2014). *Creativity and Financial Incentives*. Bocconi University.

Cretenet, J., & Dru, V. (2009). Influence of Peripheral and Motivational Cues on Rigid-Flexible Functioning: Perceptual, Behavioral and Cognitive Aspects. *Journal of Experimental Psychology*, 138, pp. 739-17.

Christensen, C. M., Raynor, M. E., & McDonald, M. (2015, December). What is Disruptive Innovation. Retrieved from Harvard Business Review: <https://hbr.org/2015/12/what-is-disruptive-innovation>

Cloninger, R., Przybeck, T. R., M., D. S., & Wetzel, R. D. (1994). *The Temperament and Character Inventory (TCI): A Guide to Its Development and Use*. St. Louis, Missouri: Center for Psychobiology of Personality Washington University.

Cohendet, P., & Simon, L. (2015). Introduction to the Special Issue on Creativity in Innovation. *Technology Innovation Management Review*, 5(7).

Csikszentmihalyi, M. (1997). *Creativity: Flow and the psychology of discovery and invention*. New York: Harper Collins.

Csikszentmihalyi, M. (1999). Implications of a systems perspective for the study of creativity. In R. Sternberg, *Creativity research handbook*, pp. 313-325. Cambridge, UK: Cambridge University Press.

-
- Dards, L. A., & Ahmad, M. M. (2013). Coping Strategies as Mediators and Moderators between Stress and Quality of Life among Parents of Children with Autistic Disorder. *Stress Health*.
- Dahl, D. W., & Moreau, C. P. (2005). Designing the solution: The impact of constraints on consumers' creativity. *Journal of Consumer Research*, pp. 13–22.
- Dahl, D. W., & Moreau, C. P. (2005). Designing the Solution: The Impact of Constraints on Consumers' Creativity. *Journal of Consumer Research*, pp. 32.
- Dahan, E., & Mendelson, H. (2001). An extreme value model of concept testing. *Management Science*, 47(1), pp. 102-116.
- Damanpour, F. (1991). Organizational innovation: A meta-analysis of effects of determinants and moderators. *Academy of Management Journal*, pp. 555–590.
- Davis, S., & Gruber, H. (1988). Inching our way up Mount Olympus: The evolving systems approach to creativity. In R. Sternberg, *The nature of creativity*, pp. 243–270. New York, NY: Cambridge University Press.
- Deci, E. L., & Ryan, R. M. (1987). The Support of Autonomy and the Control of Behavior. *Journal of Personality and Social Psychology*, pp. 1024-1037.
- Diehl, M., & Stroebe, W. (1987). Productivity loss in brainstorming groups: Towards the solution of a riddle. *Journal of Personality and Social Psychology*, 53(3), pp. 497-509.
- Drach-Zahavy, A., & Erez, M. (2002). Challenge versus Threat Effects on the Goal-Performance Relationship. *Organizational Behavior and Human Decision Processes*, 88, pp. 667-82.
- Elliot, A. J. (2006). The hierarchical Model of Approach-Avoidance Motivation. *Motivation and Emotion*, 30, pp. 111-16.
- Elliot, A. J., & Thrash, T. M. (2002). Approach–Avoidance Motivation in Personality: Approach and Avoidance Temperaments and Goals. *Journal of Personality and Social Psychology*, pp. 804–818.

Ettlie, J. E., Rubenstein, & H., A. (1987). Firm size and product innovation. *Journal of Product Innovation Management*, pp. 89–108.

Finke, R. A. (1990). *Creative imagery: Discoveries and inventions in visualization*. Hillsdale, NJ: Lawrence Erlbaum Associates.

Finke, R. A., Ward, T. B., & Smith, S. M. (1992). *Creative cognition: Theory, research and applications*. MIT Press.

Forster, J., & Higgins, E. T. (2005). How Global versus Local Perception Fits Regulatory Focus. *Psychological Science*, 16, pp. 631-636.

Forster, J., Friedman, R. S., Ozelsel, A., & Denzler, M. (2006). Enactment of Approach and Avoidance Behavior Influences the Scope of Perceptual and Conceptual Attention. *Journal of Experimental Social Psychology*, 42, pp. 133-46.

Friedman, R. S., & Forster, J. (2000). The Effect of Approach and Avoidance Motor Actions on Elements of Creative Insights. *Journal of Personality and Social Psychology*, 79, pp. 447-92.

Friedman, R. S., & Forster, J. (2002). The Influence of Approach and Avoidance Motor Action on Creative Cognition. *Journal of Experimental Social Psychology*, 38, pp. 41-55.

Friedman, R. S., & Forster, J. (2005). The Influence of Approach and Avoidance Cues on Attentional Flexibility. *Motivation and emotion*, 29, pp. 69-81.

Gallupe, R. B., Bastianutti, I. M., & Cooper, W. H. (1991). Unblocking brainstorming. *Journal of Applied Psychology*, 76(1), pp. 137-142.

Gardner, H. (1993). *Creating Minds*. New York: Basic Books.

Garud, R., & Karnoe, P. (2003). Bricolage versus breakthrough: Distributed and embedded agency in technology entrepreneurship. *Research policy*, 32, pp. 277-300.

George, J. M. (2008). Creativity in organizations. *The Academy of Management Annals*, pp. 439–477.

Ghuri, P., & Grønhaug, K. (2005). *Research Methods in Business Studies: A practical guide*. Edited by K. Grønhaug (3. Edition). Great Britain: Prentice Hall.

-
- Ghauri, P., & Grønhaug, K. (2010). *Research Methods in Business Studies (4th ed.)*. Great Britain: Prentice Hall.
- Gibbert, M., Hoegl, M., & Weiss, M. (2011). Making Virtue of Necessity: The Role of Team Climate for Innovation in Resource-Constrained Innovation Projects*. *Journal of Product Innovation Management*.
- Girotra, K., Terwiesch, C., & Ulrich, K. T. (2010). Idea Generation and the Quality of the Best Idea. *Management Science*, pp. 591-605.
- Goldenberg, J., Mazursky, D., & Solomon, S. (1999). Toward identifying the inventive templates of new products: A channeled ideation approach. *Journal of Marketing Research*, pp. 200-210.
- Grace-Martin, K. (2018). *The Analysis Factor*. From An Easy Way to Reverse Code Scale items: <https://www.theanalysisfactor.com/easy-reverse-code/>
- Hair, J. F. (2006). *Multivariate data analysis (6th ed.)*. Upper Saddle River: Prentice Hall.
- Hennessey, B. A., & Amabile, T. M. (1998). Reward, Intrinsic Motivation and Creativity. *American Psychologist*, 53, pp. 674-5.
- Hennessey, B. A., & Amabile, T. M. (2010). Creativity. *The Annual Review of Psychology*, pp. 569-598.
- Hill, K. G., & Amabile, T. M. (1993). A social–psychological perspective on creativity: Intrinsic motivation and creativity in the classroom and workplace. In M. C. G. Isaksen, *Understanding and recognizing creativity*. pp. 400-432. Norwood, NJ: Ablex.
- Hoegl, M., Gibbert, M., & Mazursky, D. (2008). Financial constraints in innovation projects: When is less more? *Research policy*, 37, pp. 1382-1391.
- IBM. (2018). *IBM Knowledge Center*. From KMO and Bartlett's Test: https://www.ibm.com/support/knowledgecenter/en/SSLVMB_24.0.0/spss/tutorials/fac_telco_kmo_01.html
- James, W. (1890). *The principles of psychology (Vol. 2)*. New York: Holt.

Joyce, C. K. (2009). The Blank Page: Effects of Constraint on Creativity. *SSRN Electronic Journal*.

Katila, R., & Shane, S. (2005). When does lack of resources make new firms innovative. *Academy of Management Journal*, 48(5), pp. 814-829.

Kelly, J. R., & McGrath, J. E. (1985). Effects of time limits and task types on task performance and interaction in four-person groups. *Journal of Personality and Social Psychology* (49), pp. 395-407.

Khaneman, D. (2011). *Thinking, Fast and Slow*. New York: Farrar, Straus and Giroux.

Kirkpatrick, S., & Locke, E. (1996). Direct and indirect effects of three core charismatic leadership components on performance and attitudes. *Journal of Applied Psychology* (81), pp. 36-51.

Kirton, M. J. (1994). *Adaptors and innovators: styles of creativity and problem solving*. New York: Routledge.

Kornai, J. (1979). Resource-constrained versus demand-constrained systems. *Econometrica*, 47(4), pp. 801-820.

Kuschel, K., Forster, J., & Denzler, J. (2010). Going beyond Information Given: How Approach versus Avoidance Cues Influence Access to Higher Order Information. *Social Psychological and Personality Science*, 1, pp. 4-11.

Liechtenfeld, S., Elliot, A. J., Maier, M. A., & Pekrun, R. (2012). Fertile Green: Freen Facilitates Creative Performance. *Personality and Social Psychology Bulletin*, 38, pp. 784-97.

Lowe, R., & Benette, P. (2003). Exploring Coping Reactions to Work-Stress: Application of an Appraisal Theory. *Journal of Occupational and Organizational Psychology*, 76, pp. 393-400.

Maier, M. A., Elliot, A. J., & Lichtenfeld, S. (2008). Mediation of the Negative Effect of Red on Intellectual Performance. *Personality and Social Psychology Bulletin*, 34, pp. 1530-40.

-
- MacCrimmon, K. R., & Wagner, C. (1994). Stimulating Ideas Through Creativity Software. *Management Science*, pp. 1514-1532.
- McCrae, R. R., & Costa, P. R. (1997). Conceptions and Correlates of openness to experience. *Handbook of personality psychology*, pp. 825-847.
- McGrath, J. E. (1984). *Groups: Interaction and performance*. Englewood Cliffs, NJ: Prentice-Hall.
- Mehta, R., & Zhu, R. (2009). Blue or Red? Exploring the Effect of Color on Cognitive Task Performances. *Science* (323), pp. 1226-1229.
- Mikulincer, M., Kedem, P., & Paz, D. (1990). Anxiety and Categorization: 1. The Structure and Boundaries of Mental Categories. *Personality and Individual Differences*, 11, pp. 805-814.
- Milliken, J., & Martins, L. L. (1996). Searching for Common Threads: Understanding the Multiple Effects of Diversity in Organizational Groups. *The Academy of Management Review*, 21(2), pp. 402-433.
- Mishina, Y., Pollock, T. G., & Porac, J. F. (2004). Are more resources always better for growth? Resource stickiness in market and product expansion. *Strategic Management Journal*, 25, pp. 1179-1197.
- Mone, M. A., McKinley, W., & Barker, V. L. (1998). Organizational decline and innovation: A contingency framework. *Academy of Management Review*, 23(1), pp. 115-132.
- Nouri, R., Erez, M., & Rockstuhl, T. (2013). Taking the bite out of culture: The impact of task structure and task type on overcoming impediments to cross-cultural team performance. *Journal of Organizational Behavior*.
- O'Hara, L. A., & Sternberg, R. J. (2001). It Doesn't Hurt to Ask: Effects of Instructions to Be Creative, Practical, or Analytical on Essay-Writing Performance and Their Interaction With Students' Thinking Styles. *Creativity Research Journal*, pp. 197-210.
- Offner, A. K., Kramer, T. J., & Winter, J. P. (1996). The effects of facilitation, recording and pauses upon group brainstorming. *Small Group Research*, 27(2), pp. 283-298.

Ohly, S., Sonnentag, S., & Plunkte, F. (2006). Routinization, work characteristics and their relationships with creative and proactive behaviors. *Journal of Organizational Behavior*, 27, pp. 257-279.

Pallant, J. (2010). *SPSS survival manual, 4th edition*. UK: McGraw-Hill Education.

Patel, N. (2015). *forbes.com*. Received 27th May 2018 from 90% Of Startups Fail: Here's What You Need To Know About The 10%: <https://www.forbes.com/sites/neilpatel/2015/01/16/90-of-startups-will-fail-heres-what-you-need-to-know-about-the-10/#501f1a9b6679>

Parker, S. K., Atkins, P. W., & Axtell, C. M. (2008). Building Better Workplaces through Individual Perspective Taking: A Fresh Look at a Fundamental Human Process. *International Review of Industrial and Organizational Psychology*, 1.

Patel, N. (2015). *forbes.com*. From May 28th, 2018 from 90% Of Startups Fail: Here's Why You Need To Know About The 10%: <https://www.forbes.com/sites/neilpatel/2015/01/16/90-of-startups-will-fail-heres-what-you-need-to-know-about-the-10/#501f1a9b6679>

Paulus, P. B. (2000). Groups, teams and creativity. *Applied Psychology International Review*, 49(2), pp. 237-262.

Paulus, P. B., Brown, V., & Ortega, A. H. (1996). Group Creativity. *Social Creativity in Organizations*.

Plucker, J. A., & Renzulli, J. S. (1999). Psychometric Approaches to Study of Human Creativity. I R. Sternberg, *Handbook of Creativity* (pp. 35-61). New York: Cambridge University Press.

Roskes, M. (2015). Constraints that Help or Hinder Creative Performance: A motivational Approach. *Creativity and Innovation Management*, 24(2), pp. 197-206.

Roskes, M., De Dreu, C. K., & Nijstad, B. A. (2012). Necessity is the mother of invention: Avoidance Motivation Stimulates Creativity through Cognitive Effort. *Journal of Personality and Social Psychology*, 103, pp. 242-56.

-
- Roskes, M., Elliot, A. J., Nijstad, B. A., & De Dreu, C. K. (2013). Time Pressure Undermines Performance more under Avoidance than Approach Motivation. *Personality and Social Psychology Bulletin*, *39*, pp. 803-13.
- Rosso, B. D. (2014). Creativity and Constraints: Exploring the Role of Constraints in the Creative Processes of Research and Development Teams. *Organization Studies*, *35*(4), pp. 551-585.
- Ridgway, N. M., & Price, L. L. (1994). Creativity under pressure: The importance of consumption situations on consumer product use. In Enhancing knowledge development in marketing: Perspectives and viewpoints. *Psychology and Marketing*, *11*, pp. 69-84.
- Rietzschel, E. F., De Dreu, C. K., & Nijstad, B. A. (2007). Personal Need for Structure and Creative Performance. *European Journal of Social Psychology*, *44*, pp. 855-66.
- Romeiro, A. A., & Wood, T. (2015). Bounded creativity: understanding the restrictions on creative work in advertising agencies. *Brazilian Administration Review*.
- Sacramento, C. A., Fay, D., & West, M. A. (2013). Workplace Duties or Opportunities? Challenge Stressors, Regulatory Focus, and Creativity. *Organizational Behavior and Human Decision Processes*, *121*, pp. 141-57.
- Salter, C. (2008). *Marissa Mayer's 9 principles of Innovation*. Retrieved April 18, 2018, from <http://www.fastcompany.com/702926/marissamayers-9-principles-innovation>
- Sawyer, R. K. (2007). *Group Genius: The Creative Power of Collaboration*. Cambridge: Perseus Books Group.
- Schumpeter, J. A. (1942). The Theory of Competitive Price. *The American Economic Review*, pp. 844-847.
- Shalley, C. E., & Gilson, L. L. (2004). What leaders need to know: A review of social and contextual factors that can foster or hinder creativity. *Leadership Quarterly*, *15*(1), pp. 33-53.
- Shalley, C. (2008). Creating roles: what managers can do to establish expectations for creative performance. I Z. J., & C. Shalley, *Handbook of Organizational Creativity*, pp. 147–164. New York: Erlbaum.

Shaw, E., & Carter, S. (2007). Social entrepreneurship: theoretical antecedents and empirical analyses of entrepreneurial processes and outcomes. *Journal of Small Business and Enterprise Development*, 14(3), pp. 418-434.

Shostack, G. L. (1988). Limitation is the mother of innovation. *Journal of Business Strategy*, 9(6), pp. 51-52.

Slijkhuis, J. M., Rietzschel, E. F., & Van Yperen, N. W. (2013). How Evaluation and Need for Structure Affect Motivation and Creativity. *European Journal of Work and Organizational Psychology*, 22, pp. 15-25.

Smith, C. A., & Lazarus, C. A. (1993). Appraisal Components, Core Relational Themes, and the Emotions. *Cognition and Emotion*, 7, pp. 233-96.

Stanovich, K. E., & West, R. F. (2000). Individual difference in reasoning: implications for the rationality debate? *Behavioral and Brain Sciences*, 23, pp. 645-726.

Sternberg, R. J. (1988). Mental self-government: A theory of intellectual styles and their development. *Human Development*, 31, pp. 197-244.

Sternberg, R. J., & Lubart, T. I. (1999). The Concept of Creativity: Prospects and Paradigms. I R. Sternberg, *Handbook of Creativity*, pp. 3-15. New York: Cambridge University Press.

Stokes, P. D. (1995). Learned variability. *Animal Learning and Behavior*, 23, pp. 164-175.

Stroebe, W., & Diehl, M. (1994). Why are group members less effective than their members: On productivity losses in idea-generating groups. *European Review of Social Psychology*, 5(1), pp. 271-303.

Stutton, R. I., & Hargadon, A. (1996). Brainstorming groups in context: Effectiveness in a production design firm. *Administrative Science Quarterly*, 41, pp. 658-718.

Taylor, D. W., Berry, P. C., & Block, C. H. (1958). Does group participation when using brainstorming facilitate or inhibit creative thinking? *Admin. Sci. Quart*, 3(1), pp. 23-47.

Terwiesch, C., & Loch, C. H. (2004). Collaborative prototyping and the pricing of custom-designed products. *Management Science*, 50(2), pp. 145-158.

-
- Ward, T. B. (1994). Structured Imagination: The role of category structure in exemplar generation. *Cognitive Psychology*, 27(1), pp. 1-40.
- Weiss, M., Hoegl, M., & Gibbert, M. (2012). Making virtue of necessity: The role of team climate for innovation in resource-constrained innovation projects. *Journal of Product Innovation Management*, 28(1), pp. 196-207.
- West, M. A. (2002). Sparkling fountains or stagnant ponds: An integrative model of creativity and innovation implementation in work groups. *Applied Psychology*, 51(3), pp. 355-424.
- Wheelwright, S. C., & Clark, K. B. (1992). *Revolutionizing Product Development*. New York: Free Press.
- Wilson, R. S., Boyle, P. A., Buchman, A. S., Yu, L., Arnold, S. E., & Bennett, D. A. (2011). Harm Avoidance and Risk of Alzheimer's Disease. *Psychosomatic Medicine*, pp. 690-696.
- Wilson, C., & Stokes, D. (2005). Managing creativity and innovation: The challenge for cultural entrepreneurs. *Journal of Small Business and Enterprise Development* (3), pp. 366-378.
- Zhang, Z., & Bartol, K. M. (2010). Linking Empowering Leadership and Employee Creativity: The Influence of Psychological Empowerment, Intrinsic Motivation and Creative Process Engagement. *Academy of Management Journal*, 53, pp. 107-28.
- Zhou, J. (1998). Feedback valence, feedback style, task autonomy, and achievement orientation: interactive effects on creative performance. *Journal of Applied Psychology*, pp. 261-276.

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A Written Material for Respondents

A.1 Invitation

The invitation to the experiment distributed to a selection of Norwegian businesses and master students at The Norwegian School of Economics is included below.

This message is for Norwegian speaking students and employees only

Informasjonsskriv om undersøkelse

Kjære fremtidige deltagere,

Vi ønsker med dette å invitere deg til å delta i vårt mastereksperiment om idégenerering i innovasjonsprosesser, og vi håper du kan tenke deg å bidra. Som respondent i vår undersøkelse vil vi som takk for hjelpen kunne sende deg våre resultater senere i vår.

Gjennomføringen vil ta ca. 20 minutter, og du vil bli satt til å løse en liten og interessant oppgave. Eksperimentet vil finne sted gjennom den nettbaserte løsningen Qualtrics, og det vil i løpet av kort tid bli distribuert en link dit.

Du kan trykke «attending» på dette arrangementet dersom du ønsker å delta.

Det vil ikke lagres noen personsensitive data i forbindelse med undersøkelsen, og deltagelse er frivillig. For å få tilsendt resultatene vil vi kun be deg sende din kontaktinformasjon til oss per e-post. Dette vil ikke kobles til din besvarelse, vi vil imidlertid trenge å ta vare på din kontaktinformasjon til masteroppgaven er levert.

Vi håper at du ønsker å delta!

Vennlig hilsen

Philippa K. Tronstad

Philip P. Lindberg

A.2 Consent Form

Included below is the consent form sent to the participants.

Forespørsel om deltakelse i forskningsprosjektet

Idégenerering som et ledd av innovasjonsprosesser

Bakgrunn og formål

Forskningsprosjektet utføres i forbindelse med en mastergradsoppgave ved Norges Handelshøyskole (NHH), ved avdeling for strategi og ledelse. Formålet med oppgaven er å få innsikt i kreativ tenkning og idéutvikling gjennom å presentere et utvalg respondenter for en fiktiv caseoppgave, som skal løses innen en gitt tidsramme.

Du er bedt om å være en del av et større utvalg da du enten er student eller i fulltidsarbeid.

Hva innebærer deltakelse i studien?

Forsøket vil kreve cirka 20 minutter av din tid, men du har en uke på å levere inn en besvarelse. Oppgaven vil omhandle hvordan du skal løse en økonomisk utfordring et norsk lakseoppdrettselskap står overfor. Du vil også bli spurt om å oppgi informasjon om alder, kjønn, arbeidsstatus og stilling eller om du er student. All informasjon vil du bli bedt om å registrere på nett, og du må ha tilgang til en data, nettbrett eller smarttelefon for å ta del i forsøket.

Hva skjer med informasjonen om deg?

Alle personopplysninger vil bli behandlet konfidensielt. Som deltaker i forskningsprosjektet vil du ikke kunne identifiseres gjennom noen direkte personopplysninger. Vi vil for eksempel aldri be om ditt navn.

Datainnsamlingen vil finne sted i løpet av april, og prosjektet skal etter planen avsluttes i juni. All datainnsamling vil bli anonymisert. Vi vil benytte Qualtrics som databehandler, som i en kortere periode, under og etter innsamling, vil ha tilgang til dataen. Eksamenssensor, vår samarbeidspartner Bergen Teknologioverføring AS (BTO), veileder og forfatterne av masteroppgaven vil også ha tilgang til dataen. Den innsamlede dataen vil bli slettet når prosjektet er over.

Frivillig deltakelse

Det er frivillig å delta i studien, og du kan når som helst trekke ditt samtykke uten å oppgi noen grunn. Dersom du trekker deg, vil alle opplysninger om deg bli anonymisert.

Dersom du ønsker å delta eller har spørsmål til studien, ta kontakt med Philippa K. Tronstad på telefon 934 94 740. Veileder i masteroppgaven, Magne Supphellen, kan også nås på telefon 55 95 94 21.

Studien er meldt til Personvernombudet for forskning, NSD - Norsk senter for forskningsdata AS.

Samtykke til deltakelse i studien

Jeg har mottatt informasjon om studien, og er villig til å delta

(Signert av prosjektdeltaker, dato)

B Written Material for Experiment

B.1 Instructions

Below follow the instructions distributed to each of the respondents in the experiment.

Hei, og tusen takk for at du tar deg tid til å delta i vårt mastereksperiment. Forsøket er anonymt, og ingen direkte personopplysninger vil bli innhentet.

Du vil først bli stilt noen korte spørsmål om deg selv, før oppgaveteksten blir presentert.

Eksperimentet vil være tilgjengelig på nett frem til midnatt den 13. april. Du kan når som helst ta testen i løpet av forsøksperioden. Du kan imidlertid ikke gå inn og ut av testen. Beregnet testtid er 15 til 20 minutter.

Ingen hjelpemidler eller forkunnskaper er påkrevd, men om noe skulle være uklart kan ansvarlig kontaktes på 934 94 740.

Når instruksene er forstått kan du gå videre ved å krysse av her:

Instruksene er forstått, jeg er klar

B.2 Experimental Cases

The case assignments used in the experiment are included below. The manuscripts for the control group and the three treatment groups; the financial constrained treatment group, the task structured constrained treatment group and the financial and task structured constrained treatment group are all included, as they slightly differ from each other.

Case Assignment for the Control Group

Du jobber med innovasjon i et norsk lakseoppdrettselskap. Selskapet omsetter årlig for 400 millioner kroner. Gjennomsnittlige salgsprisen per kilo fersk laks ligger på 50 kr, men forventes å synke i tiden som kommer. Gjennomsnittlige produksjonskostnaden har økt betraktelig og ligger nå på over 40 kr per kilo. Det forventes at gjennomsnittlige produksjonskostnad øker ytterligere i tiden som kommer.

Situasjonen medfører en stor fare for selskapets fremtidige resultat. Ledelsen har derfor bedt deg om å legge frem en rekke forslag til hva selskapet bør gjøre for å imøtekomme sine utfordringer.

Skriv inn dine idéer i tekstboksene under. Skriv så mange idéer som mulig. En idé trenger ikke være lengre enn en til to setninger. En idé per boks.

Case Assignment for the Financial Constrained Treatment Group

Du jobber med innovasjon i et norsk lakseoppdrettselskap. Selskapet omsetter årlig for 400 millioner kroner. Gjennomsnittlige salgsprisen per kilo fersk laks ligger på 50 kr, men forventes å synke i tiden som kommer. Gjennomsnittlige produksjonskostnaden har økt betraktelig og ligger nå på over 40 kr per kilo. Det forventes at gjennomsnittlige produksjonskostnad øker ytterligere i tiden som kommer.

Situasjonen medfører en stor fare for selskapets fremtidige resultat. Ledelsen har derfor bedt deg om å legge frem en rekke forslag til hva selskapet bør gjøre for å imøtekomme sine utfordringer. Et konkret forslag kan ikke koste mer enn 5 millioner kroner å gjennomføre.

Skriv inn dine idéer i tekstboksene under. Skriv så mange idéer som mulig. En idé trenger ikke være lengre enn en til to setninger. En idé per boks.

Case Assignment for the Task Structure Constrained Treatment Group

Du jobber med innovasjon i et norsk lakseoppdrettselskap. Selskapet omsetter årlig for 400 millioner kroner. Gjennomsnittlige salgsprisen per kilo fersk laks ligger på 50 kr, men forventes å synke i tiden som kommer. Gjennomsnittlige produksjonskostnaden har økt betraktelig og ligger nå på over 40 kr per kilo. Det forventes at gjennomsnittlige produksjonskostnad øker ytterligere i tiden som kommer.

Situasjonen medfører en stor fare for selskapets fremtidige resultat. Ledelsen ønsker å øke selskapets inntekter gjennom å selge mer til unge voksne i alderen 18 til 25 år. Du har derfor blitt bedt om å legge frem en rekke forslag til hvordan selskapet kan realisere dette målet.

Skriv inn dine idéer i tekstboksene under. Skriv så mange idéer som mulig. En idé trenger ikke være lengre enn en til to setninger. En idé per boks.

Case Assignment for the Financial and Task Structure Constrained Treatment Group

Du jobber med innovasjon i et norsk lakseoppdrettselskap. Selskapet omsetter årlig for 400 millioner kroner. Gjennomsnittlige salgsprisen per kilo fersk laks ligger på 50 kr, men forventes å synke i tiden som kommer. Gjennomsnittlige produksjonskostnaden har økt betraktelig og ligger nå på over 40 kr per kilo. Det forventes at gjennomsnittlige produksjonskostnad øker ytterligere i tiden som kommer.

Situasjonen medfører en stor fare for selskapets fremtidige resultat. Ledelsen ønsker å øke selskapets inntekter gjennom å selge mer til unge voksne i alderen 18 til 25 år. Du har derfor blitt bedt om å legge frem en rekke forslag til hvordan selskapet kan realisere dette målet. Et konkret forslag kan ikke koste mer enn 5 millioner kroner å gjennomføre.

Skriv inn dine idéer i tekstboksene under. Skriv så mange idéer som mulig. En idé trenger ikke være lengre enn en til to setninger. En idé per boks.

B.3 Experimental Questionnaire

In the following pages, the questionnaire from our study is included. This questionnaire was answered on a computer, after the respondents finished their task assignment. The respondents in the control group and the three treatment groups all received the same questionnaire.

Kjønn

- Kvinne
- Mann
- Annet
-

Alder

- 20-29
- 30-39
- 40-49
- 50-59
- 60 +
-

Anser du deg selv først og fremst som student eller er du i fullt arbeid?

- Student
- I fullt arbeid

Hvilken studieretning går du?

Hvilken bransje arbeider du innen?

Hva er din stillingstittel?

Til slutt kommer det noen påstander der vi er ute etter din subjektive mening. Vennligst svar så ærlig som mulig.

Skalaen går fra svært uenig og til svært enig

	Svært uenig	Ganske uenig	Noe uenig	Verken enig eller uenig	Noe enig	Ganske enig	Svært enig
Jeg er alltid på utkikk etter positive muligheter og opplevelser	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Jeg foretrekker ofte å gjøre ting alene	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Det er lett for meg å forestille at negative utfall vil inntreffe meg	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Når jeg ønsker noe går jeg ofte "all inn" for å oppnå det	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Når ting går meg i mot kan jeg ofte tenke at jeg ønsker å gi opp	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Jeg er ofte bekymret for å gjøre feil	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Jeg synes kreativ tenking og idéutvikling er gøy	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Jeg bruker mye av min fritid på innovativt arbeid	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Til daglig jobber jeg, på arbeidsplass eller studiested, med innovasjonsrettete oppgaver	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Jeg likte å arbeide med denne oppgaven	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Det lå naturlig for meg å jobbe med denne oppgaven	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Jeg har god kjennskap til fiskerinæringen fra før	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Avslutningsvis ønsker vi å høre om du hadde noen tekniske problemer underveis

- Ja
- Nei

Hva slags tekniske problemer hadde du?

C Descriptive Statistics

Table C.1: Frequency Table for Age

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	20-29	61	45.5	45.5	45.5
	30-39	15	11.2	11.2	56.7
	40-49	11	8.2	8.2	64.9
	50-59	38	28.4	28.4	93.3
	Over 60	9	6.7	6.7	100.0
	Total	134	100.0	100.0	

Table C.2: Frequency Table for Gender

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Female	59	44.0	44.0	44.0
	Male	75	56.0	56.0	100.0
	Total	134	100.0	100.0	

Table C.3: Frequency Table for Group

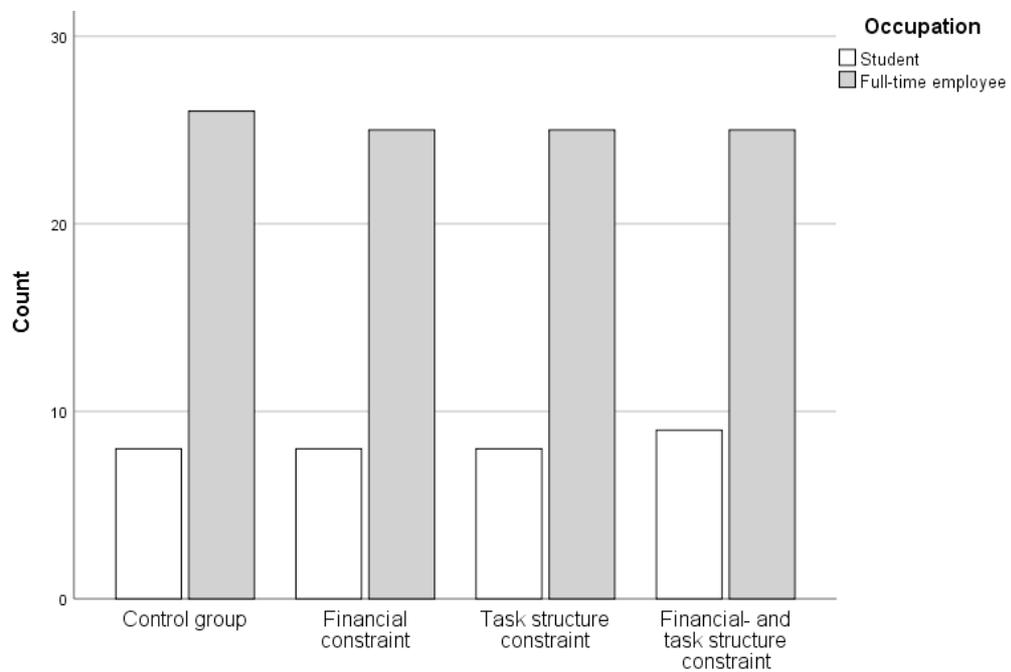
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Control group	34	25.4	25.4	25.4
	Financial constraint	33	24.6	24.6	50.0
	Task structure constraint	33	24.6	24.6	74.6
	Financial- and task structure constraint	34	25.4	25.4	100.0
	Total	134	100.0	100.0	

Table C.4: Frequency Table for Occupation

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Student	33	24.6	24.6	24.6
	Full-time employee	101	75.4	75.4	100.0
	Total	134	100.0	100.0	

Table C.5: Frequency Table for Group x Occupation

Group		Occupation		Total
		Student	Full-time employee	
Control group		8	26	34
Financial constraint		8	25	33
Task structure constraint		8	25	33
Financial- and task structure constraint		9	25	34
Total		33	101	134

Table C.6: Group x Occupation bar chart

D Factor Analysis and Scale Reliability Check

Table D.1: KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.	.719
Bartlett's Test of Sphericity	Approx. Chi-Square
	561.290
	df
	66
	Sig.
	.000

Table D.2: Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	3.863	32.194	32.194	3.863	32.194	32.194	2.756	22.968	22.968
2	2.013	16.779	48.973	2.013	16.779	48.973	2.247	18.723	41.691
3	1.242	10.349	59.321	1.242	10.349	59.321	1.788	14.896	56.587
4	1.002	8.354	67.675	1.002	8.354	67.675	1.331	11.088	67.675
5	.807	6.727	74.402						
6	.717	5.977	80.379						
7	.658	5.484	85.863						
8	.511	4.255	90.118						
9	.379	3.156	93.274						
10	.346	2.882	96.156						
11	.280	2.330	98.486						
12	.182	1.514	100.000						

Extraction Method: Principal Component Analysis.

Table D.3: Total Variance Explained

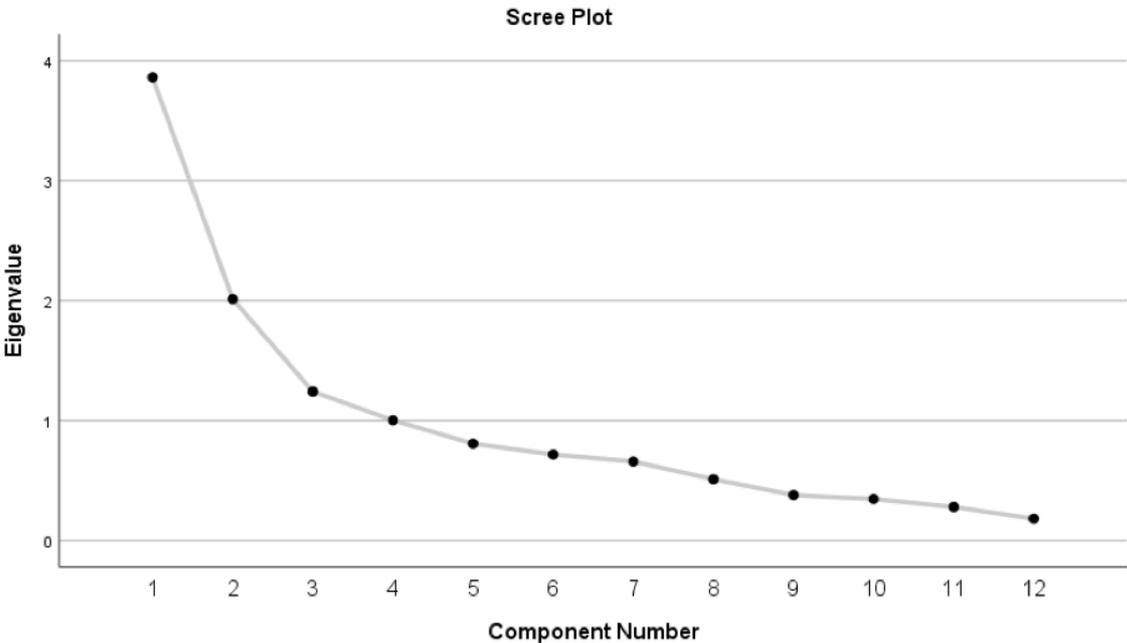


Table D.4: Rotated Component Matrix^a

	Component			
	Intrinsic Motivation	Avoidance Motivation	Approach Motivation	Control
I enjoy creative thinking and idea development	.636		.310	
I spend a lot of my spare time on innovative work	.751			
On a daily basis, I work with or study at a place with innovative tasks	.831			
I enjoyed working with this task	.646			.471
It was natural for me to work with this task	.731			.366
It is easy for me to expect that negative outcomes will happen to me		.818		
Too often, when things go wrong, I get discouraged and feel like giving up		.767		
I worry about making mistakes		.844		
I am always on the lookout for positive experiences and opportunities		-.363	.763	
When I want something I usually go all-out to get it			.812	
I usually prefer to do things alone			.509	.596
I have in-depth knowledge of the Norwegian fish farming industry.				.745

Extraction Method: Principal Component Analysis.

Rotation Method: Varimax with Kaiser Normalization.

Table D.5: Approach motivation

Cronbach's Alpha	N of Items
.620	3

Table D.6: Avoidance motivation

Cronbach's Alpha	N of Items
.793	3

Table D.7: Intrinsic motivation

Cronbach's Alpha	N of Items
.808	5

E Test of Assumptions

Table E.1: Descriptive Statistics

	N	Skewness		Kurtosis	
	Statistic	Statistic	Std. Error	Statistic	Std. Error
Index for Approach Motivation	134	-.942	.209	.583	.416
Index for Avoidance Motivation	134	.324	.209	-.641	.416
Index for Intrinsic Motivation	134	-.480	.209	.486	.416

Table E.2: Levene's Test of Equality of Variance

	Levene Statistic	Sig.
Approach Motivation	2.094	.104
Avoidance Motivation	0.271	.846
Intrinsic Motivation	.423	.737

F Additional Findings

Table F.1: Preacher and Hayes (2008) SPSS Macro for Multiple Mediation

Preacher and Hayes (2008) SPSS Macro for Multiple Mediation Mediating Variable: Intrinsic Motivation	0 = Control Group 1= Financial Constraint, Task Structure Constraint and Financial- and Task Structure Constraint	
Dependent Variables		
<i>Appropriateness</i>	B	Sig.
IV to Mediators		
Intrinsic Motivation	-0,52	0,03
Direct Effects of Mediators on DV (b paths)		
Intrinsic Motivation	-0,01	0,87
Total Effect of IV on DV (c path)	0,27	0,53
Financial-, Task Structure- and Financial- and Task Structure Constraint		
Direct Effect of IV on DV (c' path)		
Financial-, Task Structure- and Financial- and Task Structure Constraint	0,26	0,63
<i>Novelty</i>	B	Sig.
IV to Mediators		
Intrinsic Motivation	-0,52	0,03
Direct Effects of Mediators on DV (b paths)		
Intrinsic Motivation	0,77	0,16
Total Effect of IV on DV (c path)	0,27	0,07
Financial-, Task Structure- and Financial- and Task Structure Constraint		
Direct Effect of IV on DV (c' path)		
Financial-, Task Structure- and Financial- and Task Structure Constraint	0,40	0,39

Significance level: * 5%; ** 1%

Table F.2: The Best Generated Idea in each Test Group

Test Group	Appropriateness	Novelty	Idea
Control Group	6,2	6,3	<i>Turisme kombinert med lakseoppdrett for å utnytte beliggenhet av anlegg og utstyr (båter m.m.), kombinert med fjord- og agroturisme.</i>
Financial Constraint	6,35	5,25	<i>FoU: Redusere fremvekst av lus og sykdom for å få en høyere prosent av merden til salgbar vare.</i>
Task Structure Constraint	5,9	6,2	<i>Kampanje hvor man sammenligner fisk og (rødt) kjøtt mtp. klimautslipp. Fisk er bedre, og global oppvarming opptar unge.</i>
Financial and Task Structure Constraint	6,38	5,5	<i>Bygg et ungt og hipt brand med merkeambassadører som representerer sunnhet, norske tradisjoner, samt er populære blant målgruppen.</i>