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FACULTY OF BUSINESS ECONOMICS
Master of Management

Master's thesis

The role of individual level creativity in the Open Innovation process

Supervisor :
Prof. dr. Anna ROIJAKKERS

Alin-Dumitru Cojocaru

Thesis presented in fulfillment of the requirements for the degree of Master of Management

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Abstract

Having into consideration that the Open Innovation research dealt primarily with the macro-foundations of the firm, it is of great interest to shed light on its micro-foundations, namely the human factor. This study attempts at enriching our understanding of the Open Innovation process in terms of individual level implications. Valuable insight can be gained by a better understanding on how, empirically, componential factors of creativity contribute to the Open Innovation process. The aim was to uncover the relationship between creativity at the individual level, and the Open Innovation process. Therefore, componential factors of creativity were developed in accordance with the OI existing literature, and tested to observe their impact on the overall individual's creative performance in collaborative settings.Analyzing the data from a self- administered survey, the central findings of this thesis, indicate a positive relationship between the Open Innovation and the individual- level creativity. The results of the study underpin latter awareness of further investigating the Open Innovation micro foundations (Chesbrough et al., 2014).

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"*Open innovation means mass collaboration. It is a highly interactive process where an undefined number of individuals is communicating intensively and engages in cooperation and exchange*" (OIA survey, 2013)

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Be	Belgium
De	Germany
EU	European Union
H_0	Null Hypothesis
H_1	Alternative Hypothesis
IP	Intellectual Property
IT	Information and Technology
NIH	Not Invented Here
OI	Open innovation
R&D	Research and Development
Ro	Romania
Sig.	Significant

1.Introduction

Creativity happens everywhere in our lives, and it is very unpredictable. Therefore, our biggest challenge is to make the most out of our creative ideas. In this regard, Open Innovation (OI) broadens our horizons in various ways, allowing us to leverage other individuals' creative ideas but likewise expose ours, consequently maximizing the output of our creativity. Nowadays, turning a creative idea into innovation is totally different from what it was few decades ago. Innovation is a people process, therefore the factors that foster creativity ought to be prioritized and nurtured by every company. Organizing an environment that fosters creativity is a delicate task for most organizations. Moreover, orchestrating the factors that foster creativity requires specific skills, considering that individuals react differently to those factors. Although sheer number of studies provide an understanding on the way OI is managed at the organizational level, the micro foundations have not been yet in depth explored.

This thesis sheds light on the relationship between creativity at the individual level (human factor) and the OI process (organizational factor). By embedding OI specific factors into existing componential models of creativity, the most important aspects that contribute to the creative process are consequently determined. In addition to this, this research adopts an individual centric approach, thus the emphasis is on the individual's role in the open creation process.

Componential models of creativity have been traditionally used when assessing the creative process, whether tackling the organizational or individual level. The model proposed in this research embedded elements of OI into the traditional conceptual model. To the best of my knowledge no research has yet attempted to test componential models of creativity in OI settings, more specifically at the individual level. For better addressing the challenges individuals face when engaging in collaborative creation activities, the factors that impact individual's creative habit the most, have been thus investigated. Especially for companies engaging in OI activities, it is crucial to provide individuals with an environment that nurtures creativity, and concentrates on improving and sustaining the factors that trigger the open

creation process. This study provides managers with a better understanding of the creation process at the individual level, when involving in OI activities. Moreover, it highlights the importance of enhancing creativity when opening up the firm's boundaries.

1.1 Objective of the study

In recent years, open innovation (OI) has become an integral part of many companies' overall strategy. It is frequently acknowledged that OI facilitates the process of knowledge generation and sharing, as well as its successful application. Creatively using knowledge enhances the organization's ability to successfully innovate and attain the competitive advantage. Collaborating with external partners represents an opportunity to capture a wide base of external knowledge, as well as generating ideas that are impossible to achieve by the company itself. We can easily notice that nowadays innovation increasingly depends on the inflow of ideas from outside firm's boundaries, as well as on leveraging capabilities in order to strengthen the firm's ability to cope with the harsh competition. During the last decade, we have witnessed OI growing and flourishing on both research and practice fields. Researchers and scholars tackled this topic from various perspectives, currently OI having its own dedicated research area. Nevertheless, when approaching open innovation from a holistic or integrative perspective there is still a research gap as well as many unanswered questions (Chesbrough, Enkel, Gassman, 2010; Mortara and Minshall 2011).

It has sparked my curiosity that no research yet has been linking the creativity at the individual level to the OI process, hence this paper aims at addressing this gap by investigating this relationship. Furthermore, the componential factors of creativity in OI contexts are examined as well. Creativity has been widely discussed and approached from different angles. The behavioral sciences (psychology) have been primarily focusing on creativity, whereas the managerial side offers less insight into the creativity implications at the individual level. Through the last couple of years, amongst the various studies from innovation management, OI has become the central topic in both research and practice. The burgeoning OI research area covers various topics, however mostly at the organizational level, whereas the human

factor has not yet received much attention. Nonetheless, lately there is indeed awareness of the need of exploring this side (Chesbrough, Vanhaverbeke and West, 2014). I will therefore depict the OI process to its micro levels, namely the individual level, and explore the componential factors of creativity specific in collaborative knowledge creation contexts.

Chesbrough, Vanhaverbeke and West (2006), distinguish five levels for prospective open innovation research: *individual and groups, organization, inter-organizational value networks, industry/sector,* and *national institutions and innovation systems.*

Moreover, Chesbrough and Bogers (2014) suggest a list of possible research objects (Table 1.1), amongst which the *individual* level. It can also be noticed that the individual level is regarded in both intra and extra-organizational units of analysis.

Unit of Analysis	Possible Research Object
Intra-organizational	Individual Group/Team Project Functional area Business unit
Organizational	Firm Other (non-firm) organization Strategy Business model
Extra-organizational	External stakeholders: individual, community, organization
Inter-organizational	Alliance Network Ecosystem
Industry	Industry development Inter-industry differences
Regional innovation systems	Local region Nation Supra-national institution
Society	Citizens Public policy

Table 1.1 Possible units of analysis and research objects for open innovation research[1]

[1] *Chesbrough and Bogers, in "New Frontiers in Open Innovation", 2014, p. 26*

Individual's creativity can considerably impact the business's innovativeness, effectiveness, and hence its survival (Amabile 1996, Nonaka 1991). During the last three decades, several scholars and practitioners have leveraged the insights provided in the componential model of creativity and innovation proposed by Amabile (1998). Other researchers have shown interest in identifying the factors that trigger individual's innovation. Accordingly, they found factors as personal or contextual, and their interaction likewise to be facilitating the innovative habit (Kanter 1988).

One of the most frequently asked questions by entrepreneurs nowadays *is finding the creative individuals or finding creative ideas?* Innovation, usually involves many individuals that together effectively create new products or services. Most companies nowadays focused on the process of OI itself rather than on the individuals that lay the foundation for new or improved products or services.

There is a great challenge for managers when providing the necessary conditions and the right context that can boost individuals with innovativeness and creativity (Shalley and Gilso, 2004). It is important to study the role of individuals in the open innovation process in order to capture the insights that can provide companies and managers with information that will eventually help organize, stimulate, manage, or incentivize individuals to openly innovate. These capabilities may indeed improve the open innovation process performance as well as potentially fostering the firm's competitive advantage.

To sum this up, the present paper aims at contributing to the existing literature by adopting an "*individuals"* centric approach, likewise through stressing out the importance of individual-level creativity in the context of OI.

1.2 Research question

To the best of my knowledge, little empirical research attempted to tackle the relationship between creativity and the OI process. It is therefore interesting to shed some light on this topic by answering the proposed research question. Before tapping into the main research question, it is important to acknowledge that the OI process is a people process and keeping up a flow of creative ideas within the company is crucial within today's economic environment. The main pillar of innovation is creativity, hence to enrich our understanding of the way creativity is assessed at the innovation process' micro levels, it is necessary to look beyond organizational creativity and determine the factors that affect individual- level creativity. In addressing this, based on existing studies that tackled the topics of creativity and innovation, a conceptual framework is proposed, emphasizing on the factors that are believed to impact the individual- level creativity. Companies often fail to identify the creative individuals within or outside the business, and allocate the task of creating to, for instance, R&D departments. Opening up the innovation process, can enhance creativity by allowing individuals to tap into the broad knowledge base that is not internally accessible. Hereby the main research question:

What is the relationship between individual's creativity and the open innovation process?

Further, I developed a set of research sub-questions that added up will help answering the main research question. In today's increasingly competitive environment, organizations often find themselves leveraging externally developed capabilities for better addressing their customer's needs. In most of the cases, organizational decisions can influence the way individuals create. To this extent, companies must create a creativity favorable environment intended to positively impact their performance. Orchestrating this, requires that companies first understand the individual's needs, and consequently efficiently addresses them.

Since creativity has been traditionally investigated within the field of behavioral sciences (psychology), it is beyond this paper's purpose to provide a full review of the concept; nevertheless, the most important aspects of creativity ought to be addressed.

The present literature review covers both the creativity and OI concepts emphasizing on the individual- level implications. Creativity has been likewise given several definitions, and has been tackled mostly at the organizational level. The traditional approach of innovation implies that all the innovative and creative processes must be developed internally without collaborations or any other form of external involvement. OI however, stresses out the importance of leveraging creative ideas from outside the firm boundaries, so that individuals can tap into the ideas that cannot always be developed by the company itself. The main research question has been further depicted into five sub-questions that tackle the main aspects concerning the relationship between creativity and the OI process. Hereby, the research secondary questions that add up to answering the overall problem statement:

- ***What are the componential factors of Individual-level creativity in OI contexts?***
- ***What motivates individuals to openly create?***
- ***How does individual-level creativity impact the OI process?***
- ***What are the challenges associated with the creative process for individuals in an OI setting?***

2. Theoretical background

This chapter provides an overview on the general findings of prior research, as well it integrates characteristics of both creativity and OI. Further, the literature background is built by emphasizing on the link between theory and the secondary research questions proposed to answer the overall problem statement.

2.1 Creativity at the individual level

This part of the paper explores the central findings of creativity literature, the process of creativity, and componential models of creativity, stressing out the individual –level implications. In the past years organizational creativity has been extensively studied by many researchers, however in terms of open innovation there is still a research gap when tackling it from individual- level perspective. Creativity and innovation have been traditionally connected with two different research areas. Therefore, creativity has been studied mostly by the researchers in the behavioral sciences (psychology), whereas OI captured mostly the attention of researchers from economy or the innovation management field. Creativity is a very complex concept, and the various definitions that it has been given offer multiple similarities but contradiction likewise. Amabile and Hennessey (2010) define creativity as an idea or solution that can be novel and potentially useful. Creativity must involve radical innovation or propose solutions to a problem (Newell and Shaw, 1972). In a more recent definition, Sawyer (2012) describes creativity as *"the generation of a product that is judged to be novel and also to be appropriate, useful, or valuable by a suitably knowledgeable social group".* Creativity is traditionally associated with creating something that is novel. In a recent interview Jacque Fresco stated that creativity means taking the known elements and putting them together in different ways, moreover he argues that individuals usually create through the frame of reference. Bartunek (1998) also refers to creativity as the *"transformation through reframing".*

Researchers believe that creativity is a personality trait, rather than something that can be personally crafted (Amabile, 1994). Creativity has its origin in an individual's ability to respond to new challenges, the way they manage to do that being of personality nature. Stein (1974) also explores the personality factors of creativity, and argues that individuals who are intolerant of ambiguities and the unknown are less likely to create. Moreover, the author suggests that a rigid tradition-bound behavior impedes the creative process, and that in order to be creative individuals must have freedom to explore, to pursue certain ideas, and to inhibit curiosity and exploration as well. This type of behavior seems to go hand in hand with OI, since the concept implies exploration and openness towards new ideas and external sources of knowledge. Kao (1996) refers to creativity as the whole process of generating, developing, and transforming of ideas into value. Henceforth, in an OI setting it is not just about finding the creative novel ideas or solutions, it goes beyond this and requires that individuals find creative ways to tap into and efficiently take benefit of those ideas. Creativity is frequently confused with innovation, although the concepts are different but interdependent in order to successfully benefiting from innovation. While creativity is the generation of novel ideas or perspectives, innovation on the other hand entails the implementation of those novel ideas, thus creativity and innovation being mutually dependent (Oldham and Cummings, 1996). Creativity manifests under two forms, firstly adaptive creativity which refers to solutions to existing products or services, and secondly radical creativity referring to breakthroughs that somehow revolutionize a certain sector. Amabile (1988) argues that without creative ideas from individuals there is no innovation in a company. In other words, creativity is the pillar of innovation. Moreover, the author suggests a mutual influence between the individual and the organization, thus the individual creator influences what happens in the company, and the company influences the way individuals create. Woodman et al. (1993) highlight likewise the importance and influence of individual-level creativity for the organizational innovation. Individual-level creativity is of crucial importance because it can enhance the business' ability to attain and sustain the competitive advantage. Creativity is the organization's most valuable resource, and it is believed to be facilitated when crossing the firm's boundaries to leverage the external environment (Carlile, 2004). Gardner (1993) argues that creativity originates from

the interplay of individual's behavior, the work domain in which that behavior occurs, and the social arrangement in which they occur.

The author furthermore portrays the creative individual as someone who: *"regularly solves problems, fashions products, or defines new questions in a domain in a way that is initially considered novel but that ultimately becomes accepted in a particular cultural setting"* (Gardner, 1993, p. 35).

Amabile's great body of literature on creativity entails a well-recognized componential model of creativity, which over the years has been undergoing through significant changes. With respect to the individual- level creativity, the author originally proposes a model (Fig 2.1) which suggests that creativity entails four elements: task motivation, domain relevant skills, creativity relevant processes, and the social environment. Undoubtedly, depending on the circumstances creativity occurs, other various factors can alter the process of creativity, this varying in terms of both organization's characteristics and individual's ones. However, the components covered by the model below are mostly referred to when tackling creativity at the individual- level.

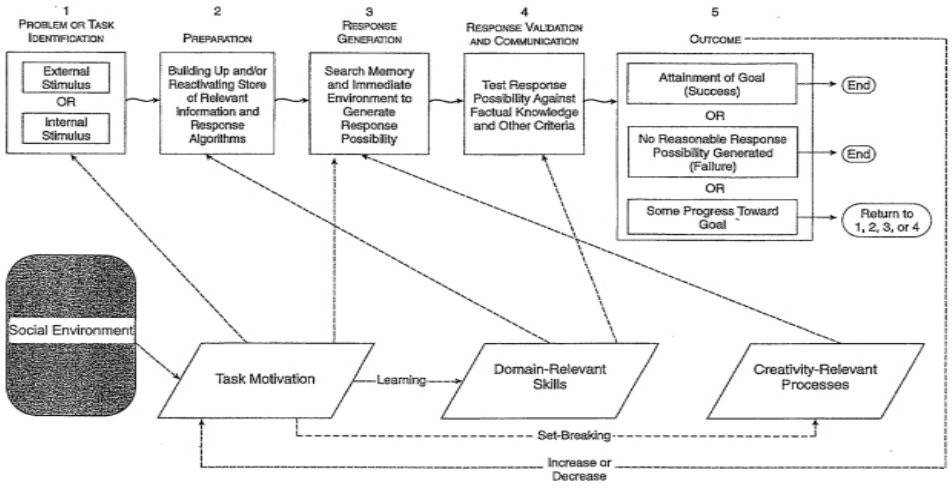


Figure 2.1 The componential model of individual-level creativity, Amabile (1988)

Amabile and Kramer (2011) argue that individual's creativity results from a combination of positive perceptions, pleasant emotions, and strong intrinsic motivation. In addition to this, the authors found that this combination of perceptions fosters creative ideas in individuals, as well as it impacts the bottom-line performance of the organization.

Moreover, a recent revised version of the model (Amabile and Pratt, 2016), built upon several theories on creativity, entails new dimensions that are believed to positively affect the individual's creation process. One notable factor that comes in addition to what the previous model entailed, is the extrinsic motivation and most important its impact on the overall creative process.

The individual creative behavior has been thoroughly investigated, several authors developing models which map out the elements that add to the individual's ability to create. Woodman et al. (1993) for instance, suggest that in order to understand creativity one should not only focus on individual factors, but also examine the context in which creativity occurs. The authors also add that creativity is affected by a variety of social or contextual factors, which can both constrain or facilitate the creative process. Having presented various descriptions of creativity, one might only notice that to some extent most authors provide similar thoughts. However, since creativity is a complex and inexhaustible research topic, there are still differences in opinions while defining creativity or the creative process.

To better highlight the importance of individual- level creativity, notable examples of efficiently managing creativity are companies like Google or 3M, that have managed to shape and sustain a culture that supports individual creativity and innovation. 3M commercializes more than 60.000 products worldwide, which requires a very large portfolio of creative ideas sourced from individuals worldwide. They encourage individuals and their creativity by engaging them in collaborative activities, also at their own initiative, since the company has a policy that allows individuals to use 15% of their time to be spent on pursuing ideas that are not task related. Moreover, due to their open culture, individuals across the company's departments, from different countries, and different specializations, manage to openly create by adding up their skills to better address the customers' needs. In recent years, this approach

has been embraced by other companies likewise. Google for instance, harnesses creativity by allowing engineers to spend 20% of their time on projects that are independent and interest them personally. The company believes that this empowers individuals to be more creative and innovative.

2.2 The link between creativity and the OI process

Creativity has been studied from various perspectives, researchers focusing on it as a source of individual's personality (Feist, 1999), the hard-working spirit (Amabile, 2001), the level of openness, risk taking or confidence (Martindale, 1989), and so forth. In their study based on personal characteristics, Oldham and Cummings (1996) found that the individuals with creative personality are more likely to adopt creative initiatives. Before proceeding to linking the two concepts it is necessary to have a brief understanding of the OI concept and the Individual- level implications. In this regard, the types of openness an individual is exposed to when involved in OI activities are likewise highlighted.

It has been more than a decade since the term open innovation has been mentioned for the first time by Professor Henry Chesbrough (2003), and since then we have witnessed many companies getting involved in, and implementing this innovation approach. We can notice after all these years that OI moves towards globalization, more and more companies are seeking for creativity beyond their boundaries in order to cope with the competition. Meanwhile, this new way of innovating captured the attention of a large number of researchers, thus creating its own research area.

Every company's uniqueness is defined to some extent by the way innovation processes are designed and assessed. Building a unique OI or open business model requires creativity, and obviously, resources. Something clear that we can observe in today's highly competitive global markets is that companies have been struggling with improving existing products and services, R&D processes, or perhaps creating ways of reaching new markets. Having access to the creative individuals has not been either the easiest task for organizations. Open innovation

comprises a wide range of manifestations, and undoubtedly the human factor contributions are different from a situation to another.

The open innovation process comprises three core archetypes (fig.2): the inside out, outside in, and the coupled one (Gassman and Enkel, 2004; Chesbrough and Bogers, 2014). These three archetypes have been since then adopted by many authors and practitioners as the core framework of the overall OI process.

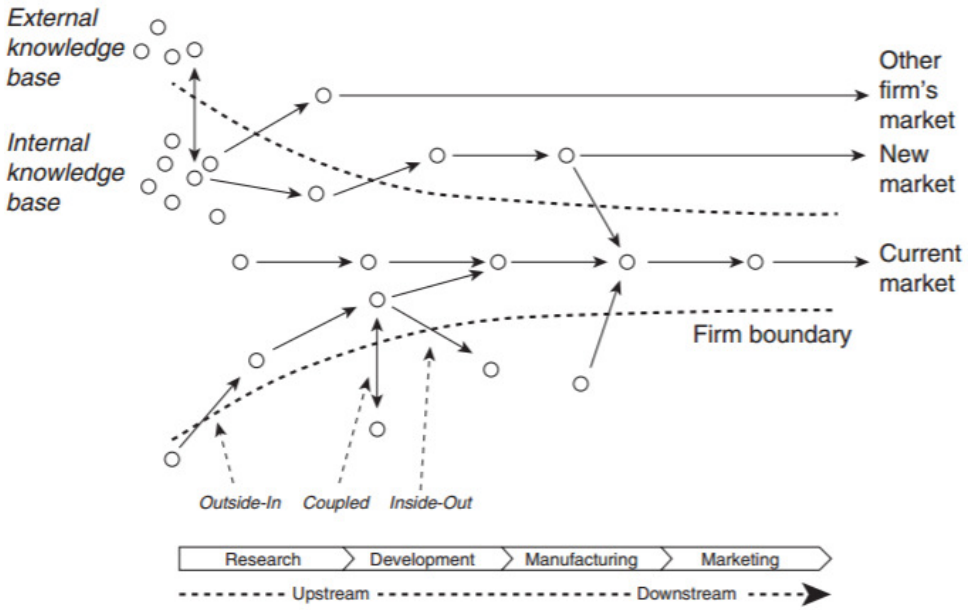


Figure 1.2 The open innovation model (Chesbrough and Bogers, 2014, p.18)

As a consequence of the three aforementioned archetypes and the heterogeneity amongst the OI practices, individuals play various roles in the process of innovation. We can thus distinguish: researchers, employees (Bessant, 2003; van de Vrande et. al., 2009) partners, customers, competitors, users (von Hippel 1988, 2005, 2010; Piller 2006), innomediaries (Roijakkers, Zynga, Bishop, 2014), co-creators (Chesbrough, 2003), crowd-source (Howe and Robinson, 2005) and several other roles that can indeed occur throughout the OI process.

When determining the role individuals have in OI settings, it is of great importance to firstly depict the process to better understand the phases and the determinants that influence individual's involvement in this process. Although differences between inside-out and outside-in OI practices occur, I consider more suitable to have an overview on the coupled OI process which covers both aforementioned OI practices. Furthermore, we can observe the individual's involvement in both circumstances at the same time. Pillar and West (2014) propose a process model for the coupled OI practice, which consists of four phases: defining, finding the participants, collaborating, and finally exploiting. To the extent of illustrating the individual-level implications in the coupled OI process, by combining with the four phases proposed by Pillar and West (2014), hereby I correlated each phase with the individual's contributions and implications.

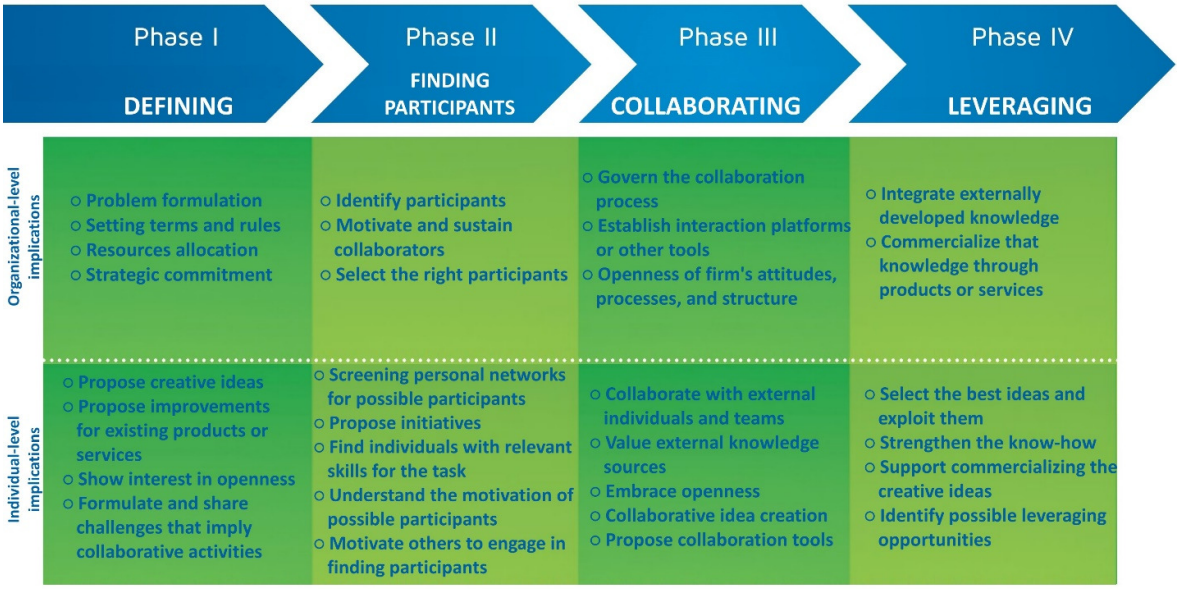


Figure 2.3 The individual-level implications in the coupled OI process (own illustration, based upon the process stages proposed by Pillar and West, 2014)

With respect to the four phases illustrated in figure 2.3, we can notice that at the beginning of the OI process the individual has more liberty of acting until the collaboration process takes shape; at the top level however, the process is thus formalized and strict. In contrast with this, Chen and Huang (2007) found that in a more integrated, less centralized, less formalized organizational structure the social interaction among individuals is more favorable. A certain path must be collaboratively proposed and in an organized way to be followed in order to mutually benefit from the collaboration. In this situation, the individual's challenge is to come up with creative ideas to cope with the job requirements, and simultaneously to collaborate with external parties in order to achieve that. As regarding the organization, it must provide an infrastructure based on which individuals can follow patterns in achieving the innovation goals. Moreover, organizations should enable individuals to find new methods of capturing and exploiting creativity. This implies that the more centralized the OI project is, the more formal the organizational creativity will become. Due to the complexity of OI activities, individuals can openly create throughout the entire innovation process. Roijakkers and Vanhaverbeke (2013) state that *"open innovation can be applied in situations where companies do not themselves develop new products or services"*. Individual's creativity therefore, is likewise needed even when companies do not themselves develop new products and services.

2.3 Motivation towards the open creation process

As creativity can be facilitated it can likewise be constrained. Thus, managing creativity can be a harsh task for companies. Yong (1994) proposed three steps that are necessary to facilitate creativity throughout organizations: firstly understand the creative process, secondly appreciate the creative individual, and thirdly maintaining a creative work environment. A most difficult task for organizations is to motivate the individuals to perform tasks at their best.

"do what you love, love what you do", Teresa M. Amabile, 1997

Nowadays, the unwillingness to openly create can be a setback for both the individual and the company. Collaboration is the essence of OI and thus it recognizes creativity as a collaborative process likewise. Innovation involves many functions within the organization, and openly creating must be a top priority having into account today's harsh competition. The motivation for openly creating can be driven by various factors and circumstances. The shrinking product or service lifetime not only impact the way companies innovate, but also the way individuals create. The markets dynamics change at a fast pace, and meeting the customer's needs in time requires that individuals have to fasten the creative process in order to cope with the demand. OI allows individuals to collectively create and distribute the tasks of new product or service development across the organization and the collaborators. Following this strategy, all the collaborating parties that will openly create will have an input in the final product. At the same time, sharing responsibility throughout the innovation process can establish a greater sense of confidence and can motivate individuals to engage in OI processes.

Motivating individuals to openly create, is not the easiest task to do. The open innovation process is very complex and individuals across the innovation funnel can export or import information at several of its phases. The degree of individual-level openness can determine whether other individuals from both internal and external environment get engaged in the open innovation activities or not. Building on the idea of opening up the innovation process we can assume that individual's creativity and the ability to innovate can be enhanced by inviting external creativity sources in, as well as commercializing the individual's creative ideas that are sometimes jammed on the innovation pipeline (Chesbrough, 2003).

An individual's ability to create is something unique that is built up by one's personality (Amabile, 1997), education, knowledge, social environment, experiences (Stein, 1974), and several other factors which combined in a specific fashion can lead to creative ideas. Chen and Huang (2007) argue that the sharing of knowledge among individuals can be enhanced by promoting a cooperative and innovative climate. The authors further suggest that the organizational climate can impact the knowledge sharing by focusing on the trust, communication and coordination of behaviors among individuals. After analyzing a great part

of the existing body of literature on creativity, I assume that the factors in the model below are adding up to the individual-level openness. The inclination towards openness can be a huge determinant in the creation of collaborative knowledge. The degree of Individual- level openness is believed to be determinant in the motivation of opening up to new sources of knowledge. Salter et al. (2014) argue that the openness towards external sources of knowledge can enhance the individual's innovative performance. Moreover, the authors found a positive relationship between individual- level openness and the idea generation. Notwithstanding the benefits of openness, the authors found that organizing various sources of knowledge can be costly and in addition to this, encouraging individuals to embrace openness implies careful management.

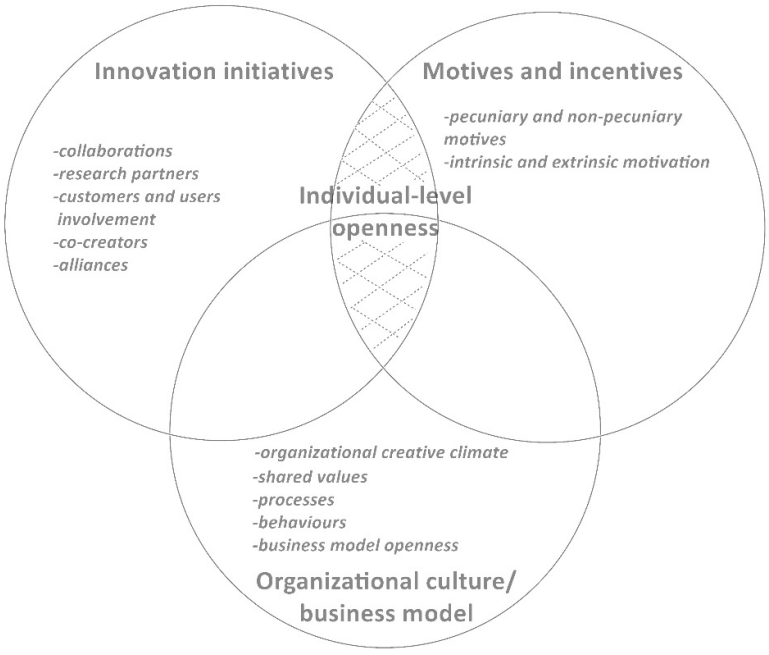


Figure 2.2 The components of individual-level openness (own illustration)

According to previous studies (e.g. Amabile et al., 1988, 2016; Woodman et al., 1993; Salter et al., 2014), the drivers included in the three componential clusters of individual- level openness, are believed to be influential in the idea generation process. The first cluster, innovation initiatives, comprises various forms of innovation activities the organization

embraces. Prior research proved that there are differences amongst companies when it comes of open innovation practices, this influencing the way knowledge is managed (Cosh and Zhang, 2011). Moreover, depending on the type of OI activities a company embeds into their business model, can influence individual's willingness to openly create.

The second category represented by the motives and incentives, suggest that the individual-level openness is to some extent driven by either pecuniary/non-pecuniary motives, as well as by the intrinsic or extrinsic motivation. Each individual is motivated or incentivized by something to embrace, in this case, openness. To the extent of motivation, psychologists have been mainly focusing on the intrinsic and extrinsic motivation that persuades individuals to perform tasks (Amabile, 1996,2016; Hamilton 2003; Ryan and Deci, 2000). The intrinsic motivation implies that individuals perform tasks because it is inherently beneficial rather than focusing on the additional benefits that the activity may generate. Intrinsic motivation is often related to non-pecuniary benefits (the self-enjoyment or the intellectual challenge of the task), while extrinsic motivation relates primarily to pecuniary benefits such as material benefits (raised incomes, prizes, or funding).

The third cluster, the organizational culture and business model, are two aspects that can either facilitate or constrain the individual- level openness. Hunter et al. (2007) argue that creativity and innovation are enhanced by an intellectually stimulating environment. The organizational culture is something unique, representing the personality of the business, determining which and how things are done. On one hand the organizational culture can inhibit and enhance innovation, but on the other hand it is believed that firm's culture can be an impediment when pursuing innovation (Ahmed, 1998; Philips, 2007). I decided to include organizational culture in this illustration (figure 2.2) drawing from the belief that a culture which inspires creativity in individuals can play an important role when deciding to open up the company's boundaries, creativity being a function of several factors including the way it is managed and distributed across the organization.

Lazzarotti and Manzini (2009) found that depending on the type of partners involved in the innovation process as well as the opening-up phase, the OI model is as a consequence

different. Accordingly, depending on the motives individuals decide to share their knowledge, openness can occur in many forms (Dahlander and Gann, 2010). Since openness is applied in various ways, the transfer of creative ideas is conducted likewise in several manners. When determining the creation modes an individual can apply in an OI setting, it is important to distinguish the modes knowledge is shared. To this extent, Dahlander and Gann (2010) categorized inbound and outbound innovation and determined four categories of open knowledge distribution.

	INBOUND	OUTBOUND
PECUNIARY	Acquiring	Selling
NON PECUNIARY	Sourcing	Revealling

Table 2.1. Different forms of openness (Dahlander and Gann, 2010, Research Policy 39, p.702)

The authors have not however included the coupled dimension, which implies simultaneously making use of both inbound and outbound innovation. The first category, pecuniary include acquiring and selling of knowledge. This way companies either leverage individuals' creativity from the outside environment, or it commercializes the internally developed creative ideas that cannot be valued by the company itself. The second category non-pecuniary motives, involves sourcing or free revealing of knowledge. Indeed, each of those types of openness has advantages and disadvantages, companies opting for what better suits their business model.

Traditionally, when tackling individual's motivation to create, the focus was exclusively directed towards the intrinsic factors (the componential model Amabile,1988) facilitating the creative process. Notwithstanding the attention given to intrinsic motivation, a revised version of the model (Amabile and Pratt, 2016) integrate insights of the role extrinsic motivation has on the creative process. Hence the new approach of the model acknowledges both intrinsic and extrinsic motivation to have a positive role in the creation process.

Another interesting statement from Herzog (2011), who mentions that when motivating individuals there ought to be no difference between a traditional or an OI model. The author

further states that whether individuals engage in open or closed innovation activities they are likely to be motivated in the same way regardless of the extrinsic or intrinsic factors. This indicates that the creativity influencing factors addressed in previous research, can be likewise applicable in OI contexts.

2.4 The benefits of engaging in Open Innovation activities

Open innovation broadens both an individual's perspectives and the access to new sources of creativity. Through engaging in collaborative initiatives, organizations allow individuals to increase their productivity, also to make progress with their ongoing projects. Amabile and Kramer (2011) argue that individual's creativity results from a combination of positive perceptions, pleasant emotions, and strong intrinsic motivation. In addition to this, the authors found that this combination of perceptions fosters creative ideas in individuals, as well as it impacts the bottom line performance of the organization. Building on the idea that there is a synergy between organizational environment, creativity, and innovation we can assume that the OI process enhances individual's creativity since it brings together knowledge from various sources. Nevertheless, it is not the organizational environment solely that fosters innovativeness and creativity in individuals, but rather a mixture between factors as: motivation, firm's culture, resources, type of innovation activities, rewards, and so forth. Many R&D project are killed due to various reasons such as shrinking budgets, market dynamics, demand, or the inability to commercialize the creative knowledge (Vanhaverbeke, 2006). Organizational motivation plays an important role for individuals since in most of the cases are the organizations that lead individuals to embrace openness.

Figure 2.5 illustrates a mutual benefit and complementarity in the interaction between individual and organizational factors. It is therefore believed that a synergy between the two dimensions is necessary to attain the goals and make progress in meaningful work (Amabile and Kramer, 2011).

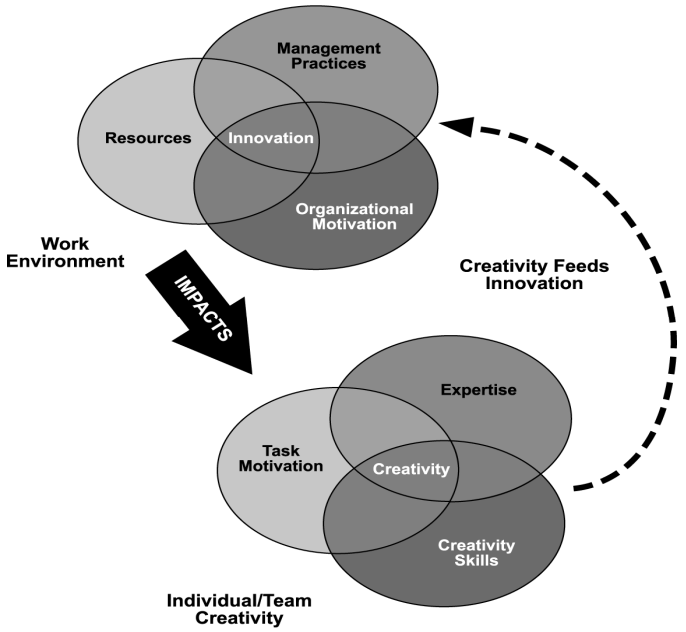


Figure 2.5 The impact of the organizational environment on creativity (Amabile, 1997)

As the figure above suggests, the individual-level creativity feeds the organizational environment and inherently the innovation process, while the organizational environment impacts the way individuals innovate. Nonetheless, we can assume that in an OI setting the situation is similar and the two levels are complementary, effort from both dimensions being required in order to successfully benefit from creativity and innovation. The organization's ability to identify and support all factors that nurture creativity and innovation represents a necessity in sustaining not only the OI model but also the firm's competitive advantage. In turn, the individual should feed the organization with creative ideas that support the organization's short or long-term goals. The organizational environment is believed to be influential for an individual's willingness to create and innovate. The support individuals get from the organization has significant impact in facilitating their creative behavior (Amabile, 1996). Tesluk et al. (1997) linked the organizational environment to the innovative performance, suggesting that individuals are more likely to share their ideas when offered pecuniary rewards (e.g. financial or material rewards). Nevertheless, this is a one case scenario and the examples are not applicable to every organization or individuals due to

motives and incentives type being different from a person to another. In an open innovation setting, companies have to find ways that help individuals to tap into both internal and external knowledge sources. External sources can be of equal or greater importance with internal ones when seeking for information. Therefore, organizations involved in OI projects have to possess a diversified portfolio of creativity sources. As long as the organization can commercialize the internally generated creative ideas, it may likewise leverage creativity from the large base of external sources. For example, customer's creativity is often welcome to contribute in the open innovation process by many companies. Berton et al. (2006) refer to customers that contribute to innovation as creative customers, which nowadays are recognized as a source of innovation and competitive value.

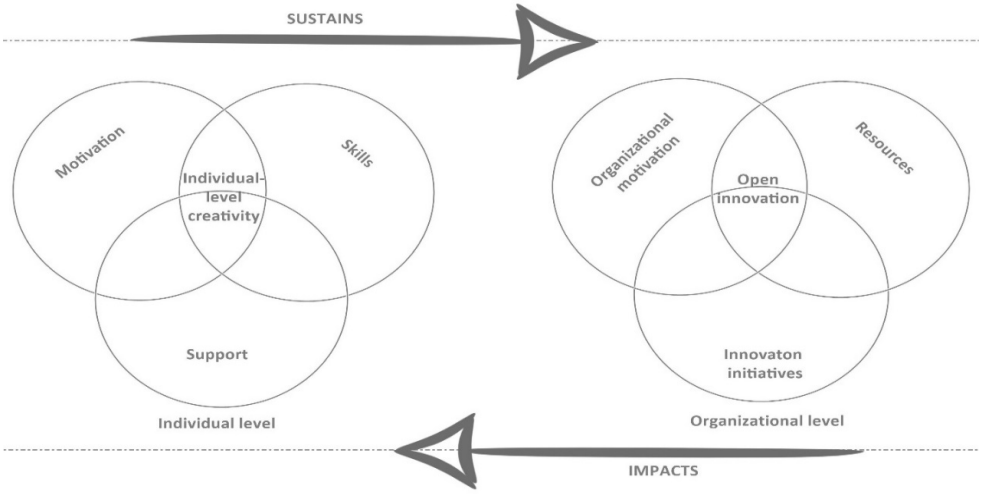


Figure 2.3 The relationship between OI and the individual-level creativity (own illustration)

2.5 Coping with Open Innovation

The less traditional approach of OI allows individuals to benefit from knowledge that cannot be attained within the firm's boundaries solely. In today's business environment knowledge is collaboratively generated at a large scale. Technology plays a very important role in the creative process, enhancing individuals with tools to tap into the boundless collection of creative ideas that are often freely exposed by other individuals. However, one might think that the externally developed knowledge is easy to inhibit and draw value from. It is important to recognize that OI poses some serious challenges when it comes to the creative process at the individual level. Salter, Criscuole and Ter Wal (2014) identified some of the challenges individuals have to cope with in the daily implementation of OI. The authors furthermore propose four coping strategies for the individuals engaging in OI processes.

Stage of Engagement	Company Stance	Individual-Level Challenge
Getting the Right Mindset	All scientists and engineers are expected to embrace open innovation.	Perception of external engagement as second best.
Building Partnerships	Established procedures have to be followed when building collaborations with new parties.	Preference for the safety of comfortable partners with whom they worked in the past.
Starting the Conversation	No disclosure of internal knowledge to third parties without confidentiality agreement in place.	Difficulty to overcome the paradox of disclosure when starting new collaborations.
Taking Advantage	Managerial pressure to increase the number of R&D projects that involve external parties.	Difficult to make external knowledge digestible in terms of alignment with internal knowledge, procedures and objectives.

Table 2.2 Individual- level challenges of OI at various stages of external engagement, (Salter et al. 2014, p.81)

One of the biggest challenges identified by the authors is the perception of externally developed knowledge as “second best”. To cope with this, individuals have to embrace a mindset that identifies the value of OI to their work progress. The first variable of the conceptual model (fig. 9), external knowledge and collaborations, covers the aspect of NIH (not invented here) which is believed to be a huge challenge for both organizations and individuals when aligning to the OI strategy. The second challenge the authors identify is the preference to stick with the partners that the individuals have previously collaborating with and they are comfortable with. Individuals might perceive new sources of openness as difficult to establish (e.g. time consuming, 3-6 months for a new partnership establishment), and can miss the opportunity to collaborate with more innovative partners.

The third proposed challenge is the paradox of disclosure, implying that the partners do not establish a balance with respect to the disclosed knowledge. In this circumstance, the confidentiality agreements are the roots of this challenge. In addition to this, individuals often are unclear of which and how much information can be disclosed. It is therefore necessary to establish a pattern that individuals can rely on when involved in the disclosure of information.

The last challenge proposed is the difficulty of aligning external knowledge to the internally developed one. Individuals must make sure that they can integrate the external ideas into their ongoing projects. The authors found that external knowledge is not easy to align with the existing one, and that considerable amount of effort and expertise is required to accomplish this. Moreover, the guidance in *“digesting”* the external ideas has a crucial role in taking absorbing the full value from the new sourced knowledge.

3. Methodology

This chapter provides a guideline of the methodology used in addressing the research question. Since the aim of this research is to provide information on the componential factors of creativity in OI contexts, and thus help managers making a decision for addressing these factors, a conclusive causal research method is adopted. This type of research method is generally useful when attempting to make decisions and draw conclusions, as well as it involves applying quantitative methods for data collection and analysis (Nargundkar,2008). Furthermore, this type of research is suitable for a topic that addresses the effect of one variable (e.g. creativity) on another (e.g. OI process). A set of hypotheses are going to be developed and further tested. The data is gathered through a self- administered survey, and afterwards statistically tested.

Further, the conceptual framework is developed and explained, followed by providing insight into the independent and dependent variables. The last part of this chapter covers the hypotheses development as well as defining the measurement factors. In addressing the impact of the selected drivers on individual- level creativity, and inherently on the OI process, an experiment ought to be conducted. As a result, firstly the relationship between the independent variables (collaborations, culture, resources, personality, motivation, and individual- level openness) and the dependent variable (individual- level creativity) was tested. Secondly, the individual- level creativity was considered as the independent variable, whereas the OI Process was the dependent one.

3.1 Experimental design

This section consists of the development of the conceptual framework, and describing the independent and dependent variables that are used in this experiment. The conceptual model entails two dependent variables and six independent ones, depicted in Figure7.

3.1.1 Conceptual framework

After thoroughly analyzing both the creativity and OI concepts, with a focus on the individual-level implications, I hereby developed a conceptual framework that displays the relationships among drivers from the open organizational creative climate and the individual- level. The central relationship that the conceptual framework entails, is the one between creativity at the individual level and the OI process. Further, it displays the drivers that according to existing research are believed to contribute to the creative process. As covered in the literature review, creativity entails factors originating in both individual's capabilities, as well as in the organizational creative climate (intra and extra-organizational). The following section of the study will therefore emphasize and describe the drivers that have been included in the conceptual framework.

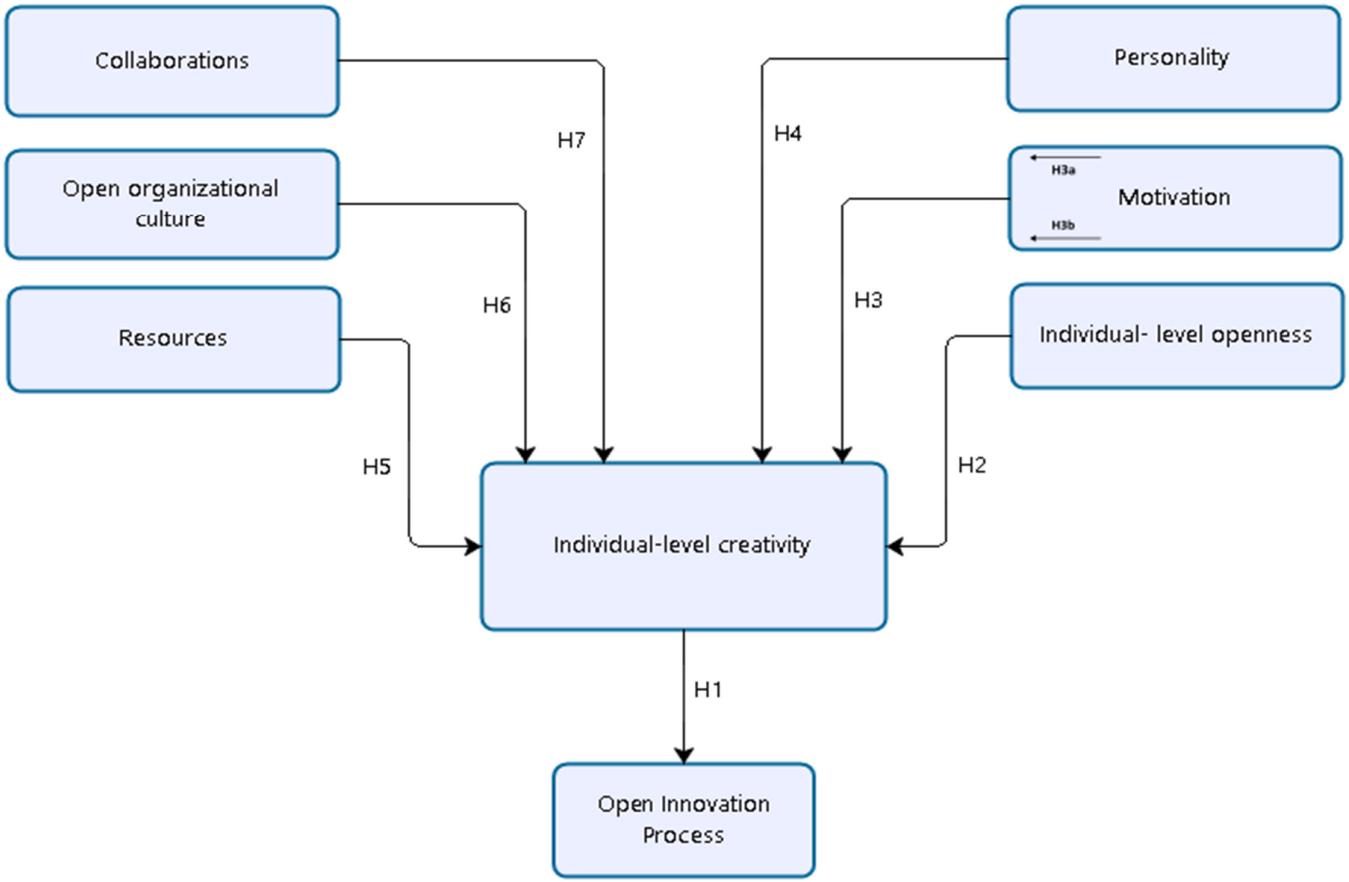


Figure 3.1 Conceptual framework

3.2 Independent variables

In this section of the study the hypotheses are going to be formulated and described. Furthermore, for all seven hypotheses the measurement factors are likewise described. The measurement method for each driver in the conceptual framework, have been selected from models (2) that have tested creativity and found a positive impact of these determinant factors at the individual level.

3.2.1 Collaborations

This chapter covers aspects of the collaborations factor. Furthermore, it emphasizes the importance of collaborative knowledge in the creation process.

The conceptual model comprises variables that originate from both the individual and the organizational levels. At the organizational level, we can distinguish three elements. The first element is represented by the collaborations and external knowledge an organization brings in when implementing OI activities. External knowledge has been extensively researched and referred by many authors (e.g. Urgal et al., 2013; Lichtenthaler, 2009), its benefits for the OI process and the successful implementation being the most stressed out aspects. At the individual level the situation differs due to the challenges and ambiguities which come along with the knowledge that is sourced-in by the company or by the individuals independently. Some individuals are more open towards collaborations and externally developed knowledge, others simply not managing to easily digest it. Not every individual will be able to see the benefits that OI comes with, nor each individual within the OI process will have the right mindset to align with the organizational strategic choices. In these circumstances, the "not-invented-here" (NIH) syndrome arises (Katz and Allen, 1982). This type of attitude is characteristic to individuals who are not willing to collaborate, and resist accepting ideas that

[2] "The conceptual model of creativity "proposed by Amabile et al. (1988,1997, 2016)
"Global measure of creativity capacity" proposed by Kumar et al. (1997)
"Creativity Audit" Creativity and Innovation Audit Tool, i-Create, 2011

come from external sources. Furthermore, individuals that claim the NIH syndrome tend to believe that internally developed capabilities are superior to the externally sourced ones. In addition to this, individuals might believe that engaging in OI activities is a potential threat towards their jobs, and perceive their capabilities as replaceable by other external sources of innovation (Antons and Pillar, 2015).

This is a very important challenge to deal with for organizations and individuals; to this extent preventing the bias against the knowledge originated from outside firm's boundaries must represent a top priority with respect to the human factor alignment with the OI strategy. This leads to the fact that is ever so important to understand the ways individuals behave in those situations, because as their innovative capability may be facilitated, it may likewise be constrained by inefficiently engaging individuals in the OI process. Indeed, various factors can alter the role of individuals in the OI. It is believed that the type of collaborators or the way the relationship with the partners is conducted can likewise have a degree of influence at the individual level. Depending on the needs and required capabilities for innovation, companies determine who to collaborate with. This, as a consequence, indirectly impacts the individual. As described in the literature review, the OI process entails three archetypes: inside-out, outside-in, and coupled, therefore we can identify several types of collaborations depending on how knowledge is exploited. When collaborating, the role of individuals becomes essential since they are the ones that will be integrating and transforming the sourced knowledge into valuable innovations. The success of collaborations often results from the support of key individuals who promote the cause and the enthusiasm within the organization (Tid et al., 2005). The authors also describe how important these roles are when managing knowledge in a collaborative context.

The table below presents some of the key individual's roles which are typical in collaborative settings.

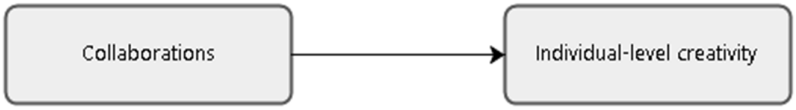
Key individual's role	**Characteristics and attributions**
The inventor	-the source of critical technical knowledge; responsible for inventions; -capable of understanding the technology beyond the innovation -Inspires motivation and commitment -not so influential through the organization
The organizational sponsor	-has power and influence; does not necessarily need to have technical knowledge on the innovation, however they need to trust its potential -business innovator, represents the user's perspective
The technological Gatekeeper	-enables networking -collects and shares valuable information to the relevant individuals -enables the effective communication of valuable knowledge -promotes the interpersonal element and manages knowledge flows
The leader	-provides necessary coordination, leadership, and motivation -balances the organizational needs with the innovation goals -decision making, accommodates others to the needs, organizes
Negative champions	- do not want particular innovations to succeed, kills projects off -Impede particular innovations; does not show support or enthusiasm -usually try to transmit the same thinking to peer individuals

Table 3.1 Key individual roles in collaborative contexts

Rubenstein (1976) also argues that individuals fulfill various roles that contribute to successful innovation, the author furthermore defining the innovation process as a people process. In a collaborative setting, efficiently managing the transfer of knowledge can determine the success of the innovation process. Munoz-Doyague and Nieto (2011) found that creativity at the individual level can be enhanced by a high-quality relationship among teams. Moreover, the creative performance is positively influenced by the high-quality exchange between individuals in teams. Ohly et al. (2006) suggest that when promoting an environment that encourages individual creativity, collaboration is essential.

Moreover, the sharing of ideas can positively impact individual-level creativity. Hence it is stated that:

Collaborations and externally developed knowledge positively impact creativity at the individual level



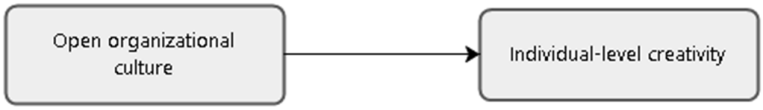
Therefore, the measurement factors for collaborations' impact on creativity are: the ability to collaboratively create, the ability to integrate externally developed knowledge into the creative process, the acceptance of external sources, type of collaborations, collaboration tools, and the co-creation methods.

3.2.2 Open organizational culture

Although researchers have mostly tackled open innovation as an organizational driven process, the individuals that contribute from the micro-level of the OI process are the ones that must be given attention to. Dul and Ceylan (2014) found that organizations that embrace creativity–supporting work environments are more successful in developing new products or services. Individuals are the ones that can shape the culture towards a more open approach, whereas the open organizational culture must encourage and support openness for individuals. Shaping the open organizational culture stands as one of the most essential challenges nowadays in accomplishing the successful implementation of creative ideas. Leifer et al. (2000) argue that few organizations have a clear and proactive approach that engages individuals in innovation. The authors also state that organizations often do not fully understand the importance and the role of individuals in the innovation process. Moreover, organizations think that individuals will somehow eventually come up with creative ideas, with the effortless input from the organization. In fact, individual-level creativity will not simply shine through; rather it should be integrated in a systematic, proactive and deliberate fashion.

Organizations must provide individuals with an enabling mechanism that helps them tap beyond firm's boundary and successfully connect them to the external networks. An organizational culture that is based on this belief and likewise openness supportive can have a positive impact in aligning individuals with the OI strategy. Organizational culture is very complex, nevertheless through openness and creativity individuals have the ability to shape the way innovation is conducted, broadening the organizational horizons by tapping into the external environment for new creativity sources. An organizational culture that embraces openness and stimulates creativity and innovation in a collaborative way, it is believed to be contributive to a company's success. Individuals that are supported by a culture which encourages and promotes creativity and openness are more likely to generate innovations. In addition to this, du Chatenier et al. (2010) suggest that organizations have to define the competencies that are required of individuals for engaging in OI processes. Moreover, the authors recommend that organizations must be supportive in preparing individuals for OI, and focus on the required competencies for individuals operating in OI processes. Hence it is stated that:

An open organizational culture affects creativity at the individual level



The organizational culture is believed to affect the way individuals create, hence the measurement factors have been likewise selected from former studies that found them as positively impacting creativity. The measurement factors are: the freedom of expressing ideas, level of autonomy, inflow and outflow of ideas, idea sharing encouragement, implemented methods of capturing external ideas, implemented creativity fostering techniques, organizational encouragement, and the work environment.

3.2.3 Resources and motivation

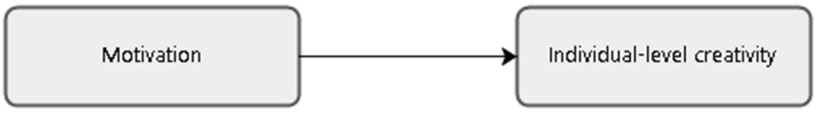
Traditionally, many organizations attribute innovation solely to their R&D department, whose main focus is to provide new products or services usually on a regular basis. In contrast with

this practice, open innovation allows organizations to integrate individuals across various departments within the innovation funnel. The knowledge resources will as a consequence origin from diverse sources, thus new innovation patterns are emerging from centralizing the resources and actively involving external parties to the innovation process. Before immersing ourselves into details about the resources and motivation at the organizational level, we must first understand the way the resources and motivation impact the innovation process at the individual level. A solid resources infrastructure requires integrating many levels of knowledge. At the micro-level, it starts with the individual then it emerges to departments, afterwards it integrates the organization as a whole, and finally it captures resources from the outside organization's boundaries. Resources are crucial in an OI context, and the way individuals manage to assess them can have a great impact on the overall innovation outcome. Motivation is also an important variable in determining the role of individuals in the OI process. Individuals are motivated to behave in a way that they believe it will lead to a reward, either material or non-material. Motivating individuals imply two basic requirements: the incentives must be of great value to the individual, and secondly individuals must believe that their effort must probably lead to a reward (Dessler, 1980). As described in the literature review (see RQ2), individuals will be motivated differently even though they are expected to perform the same tasks. Despite the extrinsic or intrinsic factors, one might not have any motivation to do the task. In addition to this, individuals who are initially motivated by intrinsic factors can likewise change towards extrinsic motivation factors, or vice versa. (Deci and Ryan, 1985)

Herzog (2011) argues that there ought to be no differences between closed and open innovation in terms of motivating individuals to perform their tasks. Individuals can be motivated to engage in collaborations due to various circumstances. Firstly, when it is really necessary and there is no alternative solution, individuals will be willing to look beyond the organization for knowledge. The other situation is when individuals are aware that the internally developed capabilities are not necessarily the best ones, and assessing the outside knowledge can provide them with new insights that can enhance the innovation process. Another aspect that ought to be considered is that individuals are often motivated by rewards

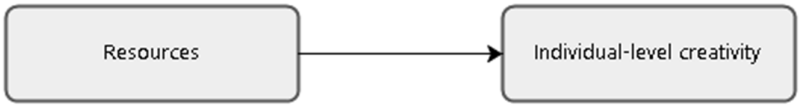
to do the task. A rewarding system is likewise necessary for individuals engaging in OI, nonetheless is not mandatory to have one since individuals are not stimulated by the same factors to do their tasks. Resources as well as motivation are believed to foster creativity. In this case resources comprise the financial aspects, time, or human resources. Amabile (1998) states that time allocation for creativity is often a difficult task, and that a too busy schedule or nonrealistic deadlines can have a limiting effect on creativity, whereas allocating sufficient time and putting a reasonable amount of pressure on individuals positively impacts the creative process. Therefore, it is stated that:

Individual- level creativity is affected by the type of motivation.



Theory suggests that motivation can be intrinsic and extrinsic, therefore for this driver the factors that are going to be measured are originating from both categories. This way, the type of motivation individual's creativity is influenced by can be determined, as well as its overall impact on creativity.

Individual- level creativity strongly depends on the resources.



The resources driver entails likewise measuring factors for personal resources. The resources in the task domain are hence, in these circumstances, personal resources. These resources (task-relevant skills) are specific to every individual, and according to former research it is believed to positively influence the creative process outcome. In the dynamic componential model of innovation, Amabile and Pratt (2016) incorporated the task-relevant skills into the model as well. Their findings indicate that the individual component skills in the task domain influence the creative process at two of its five stages (presented in fig.8). Firstly, the

information and resources gathering, and secondly checking these ideas against task-related criteria (in this case, collaborative knowledge development criteria).

The factors that are going to be measured are: task related skills, externally developed knowledge, amount of resources, sources of creativity, and the organizational support.

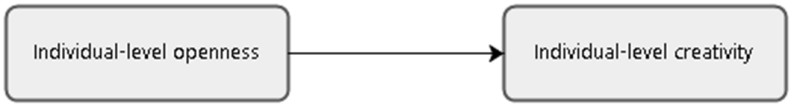
3.2.4 Individual-level openness

Openness at the individual level offers also little research, the main focus being directed towards organizational openness (Dahlander and Gann, 2010). Therefore, it is necessary to fully understand its importance in the OI settings. Being receptive to externally developed knowledge requires a mindset that identifies opportunities beyond the firm's boundaries. Companies tend to increasingly engage individuals in seeking externally developed knowledge in order to support their innovation projects. In order to cope with the challenges that occur when engaging in open innovation, individuals have to possess certain competencies (du Chatenier et al. 2010).

Gouldner (1957) argues that individuals that expose themselves to external networks are likely to inherit valuable knowledge. The author further states that individuals which have a cosmopolitan orientation are more intellectually stimulated by the external sources, resulting in a broad external network. Hence, the individual-level openness implies, to some extent, that the willingness to externally search for knowledge and information will eventually help the individual to better address innovation related challenges. Psychologists however suggest that openness to new sources of knowledge or experiences, are in fact a trait of individual's personality, and it is believed that the individual's openness is also genetically determined (Helson et al., 2002). As the conceptual model suggests, the individual openness can have impact on the creative outcome within the OI process. Essential to the individual-level openness, as described earlier, is also the acceptance that external knowledge enhances the ability to successfully create, and is not perceived as second best.

Researchers that focused on individuals, often link the organizational culture to them, more specifically individuals are characterized by cultural traits. Acerbi et al. (2009) found that cultural traits can be transmitted among individuals, and that the openness to new information is also determined by age. Consequently, depending on the cultural traits and the perception of new knowledge or information, individuals can be conservative or open. I assume that in an open innovation context, the cultural influence among individuals and the openness towards new information, varies likewise, and that the open organizational culture can be transmitted between individuals. As covered in the literature review, the individual level- openness is a construction of many factors that are of both personal and organizational nature. The conceptual model shows that individual-level openness impacts both creativity and inherently the OI process. To explore this, it is assumed that individuals who are open towards new experiences and sources of creativity are likely to be more creative. Firstly, an open individual ought to be receptive and inhibit knowledge from various internal or external sources, which can help in the creative process. Secondly, the individual should be flexible and eager to explore beyond the firm's boundaries. Thirdly, and very essential is sharing this belief to other individuals within the organization. Hence it is stated that:

The individual- level openness has an impact on the individual- level creativity



The factors that are going to be measured are: the acceptance of externally developed capabilities, willingness to collaborate with individuals from outside the company's boundaries, the freedom of expressing ideas, the relationship with colleagues and supervisors, and the willingness to encourage others to embrace openness.

3.3 Dependent variables

This part of the paper outlines the major aspects linked to the dependent variables. Therefore, the dependent variables proposed in the model are individual- level creativity, and afterwards the OI process. The relationship between these two variables is likewise the main highlight of this paper. Determining the relationship between them will provide significant insight for both creativity and innovation areas.

3.3.1 Individual- level Creativity

Earlier in the literature review, creativity has been defined and most of its general aspects have been discussed. Before further presenting the role of individual's creativity in OI, it is important to have clarified that creative ideas can occur at any level of an organization (Shalley et al., 2004), and even when companies do not develop any product or service OI can be applied (Roijakkers and Vanhaverbeke, 2013). It is commonly misunderstood and believed that only individuals who take part of the R&D activities may innovate. In fact, creativity can be applied for instance: firstly, at the creation of new products or services, secondly within improving existing products or services, even by improving procedures, or proposing solutions to daily tasks. Creativity solely does not guarantee the development of any innovation, hence effort from many departments and individuals is necessary for turning a creative idea into actual innovation. Individuals must be therefore driven by various triggers that make them pursue the creative work (Amabile, 1997, Amabile and Pratt 2016), and consequently to innovate.

The OI process is developed on several stages (Pillar and West,2014; Chesbrough, Vanhaverbeke and West, 2014). The creation process consists many stages as well, and depending on the individual motivation, resources, or the external utilized sources, the outcome is affected. The figure below emphasizes the factors that impact the individual's creative process at different stages. The individual-level creative process, as depicted by Amabile and Pratt (2016), entails five stages which are influenced by: the component of motivation, skills in the task domain, and creativity related skills.

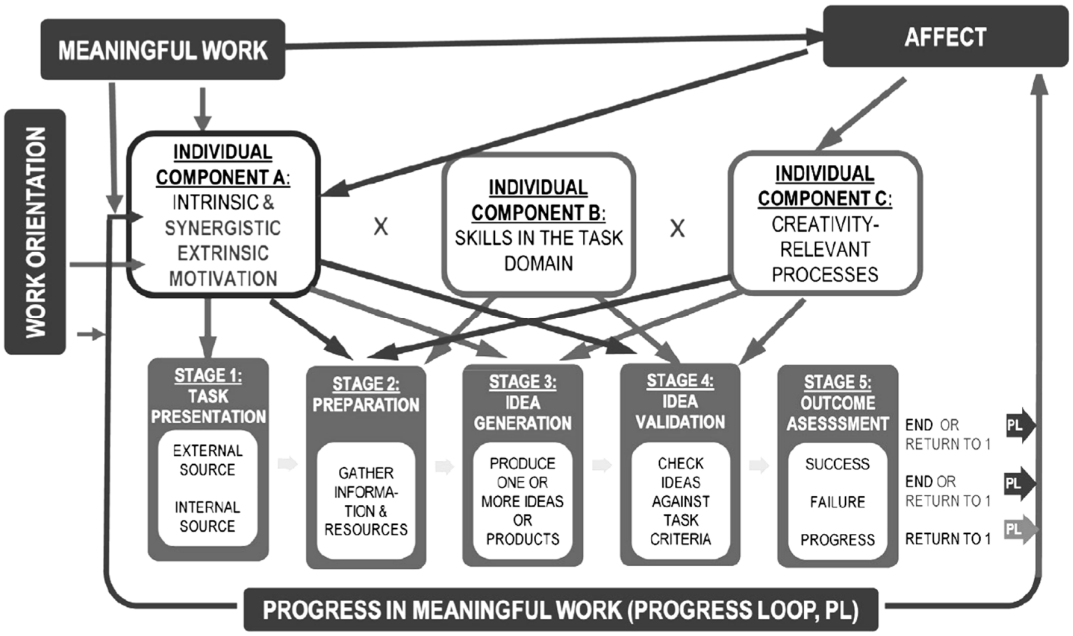
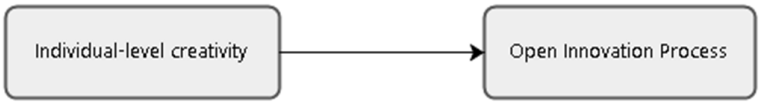


Figure 3.2 The dynamic componential model of creativity (Amabile and Pratt, 2016, p. 164)

The conceptual model integrates three components that are believed to influence individual's creative process. Creativity at the individual level is not only essential for the successful implementation of open innovation models, but also it can be the determinant of businesses' survival. Up until now, researchers and practitioners tried to depict the creativity concept and better understand its involvement in the innovation process. Indeed, the body of literature broadens our understanding on creativity and its sources, as well as the implications in the innovation process. However, as covered in the research questions section of the paper, we can notice the contradiction among the definition, sources, and motivation proposed by the authors with respect to creativity. Nevertheless, regardless of the sources or the motivation of creativity, it is important to acknowledge that innovation relies on creativity, and that individual- level creativity can positively impact, as in this case, the OI process.

Therefore, it is stated that:

There is a relationship between individual-level creativity and the OI process



3.3.2 The open innovation process

In order to determine to what degree the individual impacts the open innovation process, we must first understand the innovation process from the individual's perspective. Besides the OI characteristics covered earlier, the main OI activities individuals perform include both attributes and challenges. The same part of the paper has covered and depicted the OI process following the stages proposed by Pillar and West (2014). Following these stages, and adapting them to the individual level, I integrated the four stages of individual- level involvement (figure 2.3) in the OI process. Thus, the factors that have been used in measuring the OI process at its micro level, were developed according to those proposed stages. In this manner, it is possible to capture the insights on the implications of individual-level creativity in the OI process. On one hand, the individual-level attributes, as described by du Chatenier et al. (2010) are: the management of the intra organizational collaboration process, managing of the overall innovation process, and the collaborative creation of knowledge. On the other hand, the amount of challenges that individuals face along the OI process is numerous, among which: the lack of resources, power differences, low reciprocal commitment, no hierarchical levels, or the high level of uncertainty. Nonetheless, those challenges may be different from an individual to another depending on, for instance, the experience with OI. Another notable aspect when tackling the individual's role in the OI process is the challenge represented by the uncertainty of disclosing information. It is very often that individuals are not aware of which internally developed information ought to be disclosed and which not to.

At the organizational level, West and Gallagher (2006) identify three main challenges when coping with OI: finding ways to benefit from internally developed knowledge, combining

external knowledge with the internal one, and motivating the outsiders to contribute to the innovation stream. Dahlander et al. (2014) also mention the occurrence of challenges when individuals allocate their attention to external knowledge sources. The authors outline that if individuals with high external search do not allocate sufficient attention to the external sources, there is a risk that the cost and effort will outweigh the result. In contrast, they also found that individuals who allocated their attention to other people inside the company were more innovative. We can observe that the challenges individuals face when engaging in OI are different from the organizational ones. The individual faces more specific challenges which are specifically related to the day-to-day tasks, whereas the organization is concerned with more generally addressed challenges that are tied to the overall strategic goals. Having this in mind, successfully coping with these challenges by both the individual and the firm, can determine the overall outcome of the OI.

4. Experiment

After consulting with the literature on the methods of analyzing Likert scales, several authors have various opinions regarding the methods of analysis for this type of data. Moreover, the opinions are contradictory mostly. On one hand, Glass et al. (1972) found that F tests in ANOVA lead to accurate p-values on Likert items under certain circumstances, therefore the author suggests the use of a parametric test fort this type of data. On the other hand, Norman (2010) states that parametric tests can be used with Likert data, with small sample sizes, with unequal variances, and with non-normal distributions for the variable of interest, and with no concern of *''coming to the wrong conclusion''*. In addition to this, Jamieson (2004) recommends that only nonparametric tests should be used on this data type.

Because these differences of opinion, I decided to use two parametric tests namely One-Way ANOVA and Simple Linear Regression, and two nonparametric tests Kruskal-Wallis and Jonckheere-Terpstra. It is of great importance to make the distinction between the parametric and nonparametric tests. These tests distinguish themselves by the assumptions made on the distribution of the response variable (e.g. normality) which is done under the parametric tests but not under the nonparametric ones (e.g. “Distribution free” tests).

In this chapter, the experimental results are presented. Firstly, an exploratory data analysis was conducted in order to gain insight of the data. Secondly, a One-Way ANOVA was conducted for each hypothesis in order to see if there is a statistical significant influence between the means of the five groups (SD, D, N, A, SA) of the independent variables on the dependent ones.

Thirdly, a Simple Linear Regression for each hypothesis was used in order to estimate the relationship between the variables of interest. Moreover, the assumptions of constant variance and normality were checked for both parametric methods and they showed nonsignificant results for all my hypotheses.

The first nonparametric test used was Kruskal-Wallis test, also called a distribution free test. This test is used for determining if there are statistically significant differences between our five groups of the dependent variables (from "Strongly Agree" through "Strongly Disagree"). At the same time, it permits the comparison of more than two independent groups. For instance, the Kruskal-Wallis test is used to determine whether the respondents that fell into the five groups (SD, D, N, A, SA) of the *"Individual- level Creativity"* influence in the same way the process of OI.

The Jonckheere-Terpstra test and the Kruskal-Wallis Test are similar in the way that both can be applied to indicate if there is a statistically significant difference between several groups of the predictor variable on the response variable. The Jonckheere-Terpstra test however, provides a more accurate conclusion since the alternative hypothesis of interest is specified in an ordered manner, because there is a natural ascending trend in the groups. Therefore, I have prespecify a definite order in the alternative hypothesis which was expected before starting the experiment (also illustrated on *Figure 4.3*). I assume that the respondents falling into the *"Strongly Agree"* category to have the most influence on the dependent variables for all the conducted tests. In other words, I expect that an increase in the levels of independent variables will have a stronger impact on the dependent variables.

The *"Motivation"* variable in my model consists of ten items that have been, on purpose, categorized in two, for contrasting the intrinsic with the extrinsic motivation. The first category represents the intrinsic motivation, which entails of the first five factors (C1, C2, C3, C4, C5), whereas the extrinsic motivation is represented by the next five factors (C6, C7, C8, C9, C10). This cluster has been evenly divided and two new variables were created. The first recoded variable is *"Intrinsic Motivation" (*H3a) and the second one was recoded as *"Extrinsic Motivation"* (H3b).

4.1 Data collection

For the collection of the data a survey was developed and administered to the respondents. The survey was based on former studies that used standard scales of measuring creativity. It was proceeded in this way, on one hand because these surveys have been already conducted and validated by other researchers, and on the other hand these scales (Amabile et al 1988, 1997, 2016) have been used by several other researchers as a blueprint during the last decades (see also appendix 3), this leading to a more reliable result.

A Likert five points scale was used for this survey. Likert scales are usually used to measure the respondent's attitude towards the statements in the survey. The data was thus coded as:

- 1 =Strongly Disagree
- 2=Disagree
- 3=Neutral
- 4=Agree
- 5=Strongly Agree

In the analysis of Likert scale data, one important remark is that the mean cannot be used as a measure of central tendency. In this situation, the most appropriate measure is the median or the mode.

In addition to the scales used in measuring the creativity at the individual level, OI factors have been likewise added to the survey. I proposed these measurement scales based on the existing theory for the OI concept, and depicting it to the human factor implications.

The survey consists of nine clusters. The first one is dedicated to the introduction into the topic and the gathering of general information (age, gender, job position etc.). This section also includes a question regarding the stage at which the respondent was involved in collaborative innovation activities. From a total of 316 entries, after filtering 159, have been eligible for the study. Since the survey was exclusively addressed to the individuals that are involved or have been involved in, an eligibility question has been likewise addressed. If the

respondent was not eligible, was then automatically redirected towards the end of questionnaire. The following eight clusters were built consistent with the factors within the conceptual framework. Each of these clusters consists of maximum 12 items that are rated with the proposed 5-point Likert scale.

4.2 Exploratory data analysis

An exploratory data analysis was conducted in order to gain more insight, as well as to understand the features of the data at hand. After filtering the returned questionnaires depending on the eligibility for this study (involvement in OI activities). At the initial posting the response rate was 39%, increasing at 69.6% after personally administering the survey. Respondents were more likely to answer the survey when personally administered, probably because they were briefly introduced to the topic, considering that OI is still being novel to many individuals.

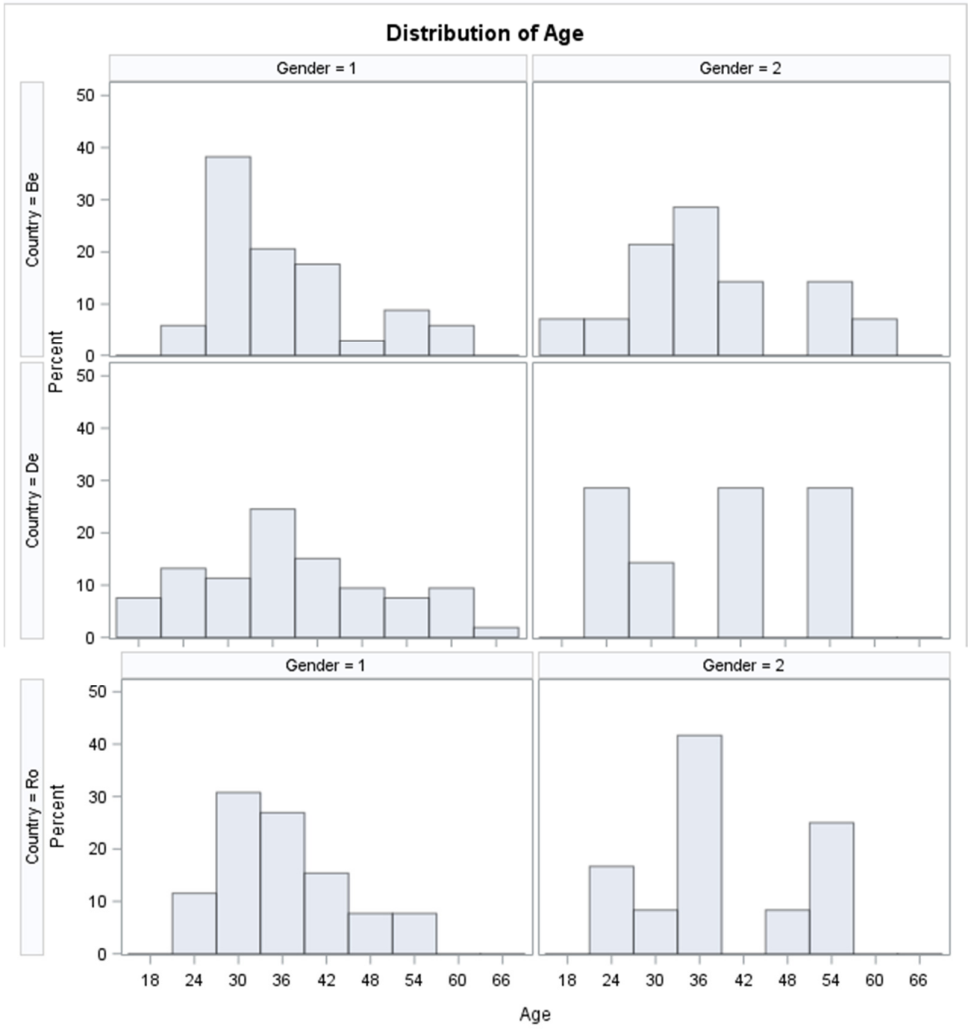


Figure 4.1 The histograms of age by country and gender

In Figure 4.1(Gender=1 for male; Gender=2 for female) the histograms of age by country and gender are presented. In Belgium, most male respondents are aged around 30 years old, while the female respondents are around 36 years old. In a very similar manner the male respondents from Romania were also aged around 30 years old, and the female respondents are around 36 years old. However, in Germany, the male respondents were mostly 36 years old, while the female group is mostly represented by respondents with ages 24, 42, and 54. As figure 4.1 illustrates, there were several age groups that are not represented by any of the respondents in the sample, for all three countries.

Country	Frequency	Percent
Belgium	53	33.3%
Germany	65	40.9%
Romania	41	25.8%
Total	159	100.0%

Table 4.1 The number of respondents by country

As table 4.1 illustrates, the greater part of the research participants come from Germany, followed by Belgium and then Romania. German companies have been the main target for this study due to their large number of High-tech companies, which made for over 30% of the total EU (European Union) companies. Moreover, the companies based in Germany account for 37.6% from EU's total R&D, with an increase of 10,6 % last year (EU R&D Investment Scoreboard, 2016). Belgium has as well a high R&D growth rate (High-tech industry 6.3% increase in 2016), and very supportive governmental policies towards the companies' R&D deduction costs (RIO Country report, 2016). As for Romania, the IT sector is one of the fastest growing in the country, due to the burgeoning presence of multinationals leveraging the cost friendly IT professionals' skills.

The results of this study also indicate that most of the respondents are engaging in R&D activities within the innovation process. Companies from industries that are characterized by high demand, short product/service lifetime, and R&D intensive, are very likely to engaging in collaborative innovation activities. Therefore, I considered appropriate to approach the potential research respondents in this kind of environment.

In Table 4.2, a summary of the variable Age is presented. A total of 146 people out of 159 declared their age. The overall mean of the age amongst the respondents is 37, with a minimum age of 19 and a maximum of 65.

Sample size	Mean	Minimum	Maximum
146	37.23	19	65

Table 4.2 The average age in the sample

Furthermore, In Figure 4.2, the histograms for job position are presented. As it can be seen, in all three countries, most male respondents have a job position in the Research and

Development (R&D) department. However, the job position for female respondents are different. In Romania, the majority has a job position in Core staff, in Belgium in Top management, while in Germany, they have a job position in R&D department. Moreover, it can be observed that for both males and females in Romania do not occupy jobs in R&D department.

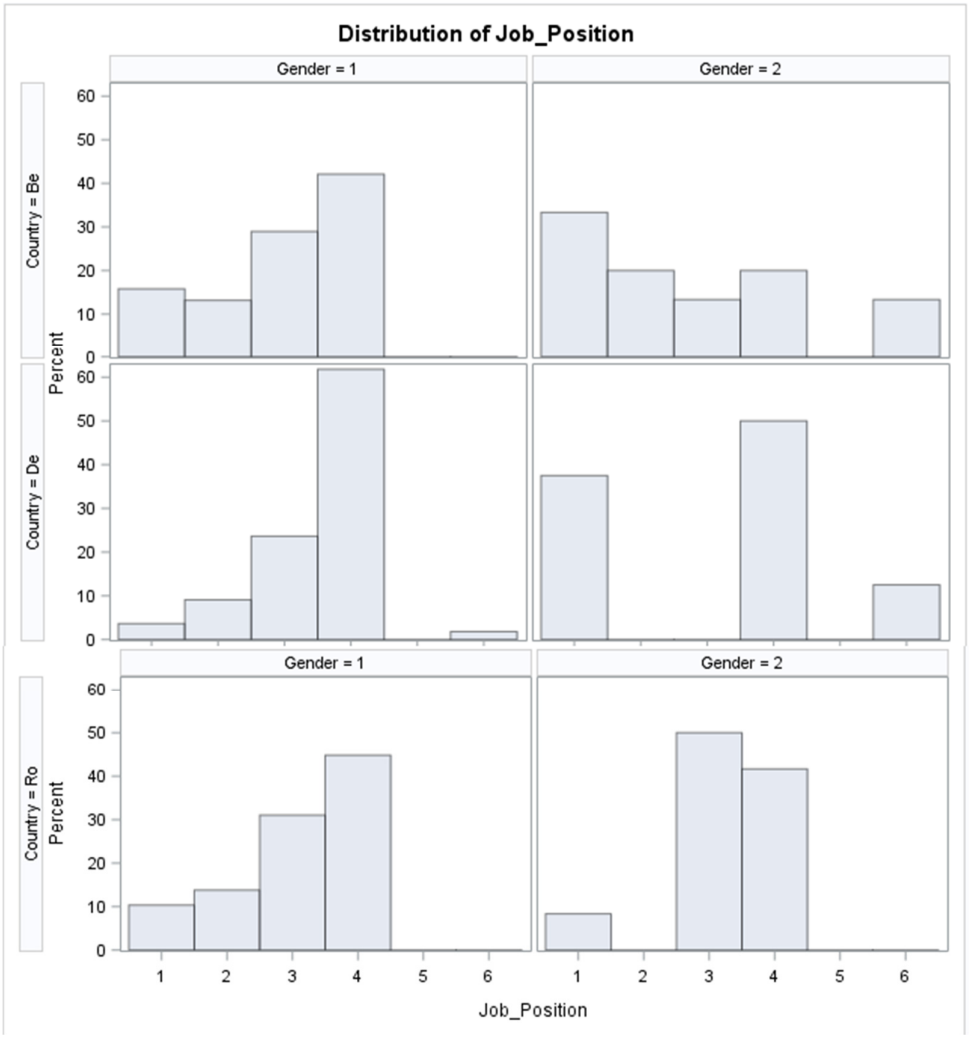


Figure 4.2 Distribution of job position by country and age

Further, the distribution of Open Innovation by gender and country was explored and presented in Figure 4.3. The male respondents in all three countries have been involved in OI

activities mostly in the R&D stage of the innovation process. However, the smallest percentage of male respondents are represented by the following OI involvement phases: Romania testing phase, for Belgium design phase, and for Germany marketing. As regarding the female respondents, most of them were involved in the R&D phase, in Belgium the marketing phase, and for Germany R&D.

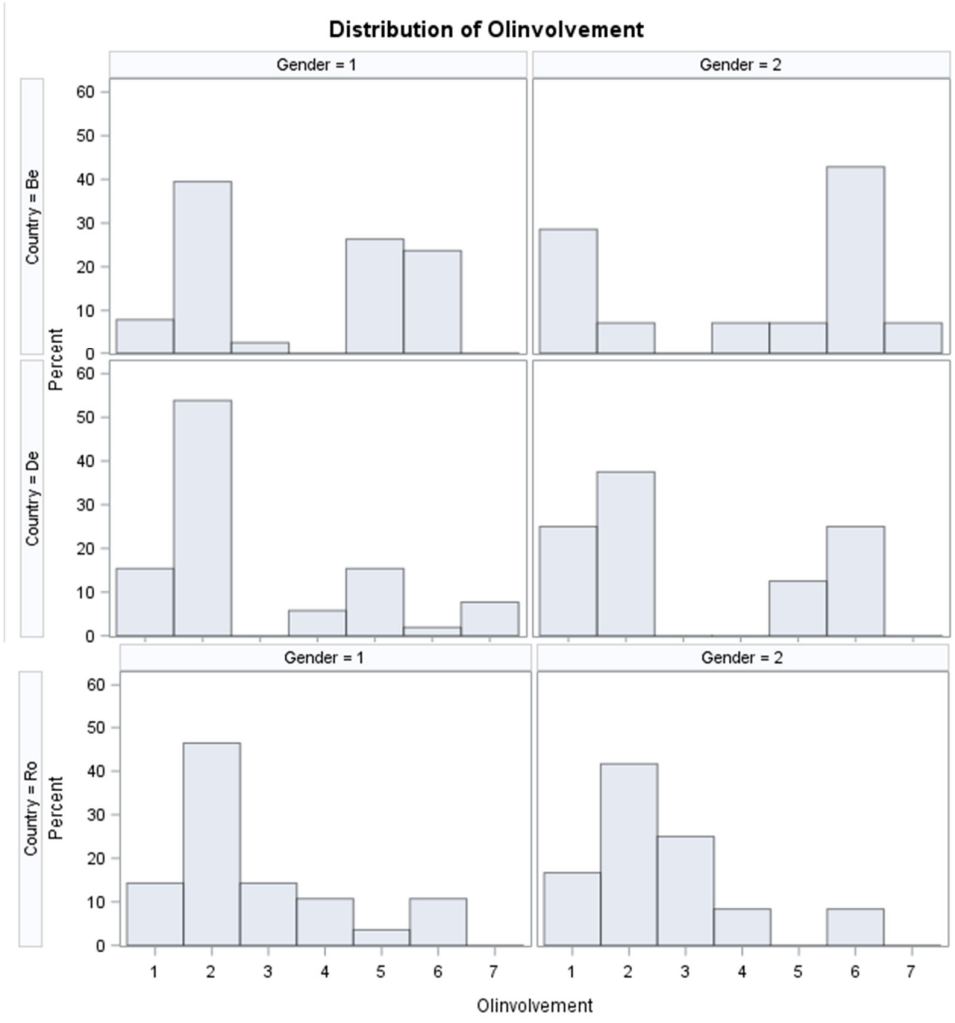


Figure 4.3 Open Innovation area of involvement distribution by gender and country

Based on gender we can observe that there is a larger percentage of male respondents, as compared with the females. Given the fact that most respondents come from the High-tech industry, and this particular sector is highly dominated by males, this explains that from the total number of respondents only less than a quarter are females. Several articles point towards the gender diversity problem in this sector, females being less attracted by the hi-tech sector (e.g. Herring, 2009).

Gender	Frequency	Percent
Males	124	77.99%
Females	35	22.01%

Table 4.3 Overall gender distribution among the respondents

Table 4.3 depicts the respondents' involvement in the various OI process phases. It can be observed that the phase in which most respondents were involved in, is the "R&D", whereas in "Distribution" we notice the least involvement. Drawing from these results, the incipient phase of the innovation process seems to be the one where most individuals engage in OI activities. However, we can also notice that respondents also engage in marketing collaborative activities. An increasing number of companies opt for leveraging other firm's capabilities, rather than creating them in-house, hence focusing solely on their core capabilities.

OI process involvement phase	Frequency	Percent
Concept generation	23	15.13%
Research and Development	65	42.76%
Design	8	5.26%
Manufacturing	8	5.26%
Testing	21	13.82%
Marketing	22	14.47%
Distribution	5	3.29%
Missing observations = 7		

Table 4.4 The OI process respondent's involvement phase

4.3 Hypotheses testing procedure

The following steps have been applied to provide an accurate statistical analysis and a reliable conclusion to my experiment. As it can be seen (Figure 5.1), at first I developed the null and alternative hypotheses according to my research questions, followed by specifying the sample size and the significance level (α). Further, consistent with the literature covered in chapter 4, I determined the appropriate statistical tests. The next stage was data collection through a self-administered survey, that was submitted online or personally to the respondents. Afterwards, the data was analyzed for each of the selected tests, accordingly the conclusions were drawn conforming to the selected significance level. Hereby, the general procedure for hypothesis testing.

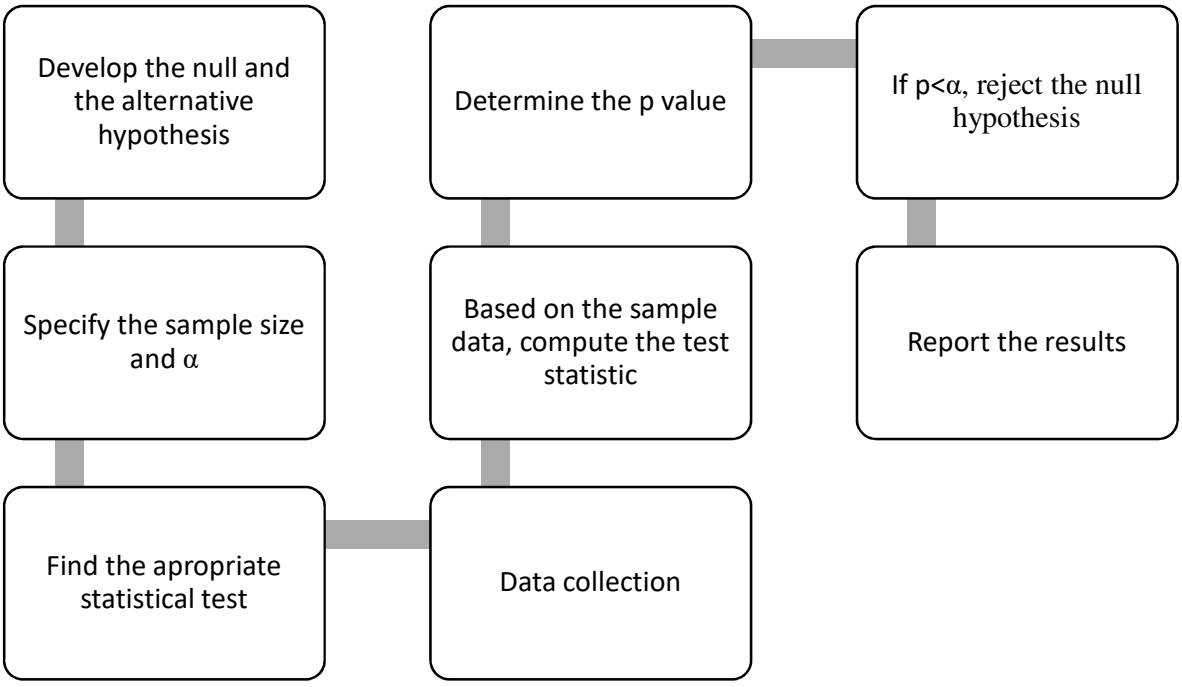


Figure 5.1 The procedure for testing the null hypotheses

5. Results

5.1 Individual-level Creativity (Tests hypothesis 1)

5.1.1 One-Way ANOVA

H_0 *Respondents from different groups in "Individual- level Creativity" (SD, D, N, A, SA), all rate "Open Innovation Process" the same on average.*

H_1 *Respondents from different groups in "Individual- level Creativity" (SD, D, N, A, SA), do not all rate "Open Innovation Process" the same on average.*

As it can be observed from Table 1, since the p-value is statistically significant (p-value lower than 0.05) I conclude the alternative hypothesis, meaning that the responses in the five different groups in *"Individual- level Creativity"* do not lead to the same rating of *"Open Innovation Process"*. This conclusion of the relationship between *"Individual- level Creativity" and "Open Innovation Process"* did not surprised me since the study was conducted because I expected that the groups of the independent variable will influence in a different way the *"Open Innovation Process".* My initial expectation was that the respondents who answered with "Strongly Agree" on the items from *"Individual- level Creativity",* will have a higher impact on the *"Open Innovation Process".* However, the One-Way ANOVA did not provide me with this conclusion, therefore this will be further explored by conducting a Jonckheere-Terpstra test for each hypothesis of interest.

Parameter estimates One Way ANOVA			
Independent Variable	F Value	df	p value
Individual Creativity	93.34	3	$< .0001$

Table 5.1 Results from the One-Way ANOVA test (Hypothesis 1)

5.1.2 Linear Regression

The first hypothesis of interest that is tested, was formulated as following:

H_0 *There is no relationship between the "Individual- level Creativity" and the "Open Innovation Process"*

H_1 *The "Individual- level Creativity" has a linear impact on the "Open Innovation Process"*

It can be observed in Table 2 that the p value of the predictor "Individual Creativity" is less than 0.05, thus I conclude that the null hypothesis is rejected. Therefore, this implies that there exists a positive linear association between the *"Individual Creativity"* and the *"Open Innovation Process".* In addition to this, the adjusted coefficient of multiple determination (adjusted R^2) of my model equals 0.6476, this involves that the linear regression explains approximatively 65% variability of the *"Open Innovation Process".* In other words, the variation in the dependent variable is reduced by approximatively 65% when the predictor *"Individual Creativity"* is considered in the model.

$$R^2_{adjusted} = 0.6476$$

Parameter estimates				
Variable	Parameter Estimate	Standard Error	t Value	p value
Intercept	16.24663	2.01619	8.06	$< .0001$
Individual Creativity	0.64031	0.03751	17.07	$< .0001$

Table 5.2 Regression model (Hypothesis 1)

5.1.3 Kruskal-Wallis Test

As I previously mentioned this test is the non-parametric version of the One-Way ANOVA and it can be used for establishing if there are statistically significant differences between several groups of the independent variable *"Individual Creativity"* on the ordinal response variable *"Open Innovation Process".* Depending on the answers provided by the respondents for *"Individual Creativity"* (Strongly Disagree, Disagree, Neutral, Agree, Strongly Agree), the Kruskal-Wallis Test assigns ranks to these answers and then it calculates the mean rank for

each group in order to see if these components influence the in the same way, or differently the *"Open Innovation Process".* The hypotheses of interest are:

H_0 *The groups representing the "Individual Creativity" (SD, D, N, A, SA) have the same influence on the "Open Innovation Process"*

H_1 *The groups representing the "Individual Creativity" (SD, D, N, A, SA) influence differently the "Open Innovation Process"*

As it can be observed from Table 3, due to the fact that the p-value of the Kruskal-Wallis Test is lower than level of significance (α =0.05), I reject the null hypothesis and I conclude that there is a statistical significant difference in the groups representing the *"Individual Creativity"*, meaning that they influence differently the *"Open Innovation* Process*".*

Individual Creativity	Mean Rank	Chi-Square	p value
Disagree	2.50	87.9086	$< .0001$
Neutral	17.72		
Agree	77.08		
Strongly Agree	87.46		

Table 5.3 The results from Kruskal-Wallis Test (Hypothesis 1)

5.1.4 Jonckheere-Terpstra test

H_0 *The groups representing the "Individual Creativity" (SD, D, N, A, SA) have the same influence on the "Open Innovation Process"*

H_1 *An increase in the groups representing the "Individual Creativity" accompanies an increase in the "Open Innovation Process" (SD < D < N < A < SA)*

Table 4 below presents the results of this test. Due to the fact that I have found a significant result, this is a clear evidence that an increase in the *"Individual Creativity"* groups will produce likewise an increase in the *"Open Innovation Process".* In other words, consistent with my assumption, a higher level of creativity at the individual level is more likely to produce a positive impact the process of OI.

Parameter estimates Independent-Samples Jonckheere-Terpstra Test for Ordered Alternatives			
Independent Variable	Test statistic	Standard Error	Asymptotic Sig.
Individual-level Creativity	3469	142.27	< .0001

Table 5.4 Results from Jonckheere-Terpstra test (Hypothesis 1)

5.2 Individual- level Openness (Tests Hypothesis2)

5.2.1 One-Way ANOVA

H_0 *Respondents from different groups in "Individual- level Openness" (SD, D, N, A, SA), all rate "Individual- level Creativity" the same on average.*

H_1 *Respondents from different groups in "Individual- level Openness" (SD, D, N, A, SA), do not all rate "Individual- level Creativity" the same on average.*

Table 5 hereby illustrates a statistically significant p-value (p-value < 0.05) henceforth I conclude H1. Accordingly, the responses in the five different groups in *"Individual- level Openness"* do not lead to the same rating of *"Individual- level Creativity"*.

Parameter estimates One Way ANOVA			
Independent Variable	F Value	df	p value
Individual-level Openness	178.85	2	< .0001

Table 5.5 Results from the One-Way ANOVA test (Hypothesis 2)

5.2.2 Linear Regression

The second hypothesis of interest that is tested, was formulated as following:

H_0 *There is no relationship between the "Individual- level Openness" and the "Individual- level Creativity"*

H_1 *The "Individual- level Openness" has a linear impact on the "Individual- level Creativity"*

Table 6 illustrates that the p-value of the predictor *"Individual- level Openness"* is less than 0.05, therefore I conclude that the null hypothesis is rejected. This involves that there exists a positive linear association between the *"Individual- level Openness"* and the *"Individual- level Creativity".* Moreover, the adjusted coefficient of multiple determination (adjusted R^2) of my

model equals 0.7979. This involves that the linear regression explains approximatively 80% variability of the *"Individual- level Creativity".*

$$R^2_{adjusted} = 0.7979$$

Parameter estimates				
Variable	Parameter Estimate	Standard Error	t Value	p value
Intercept	-1.19012	2.19314	-0.54	0.5881
Individual-level openness	1.29657	0.05188	24.99	$< .0001$

Table 5.6 Regression model results (Hypothesis 2)

5.2.3 Kruskal-Wallis Test for Hypothesis

The hypotheses of interest are:

H_0 *The groups representing the "Individual- level openness" (SD, D, N, A, SA) have the same influence on the "Individual- level Creativity"*

H_1 *The groups representing the "Individual- level openness" (SD, D, N, A, SA) influence differently the "Individual- level Creativity"*

Based on the p-value of this test, illustrated in Table 7, I thus reject the null hypothesis and conclude the alternative, furthermore I state that there is a different influence of the levels of *"Individual- level openness"* on the *"Individual- level Creativity".*

Individual-level Openness	Mean Rank	Chi-Square	p value
Neutral	88.21	77.9045	$< .0001$
Agree	13.38		
Strongly Agree	88.21		

Table 5.7 The results from Kruskal-Wallis Test (Hypothesis 2)

5.2.4 Jonckheere-Terpstra test for Hypothesis 2

H_0 *The groups representing the "Individual-level Openness" (SD, D, N, A, SA) have the same influence on the "Individual- level Creativity"*

H_1 *An increase in the groups representing the "Individual-level Openness" accompanies an increase in the "Individual- level Creativity" (SD < D < N < A < SA)*

The results provided by the Jonckheere-Terpstra test are illustrated in Table 8 below. The statistical significant result of the test leads to the conclusion that an increase in the *"Individual-level Openness"* groups will produce likewise an increase in the *"Individual- level Creativity".*

Parameter estimates Independent-Samples Jonckheere-Terpstra Test for Ordered Alternatives			
Independent Variable	Test statistic	Standard Error	Asymptotic Sig.
Individual-level Openness	2417	132.54	$< .0001$

Table 5.8 Results from Jonckheere-Terpstra test (Hypothesis 2)

5.3 Motivation (Tests Hypothesis 3)

5.3.1 One-Way ANOVA

H_0 *Respondents from different groups in "Motivation" (SD, D, N, A, SA), all rate "Individual -level Creativity" the same on average.*

H_1 *Respondents from different groups in "Motivation" (SD, D, N, A, SA), do not all rate "Individual -level Creativity" the same on average.*

As Table 9 illustrates, the p-value is statistically significant (p-value lower than 0.05) and I conclude the alternative hypothesis. This implies that the responses in the five different groups from *"Motivation"* do not lead to the same rating of *"Individual -level Creativity".*

Parameter estimates One Way ANOVA			
Independent Variable	F Value	df	p value
Motivation	141.82	3	$< .0001$

Table 5.9 Results from the One-Way ANOVA test (Hypothesis 3)

5.3.2 Linear Regression

The third hypothesis of interest that is tested, was formulated as following:

H_0 *There is no relationship between the "Motivation" and the "Individual- level Creativity"*

H_1 *The "Motivation" has a linear impact on the "Individual- level Creativity"*

We can observe from Table 10 that the p value of the predictor "*Motivation*" is less than the significance level, I thus conclude that the null hypothesis is rejected. Moreover, this implies that there exists a positive linear association between the *"Motivation"* and the *"Individual-level Creativity",* and the adjusted coefficient of multiple determination (adjusted R^2) of my model equals 0.6434. The linear regression explains 64.3% variability of the *"Individual- level Creativity".*

$$R^2_{adjusted} = 0.6434$$

Parameter estimates				
Variable	Parameter Estimate	Standard Error	t Value	p value
Intercept	9.68764	2.59757	3.73	0.0003
Motivation	0.99064	0.05857	16.91	< .0001

Table 5.10 The results form Linear Regression test (Hypothesis 3)

5.3.3 Kruskal-Wallis Test

The hypotheses of interest are:

H_0 *The groups representing the "Motivation" (SD, D, N, A, SA) have the same influence on the "Individual- level Creativity"*

H_1 *The groups representing the "Motivation" (SD, D, N, A, SA) influence differently the "Individual- level Creativity"*

Table 11 depicts that the p-value of the Kruskal-Wallis Test is lower than level of significance (α =0.05), I reject the null hypothesis and I conclude that there is a statistical significant difference in the groups representing the *"Motivation"*, meaning that they influence differently the *"Individual- level Creativity".*

Motivation	Mean Rank	Chi-Square	p value
Disagree	1.50	102.27	< .0001
Neutral	7.07		
Agree	38.02		
Strongly Agree	94.35		

Table 5.11 The results from Kruskal-Wallis Test (Hypothesis 3)

5.3.4 Jonckheere-Terpstra test

H_0 *The groups representing the "Motivation" (SD, D, N, A, SA) have the same influence on the "Individual- level Creativity"*

H_1 *An increase in the groups representing the "Motivation" accompanies an increase in the "Individual- level Creativity" (SD < D < N < A < SA)*

The Jonckheere-Terpstra test for this hypothesis, depicted in Table 12, indicates a statistical significant result leading to the conclusion that an increase in the *"Motivation"* groups will produce likewise an increase in the *"Individual- level Creativity".*

Parameter estimates Independent-Samples Jonckheere-Terpstra Test for Ordered Alternatives			
Independent Variable	Test statistic	Standard Error	Asymptotic Sig.
Motivation	4194	180.33	$< .0001$

Table 5.12 Results from Jonckheere-Terpstra test (Hypothesis 3)

5.4 Intrinsic Motivation (Tests Hypothesis 3a)

5.4.1 One-Way ANOVA

H_0 *Respondents from different groups in "Intrinsic Motivation" (SD, D, N, A, SA), all rate "Individual -level Creativity" the same on average.*

H_1 *Respondents from different groups in "Intrinsic Motivation" (SD, D, N, A, SA), do not all rate "Individual -level Creativity" the same on average.*

The p-value is likewise statistically significant (p-value lower than 0.05), hence I conclude the alternative hypothesis. The responses in the five different groups from *"Intrinsic Motivation"* do not lead to the same rating of *"Individual -level Creativity".*

Parameter estimates One Way ANOVA			
Independent Variable	F Value	df	p value
Intrinsic Motivation	83.5	3	$< .0001$

Table 5.13 Results from the One-Way ANOVA (Hypothesis 3a)

5.4.2 Linear Regression

The hypothesis 3a is tested, hence it was formulated as:

H_0 *There is no relationship between the "Intrinsic Motivation" and the "Individual- level Creativity"*

H_1 *The "Intrinsic Motivation" has a linear impact on the "Individual- level Creativity"*

The strongly statistically significant result presented in Table 14 leads to the rejection of the null hypothesis. This implies a positive linear association between the *"Intrinsic Motivation"* and the *"Individual- level Creativity".* Moreover, the adjusted coefficient of multiple determination (adjusted R^2) of my model equals 0.5827. This involves that the linear regression explains 58% variability of the *"Individual- level Creativity".*

$$R^2_{adjusted} = 0.5827$$

Parameter estimates				
Variable	Parameter Estimate	Standard Error	t Value	p value
Intercept	7.35088	3.10440	2.37	0.0191
Intrinsic Motivation	9.75396	0.65524	14.89	$< .0001$

Table 5.14 The results form Linear Regression test (Hypothesis 3a)

5.4.3Kruskal-Wallis Test

The hypotheses of interest are:

H_0 *The groups representing the "Intrinsic Motivation" (SD, D, N, A, SA) have the same influence on the "Individual- level Creativity"*

H_1 *The groups representing the "Intrinsic Motivation" (SD, D, N, A, SA) influence differently the "Individual- level Creativity"*

The results of this test indicate that the null hypothesis ought to be rejected, hence concluding the alternative. There is a different influence of the levels of *"Intrinsic Motivation"* on the *"Individual- level Creativity".*

Intrinsic Motivation	Mean Rank	Chi-Square	p value
Disagree	4.75	82.6096	< .0001
Neutral	20.00		
Agree	43.23		
Strongly Agree	93.11		

Table 5.15 The results from Kruskal-Wallis Test (Hypothesis 3a)

5.4.4 Jonckheere-Terpstra test

H_0 *The groups representing the "Intrinsic Motivation" (SD, D, N, A, SA) have the same influence on the "Individual- level Creativity"*

H_1 *An increase in the groups representing the "Intrinsic Motivation" accompanies an increase in the "Individual- level Creativity" (SD < D < N < A < SA)*

Table 16 below illustrates the findings of the Jonckheere-Terpstra test, indicating a statistical significant result leading to the conclusion that an increase in the *"Intrinsic Motivation"* groups will produce likewise an increase in the *"Individual- level Creativity".*

Parameter estimates Independent-Samples Jonckheere-Terpstra Test for Ordered Alternatives			
Independent Variable	Test statistic	Standard Error	Asymptotic Sig.
Intrinsic Motivation	4080	182.2	< .0001

Table 5.16 Results from Jonckheere-Terpstra test (Hypothesis 3a)

5.5 Extrinsic Motivation (Tests Hypothesis 3b)

5.5.1One-Way ANOVA

H_0 *Respondents from different groups in "Extrinsic Motivation" (SD, D, N, A, SA), all rate "Individual -level Creativity" the same on average.*

H_1 *Respondents from different groups in "Extrinsic Motivation" (SD, D, N, A, SA), do not all rate "Individual -level Creativity" the same on average.*

Due to a strongly significant result presented in Table 17, I reject the null hypothesis, suggesting that the responses in the five different groups in *"Extrinsic Motivation"* do not lead to the same rating of *"Individual -level Creativity".*

Parameter estimates One Way ANOVA			
Independent Variable	F Value	df	p value
Extrinsic Motivation	93.7	3	$< .0001$

Table 5.17 Results from the One-Way ANOVA (Hypothesis 3b)

5.5.2 Linear Regression

The hypothesis 3b is tested, hereby it was formulated as:

H_0 *There is no relationship between the "Extrinsic Motivation" and the "Individual- level Creativity"*

H_1 *The "Extrinsic Motivation" has a linear impact on the "Individual- level Creativity"*

Table 18 indicates that the p-value of the predictor *"Extrinsic Motivation"* is less than 0.05, on that account I conclude that the null hypothesis is rejected. In other words, there exists a positive linear association between the *"Extrinsic Motivation"* and the *"Individual- level Creativity".* Moreover, the adjusted coefficient of multiple determination (adjusted R^2) of my model equals 0.4797. This involves that the predictor *"Extrinsic Motivation"* explains 48% variability of the *"Individual- level Creativity".*

$$R^2_{adjusted} = 0.4797$$

Parameter estimates				
Variable	Parameter Estimate	Standard Error	t Value	p value
Intercept	18.04489	2.93516	6.15	$< .0001$
Extrinsic Motivation	7.75814	0.64060	12.11	$< .0001$

Table 5.18 The results form Linear Regression test (Hypothesis 3b)

5.5.3 Kruskal-Wallis Test for Hypothesis 3b

H_0 *The groups representing the "Extrinsic Motivation" (SD, D, N, A, SA) have the same influence on the "Individual- level Creativity"*

H_1 *The groups representing the "Extrinsic Motivation" (SD, D, N, A, SA) influence differently the "Individual- level Creativity"*

The p-value of the Kruskal-Wallis test is lower that the assumed significance level, this leading to rejecting the null hypothesis and thus conclude the alternative. There is a different influence of the levels of *"Intrinsic Motivation"* on the *"Individual- level Creativity".*

Extrinsic Motivation	Mean Rank	Chi-Square	p value
Disagree	1.50	78.1415	< .0001
Neutral	19.00		
Agree	67.13		
Strongly Agree	94.88		

Table 5.19 The results from Kruskal-Wallis Test (Hypothesis 3b)

5.5.4 Jonckheere-Terpstra test

H_0 *The groups representing the "Extrinsic Motivation" (SD, D, N, A, SA) have the same influence on the "Individual- level Creativity"*

H_1 *An increase in the groups representing the "Extrinsic Motivation" accompanies an increase in the "Individual- level Creativity" (SD < D < N < A < SA)*

The p-value provided by Jonckheere-Terpstra test depicted in Table 20 below, indicate a statistical significant result leading to the conclusion that an increase in the *"Extrinsic Motivation"* groups will produce likewise an increase in the *"Individual- level Creativity".*

Parameter estimates Independent-Samples Jonckheere-Terpstra Test for Ordered Alternatives			
Independent Variable	Test statistic	Standard Error	Asymptotic Sig.
Extrinsic Motivation	5034	210.4	< .0001

Table 5.20 Results from Jonckheere-Terpstra test(Hypothesis 3b)

As we increase the level of intrinsic or extrinsic motivation, the level of the creativity in individuals will increase as well. Individuals who responded SA to the intrinsic and extrinsic motivation factors, have the highest creativity level, therefore they are considered to be the most creative individuals, as compared with the individuals who responded D, N and A to the same factors.

5.6 Personality (Tests Hypothesis 4)

5.6.1 One-Way ANOVA

H_0 *Respondents from different groups in "Personality" (SD, D, N, A, SA), all rate "Individual-level Creativity" the same on average.*

H_1 *Respondents from different groups in "Personality"" (SD, D, N, A, SA), do not all rate "Individual- level Creativity" the same on average.*

Table 21 below indicates that the p-value is statistically significant (p-value < 0.05), consequently I conclude the alternative hypothesis, in other words the responses in the five different groups in *"Personality"* do not lead to the same rating of *"Individual- level Creativity"*.

Parameter estimates One Way ANOVA			
Independent Variable	F Value	df	p value
Personality Factors	9.76	2	$< .0001$

Table 5.21 Results from the One-Way ANOVA (Hypothesis 4)

5.6.2 Linear Regression

The forth hypothesis of interest that is tested, was formulated as following for the linear regression model:

H_0 *There is no relationship between the "Personality" and the "Individual- level Creativity"*

H_1 *The "Personality" has a linear impact on the "Individual- level Creativity"*

Table 22 illustrates that the p-value of the predictor *"Personality"* is less than 0.05, accordingly I conclude that the null hypothesis is rejected. However, the adjusted coefficient of multiple determination (adjusted R^2) of my model equals 0.0954. This level of the adjusted R^2 is considered to be extremely small indicating a very poor fit of the model, due to the fact that the adjusted coefficient of multiple determination should have a value close to 1 in order to express a good fit of a model. This involves that the linear regression explains approximatively 9% variability of the *"Individual- level Creativity".*

$$R^2_{adjusted} = 0.0954$$

Parameter estimates				
Variable	Parameter Estimate	Standard Error	t Value	p value
Intercept	28.06155	6.00605	4.67	$< .0001$
Personality Factors	0.64138	0.15264	4.20	$< .0001$

Table 5.22 Regression model results (Hypothesis 4)

5.6.3 Kruskal-Wallis Test

The hypotheses of interest are:

H_0 *The groups representing the "Personality" (SD, D, N, A, SA) have the same influence on the "Individual- level Creativity"*

H_1 *The groups representing the "Personality" (SD, D, N, A, SA) influence differently the "Individual- level Creativity"*

My conclusion for this test is that the null hypothesis is rejected at the significance level 0.05, hence I conclude the alternative. Therefore, there is a different influence of the levels of *"Personality" (SD, D, N, A, SA) on* the *"Individual- level Creativity".*

Personality Factors	Mean Rank	Chi-Square	p value
Neutral	90.54	12.5056	$< .0001$
Agree	76.31		
Strongly Agree	90.54		

Table 5.23 The results from Kruskal-Wallis Test (Hypothesis 4)

5.6.4 Jonckheere-Terpstra test

H_0 *The groups representing the "Personality" (SD, D, N, A, SA) have the same influence on the "Individual- level Creativity"*

H_1 *An increase in the groups representing the "Personality" accompanies an increase in the "Individual- level Creativity" (SD < D < N < A < SA)*

The p-value from Jonckheere-Terpstra test showed in Table 24, indicates a statistical significant result leading to the conclusion that an increase in the *"Personality"* groups will produce likewise an increase in the *"Individual- level Creativity".*

Parameter estimates Independent-Samples Jonckheere-Terpstra Test for Ordered Alternatives			
Independent Variable	Test statistic	Standard Error	Asymptotic Sig.
Personality	3902	211.55	0.001

Table 5.24 Results from Jonckheere-Terpstra test (Hypothesis 4)

5.7 Resources (Tests Hypothesis 5)

5.7.1One-Way ANOVA

H_0 *Respondents from different groups in "Resources" (SD, D, N, A, SA), all rate "Individual-level Creativity" the same on average.*

H_1 *Respondents from different groups in "Resources" (SD, D, N, A, SA), do not all rate "Individual- level Creativity" the same on average.*

Having a look at Table 21, we can notice the p-value is statistically significant (p-value < 0.05), accordingly I reject the null hypothesis. This implies that the responses in the five different groups in *"Resources"* do not lead to the same rating of *"Individual- level Creativity"*.

Parameter estimates One Way ANOVA			
Independent Variable	F Value	df	p value
Resources	206.13	3	$< .0001$

Table 5.25 Results from the One-Way ANOVA (Hypothesis 5)

5.7.2 Linear Regression

The hypothesis of interest that is tested, was formulated as following for the linear regression model:

H_0 *There is no relationship between the "Resources" factor and the "Individual- level Creativity"*

H_1 *The "Resources" factor has a linear impact on the "Individual- level Creativity"*

Table 22 indicates a statistically significant p-value, accordingly I conclude that the null hypothesis is rejected. Moreover, the adjusted coefficient of multiple determination (adjusted R^2) of my model equals 0.7406. This involves that independent variable *"Resources" explains* 74% variability of the *"Individual- level Creativity".*

$$R^2_{adjusted} = 0.7406$$

Parameter estimates				
Variable	Parameter Estimate	Standard Error	t Value	p value
Intercept	5.35071	2.27152	2.36	0.0197
Resources	1.06323	0.05001	21.26	$< .0001$

Table5.26 Regression model (Hypothesis 5)

5.7.3 Kruskal-Wallis Test

The hypotheses of interest for this test can be stated as:

H_0 *The groups representing the "Resources" (SD, D, N, A, SA) have the same influence on the "Individual- level Creativity"*

H_1 *The groups representing the "Resources" (SD, D, N, A, SA) influence differently the "Individual- level Creativity"*

As reported in Table 27 below, the p-value is statistically significant. The null hypothesis is rejected for this test and I conclude the alternative one. Therefore there is a different influence of the levels of *"Resources" (SD, D, N, A, SA) on* the *"Individual- level Creativity".*

Resources	Mean Rank	Chi-Square	p value
Disagree	4.75	113.6585	$< .0001$
Neutral	7.19		
Agree	29.95		
Strongly Agree	93.94		

Table 5.27 The results from Kruskal-Wallis Test (Hypothesis 5)

5.7.4 Jonckheere-Terpstra test

H_0 *The groups representing the "Resources" (SD, D, N, A, SA) have the same influence on the "Individual- level Creativity"*

H_1 *An increase in the groups representing the "Resources" accompanies an increase in the "Individual- level Creativity" (SD < D < N < A < SA)*

Conforming to the results reported by the Jonckheere-Terpstra test, I conclude that an increase in the *"Resources"* groups will produce likewise an increase in the *"Individual- level Creativity".*

Parameter estimates Independent-Samples Jonckheere-Terpstra Test for Ordered Alternatives			
Independent Variable	Test statistic	Standard Error	Asymptotic Sig.
Resources	3977	170.63	< .0001

Table 5.28 Results from Jonckheere-Terpstra test (Hypothesis 5)

5.8 Organizational Culture (Tests Hypothesis 6)

5.8.1One-Way ANOVA

H_0 *Respondents from different groups in "Open organizational culture" (SD, D, N, A, SA), all rate "Individual- level Creativity" the same on average.*

H_1 *Respondents from different groups in "Open organizational culture" (SD, D, N, A, SA), do not all rate "Individual- level Creativity" the same on average.*

Since the p-value provided by this test is statistically significant (p-value < 0.05), I conclude the alternative hypothesis, suggesting that the responses in the five different groups in *"Open organizational culture"* do not lead to the same rating of *"Individual- level Creativity"*.

Parameter estimates One Way ANOVA			
Independent Variable	F Value	df	p value
Open organizational culture	123.19	3	< .0001

Table 5.29 Results from the One-Way ANOVA (Hypothesis 6)

5.8.2 Linear Regression

The hypothesis of interest that is tested, was formulated as following for the linear regression model:

H_0 *There is no relationship between the "Open organizational culture" factor and the "Individual- level Creativity"*

H_1 *The "Open organizational culture" factor has a linear impact on the "Individual- level Creativity"*

Table 22 illustrates that the p-value of the independent variable *"Resources"* is less than 0.05, accordingly I conclude that the null hypothesis is rejected. Moreover, the adjusted coefficient of multiple determination (adjusted R^2) of my model equals 0.6029. Therefore, the independent variable *"Resources" explains* 60% variability of the *"Individual- level Creativity".*

$$R^2_{adjusted} = 0.6029$$

Parameter estimates				
Variable	Parameter Estimate	Standard Error	t Value	p value
Intercept	7.92058	2.94203	2.69	0.0079
Open Organizational Culture	0.93999	0.06057	15.52	< .0001

Table 5.30 Regression model (Hypothesis 6)

5.8.3 Kruskal-Wallis Test

The hypotheses of interest for this test can be stated as:

H_0 *The groups representing the "Open organizational culture" (SD, D, N, A, SA) have the same influence on the "Individual- level Creativity"*

H_1 *The groups representing the "Open organizational culture" (SD, D, N, A, SA) influence differently the "Individual- level Creativity"*

The significant result found by this test leads to the rejection of the null hypothesis. I thus conclude that there is a different influence of the levels of *"Open organizational culture" (SD, D, N, A, SA) on* the *"Individual- level Creativity".*

Open organizational culture	Mean Rank	Chi-Square	p value
Disagree	1.50	85.5773	$< .0001$
Neutral	10.19		
Agree	71.30		
Strongly Agree	96.84		

Table 5.31 The results from Kruskal-Wallis Test (Hypothesis 6)

5.8.4 Jonckheere-Terpstra test

H_0 *The groups representing the "Open organizational culture" (SD, D, N, A, SA) have the same influence on the "Individual- level Creativity"*

H_1 *An increase in the groups representing the "Open organizational culture" accompanies an increase in the "Individual- level Creativity" (SD < D < N < A < SA)*

As reported by the Jonckheere-Terpstra test, there is a statistical significant result. This leads to the conclusion that an increase in the *"Open organizational culture" groups* will produce likewise an increase in the *"Individual- level Creativity".*

Parameter estimates Independent-Samples Jonckheere-Terpstra Test for Ordered Alternatives			
Independent Variable	Test statistic	Standard Error	Asymptotic Sig.
Open Organizational Culture	5389	218.9	$< .0001$

Table 5.32 Results from Jonckheere-Terpstra test(Hypothesis 6)

5.9 Collaborations (Tests Hypothesis 7)

5.9.1One-Way ANOVA

H_0 *Respondents from different groups in "Collaborations" (SD, D, N, A, SA), all rate "Individual-level Creativity" the same on average.*

H_1 *Respondents from different groups in "Collaborations" (SD, D, N, A, SA), do not all rate "Individual- level Creativity" the same on average.*

Illustrated in Table 33, the p-value is statistically significant (p-value < 0.05), as a consequence I conclude the alternative hypothesis. Accordingly, the responses in the five different groups in *"Collaborations""* do not lead to the same rating of *"Individual- level Creativity"*.

Parameter estimates One Way ANOVA			
Independent Variable	F Value	df	p value
Collaborations	5.47	2	0.005

Table 5.33 Results from the One-Way ANOVA (Hypothesis 7)

5.9.2 Linear Regression

The last hypothesis of interest that is tested, was formulated as following for the linear regression model:

H_0 *There is no relationship between the "Collaborations" and the "Individual- level Creativity"*

H_1 *The "Collaborations" has a linear impact on the "Individual- level Creativity"*

As reported in Table 33, the p-value of the predictor *"Collaborations"* is less than 0.05, respectively I conclude that the null hypothesis is rejected. However, the adjusted coefficient of multiple determination (adjusted R^2) of my model equals 0.0456. This level of the adjusted R^2 is considered to be extremely small indicating a very poor fit of the model. This involves that the linear regression explains approximatively 4% variability of the *"Individual- level Creativity".*

$$R^2_{adjusted} = 0.0456$$

Parameter estimates				
Variable	Parameter Estimate	Standard Error	t Value	p value
Intercept	40.65512	4.32459	9.40	$< .0001$
Collaborations	0.32928	0.11261	2.92	0.0040

Table 5.34 Regression model (Hypothesis 7)

5.9.3 Kruskal-Wallis Test

The hypotheses of interest for this test can be stated as:

H_0 *The groups representing the "Collaborations" (SD, D, N, A, SA) have the same influence on the "Individual- level Creativity"*

H_1 *The groups representing the "Collaborations" (SD, D, N, A, SA) influence differently the "Individual- level Creativity"*

The Kruskal-Wallis Test for this hypothesis provided a significant result, therefore there is a different influence of the levels of *"Collaborations" (SD, D, N, A, SA)* on the *"Individual- level Creativity".*

Collaborations	Mean Rank	Chi-Square	p value
Neutral	61.70	6.5027	0.0339
Agree	70.19		
Strongly Agree	83.83		

Table 5.35 The results from Kruskal-Wallis Test (Hypothesis 7)

5.9.4 Jonckheere-Terpstra test

H_0 *The groups representing the "Collaborations" (SD, D, N, A, SA) have the same influence on the "Individual- level Creativity"*

H_1 *An increase in the groups representing the "Collaborations" accompanies an increase in the "Individual- level Creativity" (SD < D < N < A < SA)*

In line with the results of Jonckheere-Terpstra test, there is a statistical significant result leading to the conclusion that an increase in the *"Collaborations" groups* will produce likewise an increase in the *"Individual- level Creativity".*

Parameter estimates Independent-Samples Jonckheere-Terpstra Test for Ordered Alternatives			
Independent Variable	Test statistic	Standard Error	Asymptotic Sig.
Collaborations	3205.5	193.678	0.011

Table 5.36 Results from Jonckheere-Terpstra test (Hypothesis 7)

6. Discussion and Conclusion

In the first chapter of this thesis, the proposed research question has been depicted, resulting into four research sub questions for addressing the problem statement. The first research question emphasizes on the componential creativity factors for individuals engaging in OI activities. Up until now, to the best of my knowledge, no research has yet attempted to integrate elements of OI while testing creativity componential models. Factors like personality, motivation, or resources have been widely discussed in the existing literature. However, my model contributes to the existing literature by acknowledging the externally developed knowledge, openness towards new sources of creativity, and a culture that promotes the benefits of openly creating, as integral part of the creative process. In addition to this, the study result demonstrates that there is a positive influence between those componential factors and creativity at the individual level.

This study demonstrates that to the same extent as intrinsic, extrinsic motivation has a positive impact for individuals participating in collaborative creative activities and consequently facilitating the innovative habit. It is likewise generally admitted that individual's creativity is a personality trait. I on the other hand, believe that creativity can be crafted, by taking the known elements and combining them with the ones from our external environment. In this regard, individuals are not limited within the organizational boundaries, rather they have the opportunity of tapping into the external environment and enrich their knowledge base. Furthermore, creativity entails the freedom to explore, because imposing a rigid tradition-bound behavior, hinders the development of creative ideas. Put it differently, it is not just individual's personality that defines creativity, it is rather a combination of various factors that originate both from individuals but as well as from the external environment.

The second question stressed out the aspects of individual's motivation when openly creating. Due to its popularity in the prior research conducted on creativity, this aspect has been regarded as the main trigger for engaging in creative activities. Motivation has been indeed widely discussed and studied when determining the triggers of creativity.

Traditionally, it is believed that strongly intrinsically motivated individuals are more likely to engage in creative activities, whereas individuals that are extrinsically motivated were less likely to doing so. Indeed, lately researchers have started to shed light on the extrinsic factors and acknowledge their importance in the creative process.

Individuals vary depending on several aspects. It can be either our personality, environmental influences, our ideals, but most important our motivation. The variation in individual's motivation, can be due to differences in our experiences, the sector we are working in, or simply by the things we are thriving for. To this extent, numerous researchers emphasized on highlighting the differences between intrinsic and extrinsic motivation for engaging in creative processes. I have likewise considered that would be of great importance to highlight and contrast these motivation types, especially in an OI context where individuals have the opportunity to co-create. A central finding of the creativity literature (Appendix 3), is that individuals are most creative when pursuing activities that they enjoy, rather than being pressured/influenced by factors from the external environment (extrinsic motivators). The intrinsic motivation principle received thus support from several research studies. As previously stated, a central finding in the creativity literature is that strong intrinsic motivation has a greater impact than extrinsic motivation on the creative process' outcome. However, a latest update of the componential model of creativity (Amabile and Pratt, 2016) acknowledges that extrinsic motivation plays a positive role in the creation process. The findings of my empirical study also indicate that a balance between intrinsic and extrinsic motivation is more likely to have a positive outcome on the overall creation process.

Contrary to the traditional expectations, extrinsic motivation is likewise conductive to creativity, and naturally has an impact in the OI process. Furthermore, the results of this study indicate that in OI settings both intrinsically and extrinsically motivated individuals are likely to engage in creative activities. This result is consistent with the latest findings of Amabile and Pratt (2016), which recognize both extrinsic and intrinsic motivation as integral part of the creative process. However, it is worth to mention that the findings of the authors are not based on individuals engaging in OI creative activities. Nevertheless, as Herzog (2011) stated,

whether engaging in open or traditional innovation activities, individuals are likely to be motivated in the same way regardless of the intrinsic or extrinsic motivation factors.

Further, the individual- level creativity's impact on the OI process was addressed. As I earlier highlighted, mostly the focus shifted towards the macro foundations of OI, whereas the human factor has not been given much attention. Creativity is essential for every company, either for turning it into innovative products or services, or for leveraging it when advancing their business model. The main highlight though, that is likewise consistent with the literature on traditional innovation, is that the individual and the organizational factors are complementary. Thus, as the findings indicate, the individual's creative ideas feed the process of OI, whereas the organization must identify and support all the factors that nurture creativity. The elements that are OI specific, have shown significant influence on individual's ability to create. Therefore, allowing individuals to benefit from a diversified portfolio of external creativity sources, supports the organization's short or long-term OI goals.

Thereafter, the challenges associated with individual's involvement in OI activities were addressed. We still lack insight with respect to this aspect, and very few studies underlining the challenges or coping strategies for individuals in OI settings. Four of these proposed coping strategies have been as well presented in the literature review, however the challenges that arise together with the involvement in OI are various and numerous. Depending on the stage of the innovation process, the business model, and the external factors, individuals face several new challenges that consequently they must cope with. Some of the greatest challenges that this study identifies are the risk taking in pursuing ideas, and the openness towards new sources of knowledge. Individuals ought not to perceive engaging in OI activities as the "*last option*", rather they should consider it as an opportunity even more at incipient phase of their creation process. Furthermore, the engagement in OI activities must not to regarded as a risk. Firstly, individuals may believe that the external engagement is a threat to their job or intellectual propriety. Secondly, individuals perceive disclosure as a risk. In many cases, collaborations fail due to an uneven balance of the disclosed information. Hence, establishing a fair balance and certain rules can help avoid the uncertainties.

Conclusion

This paper developed and tested a model of assessing the individual- level creative process in the context of OI. The key finding of this study, in addition to the existing creativity literature, is the positive overall impact of including OI contextual factors on the Individual's creative process. Therefore, based on the study findings and existing literature I conclude the following.

An environment that promotes openness towards new sources of knowledge, an open organizational culture, and stresses out the benefits of engaging in collaborative activities, facilitates the individual's creative habit. Between the organizational and human factors, a synergy ought to be established for being able to openly innovate. The open organizational factors are essential and should be an integral part of any firm's strategy, because they constitute the framework on which individuals will generate their creative ideas.

Contrasting with a closed innovation model, In OI contexts due to a higher number of individuals taking part in the innovation process, efficiently organizing and managing the transfer of knowledge becomes a delicate task for most companies. The results of this study indicate that focusing on the proposed componential factors, can help aligning individuals to the open business model strategy.

In addition to this, it is very important for individuals and companies to realize the possible value of OI, and implement it since the incipient phase of the creation process. Engaging in OI activities should not be thus perceived as a backup plan, rather ought to be acknowledged as integral part of the creative process.

I conclude this by stating that innovation is essentially a people process and when engaging in collaborative knowledge creation activities, it is of crucial importance that individuals are willing to cooperate, open towards new sources of knowledge, highly motivated, and most important able to influence others to take part in such initiatives.

7. Implications for managers and policymakers

As a manager, it is highly important to ***know*** the individuals that take part of the OI process. This study revealed that innovation is a people process, hence focusing on promoting an environment that fosters creativity is crucial when engaging individuals to openly innovating. Knowing what individuals are motivated by, or offering them the freedom to express ideas are likewise notable aspects. Managers should focus on providing a less rigid organizational environment, and allow individuals to freely express their ideas without any fear of repercussions.

Considering the today's highly competitive economic environment, individuals migrating from a company to another is challenging to control, many companies facing difficulties in recruiting retaining highly skilled individuals. Thus, concentrating on extrinsic factors (e.g. pecuniary incentives) is as aspect ought to be considered. Consequently, one should not only rely on the fact that individuals are solely driven by passion when openly creating.

To the managers that have not yet engaged in OI activities, the results of this study can help organize, stimulate, and align individuals to the open business model. Moreover, concentrating on the componential factors that are found to positively impact individual' s creativity, can lead to a more efficient implemented OI model.

With respect to the policymakers, we can notice that to present there are no clear developed policies or plans for managing IP at the individual level. Many of the collaborations often fail due to IP disclosure infringements. This paper also addressed the information disclosure paradox as a challenge for individuals. Therefore, implementing modular IP training[3] can be a good point to start.

I hope that the findings of this thesis will enable managers and policymakers to better address the individual-level implications in the OI process, and come up with new managerial practices for effectively exploring the creativity opportunities that OI uncovers.

[3] Also stressed out by Salter et al. (2014) for individuals engaging in open innovation activities

Limitations and further research

This research has some limitations. Even though the information was gathered from different companies, the respondents come mostly from the high-tech sector. Therefore, I was unable to identify the differences of individual's experiences with OI across different industries.

The macro foundations of Open Innovation have been widely discussed during the last couple of years, however we still have little knowledge about its micro foundations. Drawing from the findings of this research, and the dialogues I had with some of the respondents, I consider that further research should concentrate mainly on three aspects.

Firstly, even though 70% of the respondents in this study agreed that they do not perceive externally developed knowledge as "second best", for individuals that had no experience with OI activities, this uncertainty may occur. Therefore, researchers should focus on developing coping strategies for individuals preparing to engage in collaborative activities.

Furthermore, investigating the main challenges at the individual level when finding the right balance towards knowledge disclosure (management of IP at the individual- level), is of great importance as well. Coping strategies tackling the disclosure aspect, can be of considerable help for both the organization and individuals, especially when attempting to align everyone with the new open business model strategy.

The third suggested aspect for future research, is investigating the way individuals use OI tools. A better understanding of the tools used by individuals to reach outside the firm's boundaries, manage IP, as well as the implementation of collaboration techniques can be of great help for both managers and individuals.

References

Acerbi, A., Enquist, M., Ghirlanda, S., 2009. "*Cultural evolution and individual development of openness and conservatism"*, P.N.A.S., 106(45)

Allen, T., 1977. *"Managing the flow of technology: Technology transfer and the dissemination of technological information within the R&D organization*". Cambridge, MA, MIT Press.

Amabile, T.M., Pratt, M.G., 2016 "*The dynamic componential of creativity and innovation in organizations: Making progress, making meaning",* Research in Organizational Behavior, 36(2016), p.p. 157-183

Amabile, T.M., Kramer, S.J., 2010*," What really motivates workers". Harvard Business Review*, 88

Amabile, T.M., 1988. *"A model of creativity and innovation in organizations".* In B.M. Straw and L.L. Cummings. Research in Organizational Behavior, 10.

Amabile, T.M. 1996. "*Creativity in context",* Update to *"The Social Psychology of Creativity".* Westview Press

Amabile, T. M., Conti, R., Coon, H., Lazenby, J., Herron, M., 1996. *"Assessing the work environment for creativity"*. Academy of Management Journal, 39, p.p. 1154- 1184

Ahmed, P.K., 1998. *"Culture and climate for innovation".* European Journal of Innovation Management. 1, 30–43

Bartunek, J.M., 1988. "*The Dynamics of Personal and Organizational Reframing",* Paradox and transformation: Toward a theory of change in organization and management, Cambridge, p.p 137-162

Berthon, P. R., Pitt, L. F., McCarthy, I., & Kates, S. M., 2007. *"When customers get clever: Managerial approaches to dealing with creative consumers".* Business Horizons, 50, p.p. 39-47.

Berger, C., Moslein, K., Piller, F., Reichwald, R., 2005. *"Co-designing modes of cooperation at the customer interface: Learning from exploratory research"*. EURAM 2005

Carlile, R., 2004. "*Transferring, translating, and transforming: An integrative framework for managing knowledge across boundaries"*. Organization Science, 15

Chesbrough, W. Vanhaverbeke, and J. West (eds.),2014, *"New Frontiers in Open Innovation"*, Oxford: Oxford University Press

Chesbrough, H., Brunswicker, S. 2013, "*Managing Open Innovation in large firms"*

Chesbrough, H. W., 2003*, "Open innovation: The new imperative for creating and profiting from technology"*, Boston: Harvard Business School Press

Chesbrough, H. W., 2003. "*Open innovation: The new imperative for creating and profiting from technology*", Boston: Harvard Business School Press.

Chen C.-J., Huang J.-W., 2007. *"How organizational climate and structure affect knowledge management—The social interaction perspective"*. International Journal of Information Management 27 (2007), 104–118

Chioncel, M., Zifciakova, J., 2016. *"Research and Innovation Observatory".* RIO Country report

Cropley, A.J., 2001. "*Creativity in education and learning: A guide for teachers and Educators*". Kogan Page London

Dahlander, L., Gann, D. M., 2010. *"How open is innovation?"*. Research Policy 39, 2010, 699- 709

Deci, E.L., Ryan, R.M., 1985. "Intrinsic motivation and self-determination in human behavior", New York Plenum

Dessler, G., 1980. "Organization theory: integrating structure and behavior "

Diener, K., Piller F., 2013. *"The Market for Open Innovation: The 2013 RWTH Open Innovation Accelerator (OIA) Survey",* 2nd edition, Lulu Publishing

Dul, J. and Ceylan, C., 2014. *"The impact of a creativity-supporting work environment on a firm's product innovation performance"*. Product Development & Management Association. Vol. 31.

Du Chatenier, E., Verstegen, J., Biemans, H., Mulder, M., Omta, O., 2010, *"Identification of competencies for professionals in open innovation teams"*, Research and Development 40, 3, 2010

Elfenbein, D. W., Hamilton, B. H., & Zenger, T. R. 2010. *"The small firm effect and the entrepreneurial spawning of scientists and engineers"*. Management Science

Euchner, J., 2013, *"User Innovation. An interview with Eric von Hippel",* Research Technology Management, May-June 2013

Feist, G. J., 1999. "*The influence of personality on artistic and scientific creativity".* Handbook of creativity New York: Cambridge University Press, p.p. 273–296.

Gardner, H., 1993. *"Creating minds: An anatomy of creativity seen through the lives of Freud, Einstein, Picasso, Stravinsky, Eliot, Graham, and Gandhi*". NY Basic Books, p 35

Gassmann, O., Enkel, E., 2004. *"Towards a theory of open innovation: three core process archetypes".* Institute of Technology Management, University of St. Gallen, Switzerland, p. 7

Gassmann, O., Enkel, E., Chesbrough, H., 2010. *"The future of open innovation".* R&D Management 40, p.p. 213–221

Glass, G.V., Peckham, P.D., Sanders, J.R.,1972. *"Consequences of failure to meet assumptions underlying the analyses of variance and covariance"*. Review of Educational Research, 42, p.p.237-288.

Gouldner A.W., 1957. *"Cosmopolitans and locals: toward an analysis of latent social roles"*. Administrative Science Quarterly, 2, p.p. 288–296

Grant, A. M., Berry, J. W.,2011. *"The necessity of others is the mother of invention: Intrinsic and prosocial motivations, perspective taking, and creativity".* Academy of Management Journal, Vol 54, p.p. 73–96

Jamieson, S.,2004. *"Likert scales: how to (ab)use them"*. Medical Education, 38, p.p. 1212-1218.

Helson, R., Kwan, V. S. Y., John, O. P., Jones, C., 2002. *"The growing evidence for personality change in adulthood: Findings from research with personality inventories",* Journal of Research in Personality, 36(4), p.p. 287-306.

Herzog, P., 2011. *"Open and closed innovation. Different cultures for different strategies",* 2nd revised edition

Herring, C., 2009. "*Does diversity pay? Race, gender, and the business case diversity",* American sociological review, 74

Hunter, S. T., Bedell, K. E., Mumford, M. D., 2007. *"Climate for Creativity: A Quantitative Review"*, Creativity Research Journal, 19.

Kanter, R., 1988. *"When a thousand flowers bloom: structural, collective, and social conditions for innovation in organizations".* Research in organizational behavior.

Katz, R. and Allen, T. 1982. *"Investigating the Not-Invented-Here (NIH) Syndrome: A Look at Performance, Tenure and Communication Patterns of 50 R&D Project Groups"*. R&D Management , 12, p.p. 7–19.

Kumar, V.K., Kemmler, D., Holman, E.R., 1997. *"Creativity styles questionnaire-revised"*, West Chester University, Journal of creative behavior, 10, p.p. 320-323

Lazzarotti, M., Manzini, R., 2009. *"Different modes of Open Innovation: A theoretical Framework and an empirical study"*. International Journal of Innovation Management (13), p.p. 615-636

Leifer R. M., McDermott,C., Colarelli, G.O., Peters, L. S., Rice, M. P., Veryzer R.W. *"Radical Innovation: How Mature Companies Can Outsmart Upstarts*", Harvard Business School Press, 2002

Lichtenthaler, U., Lichtenthaler, E., 2009. *"A capability-based framework for open innovation: complementing absorptive capacity"*. Journal of Management Studies 46 (8)

Martindale, C., 1989. *"Personality, situation, and creativity".* Handbook of creativity, pp. 211–215. New York: Plenum.

Miron, E., Erez, M., & Naveh, E., 2004. *"Do personal characteristics and cultural values that promote innovation, quality, and efficiency compete or complement each other?"* Journal of Organizational Behavior, 25

Mumford, M. D., 2000. "*Managing creative people: strategies and tactics for innovation."* Human Resource Management Review

Munoz-Doyague, M.F., Nieto, M., 2011. *"Individual creativity performance and the quality of interpersonal relationships"*. IM & DS, 112, pp. 125- 145

Morrison, E., Phelps, C., 1999. *"Taking charge at work: Extra-role efforts to initiate workplace change"*. Academy of Management Journal, 42

Nargundkar, R. ,2008. *"Marketing Research: Text and Cases"*, Tata McGraw-Hill Educational, p.39

Norman, G., 2010. "Likert scales, levels of measurement and the "laws" of statistics". Springer Science and Business Media

Ohly, S., Sonnentag, S., Pluntke, F., 2006. *"Routinization work characteristics and their relationships with creative amnd proactive behaviors"*, Journal of Organizational behavior,27, p.p. 257-279

Oldham, G. R., Cummings, A.,1996. *"Employee creativity: Personal and contextual factors at work".* Academy of Management Journal, 39

O'Reilly C.A., Tushsman, M.L., 2004. *"Ambidextrous organizations: managing evolutionary and revolutionary change".* California Management Review, 38

Phillips, J., 2007. *"Creating a culture of innovation: changing your culture to accept and embrace innovation"*. InNetCentrics 2007

Piirto, J., 2004. *"Understanding Creativity".* Great Potential Press

Roijakkers, N., Zynga, A., Bishop, C., 2014, "*Getting help from innomediaries",* in "*Open innovation: The new imperative for creating and profiting from technology*", Boston: Harvard Business School Press. p.p. 242-255

Roijakkers, N., Vanhaverbeke, W.,2013, *"Enriching Open Innovation theory and practice by strengthening the relationship with strategic thinking"*, in "Strategy and communication for innovation" 2nd edition, p.p. 15-25

Rosenkopf, L., Nerkar, A. 2001. *"Beyond local search: Boundary spanning, exploration, and impact in the optical disk industry"*. Strategic Management Journal, 22(4), p.p. 287-306.

Salter, A., Ter Wal, A.L.J, Criscuolo, P., Alexy, O., 2014. *"Open for ideation: Individual- level openness and idea generation in R&D"*. Journal of Product Innovation Management, 32, p.p. 488- 504

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

Stein, M.I., 1974. *"Stimulating Creativity",* 1st Edition: Individual Procedures, Academic Press NY, p.p. 24-25

Tesluk, P. E., Farr, J. L., & Klein, S. R., 1997. *"Influences of organizational culture and climate on individual creativity".* Journal of Creative Behavior, 31

Tidd, J., Bessant, J., Pavitt, K., 2005. *"Managing innovation. Integrating technological, market and organizational change"*, 3rd edition, p.p. 476-483

Cosh, A., Z hang J.J., 2011. *"Open Innovation Choices -What is British Enterprise doing?",* UK Innovation and Research Centre

Ryan, R. M. & Deci, E. L. 2000. *"Intrinsic and Extrinsic Motivations: Classic Definitions and New Directions"*. Contemporary Educational Psychology 25, p.p. 54–67

Sawyer, R.K., 2012. *"Explaining Creativity: The Science of Human Innovation".* New York: Oxford University Press

Urgal, B., Quintás M.A., and Raquel A-T., 2013. *"Knowledge resources and innovation performance: the mediation of innovation capability moderated by management commitment"*. Technology Analysis & Strategic Management, 25

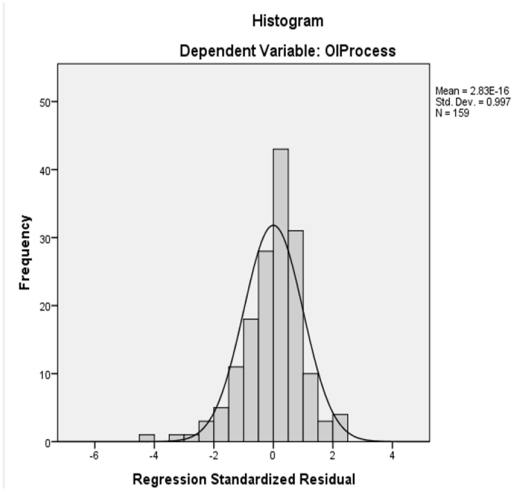
West, J., Gallagher, S., 2006. *"Challenges of open innovation: the paradox of firm investment in open-source software"*, R&D Management, 36, p.p. 3

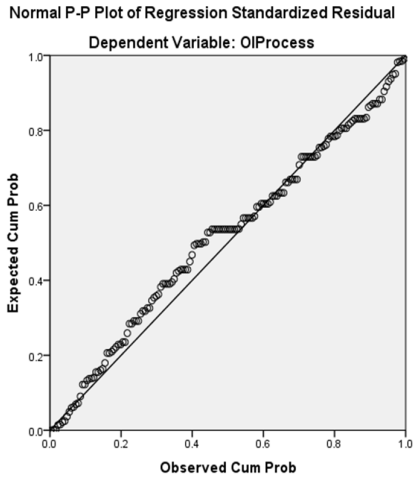
Woodman, R.W., Sawyer, J.E.,Griffin, R.W., 1993. *"Toward a theory of organizational creativity.",* Academy of management review, 18, p. 293

Appendixes

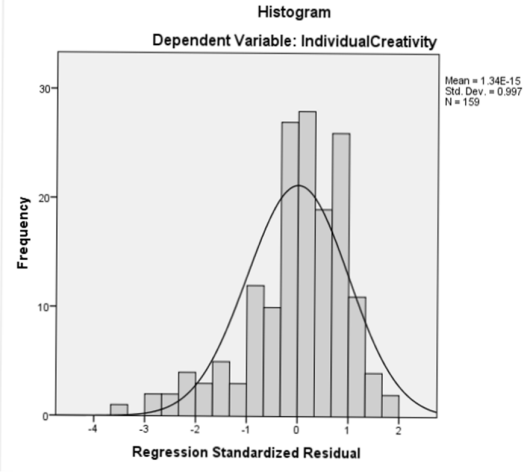
Appendix 1 Linear Regression- Histogram and PP Plot for the Hypotheses

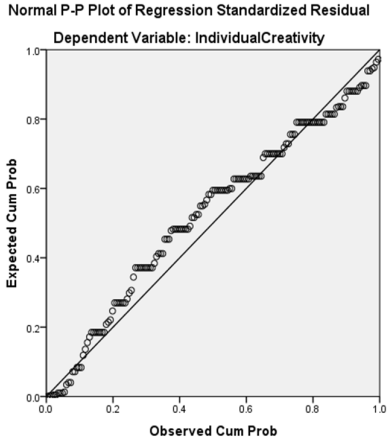
Appendix 1.1 Histogram and PP Plot Hypothesis1



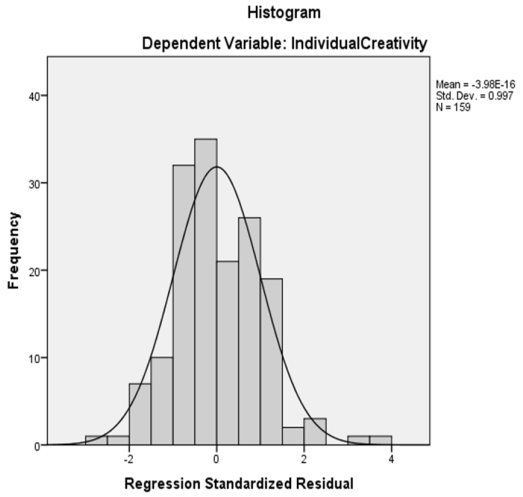


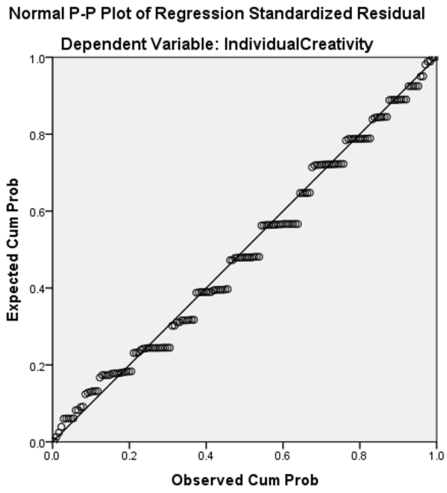
Appendix 1.2. Histogram and PP Plot Hypothesis2



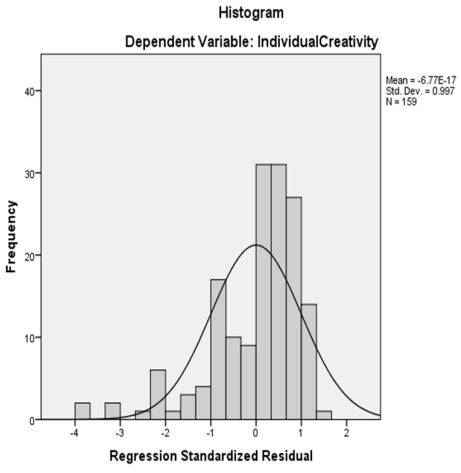


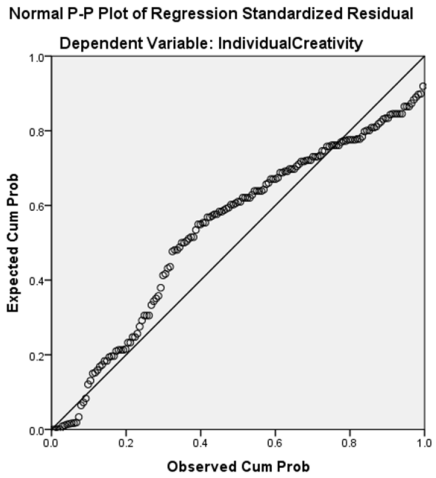
Appendix 1.3. Histogram and PP Plot Hypothesis3



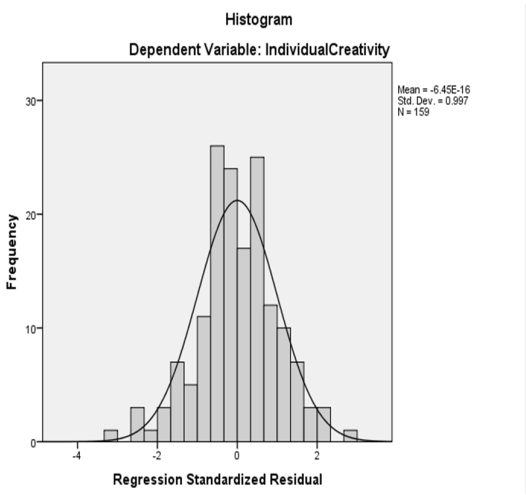


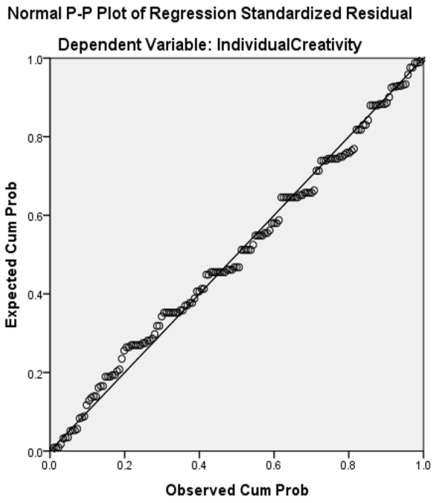
Appendix 1.4. Histogram and PP Plot Hypothesis4



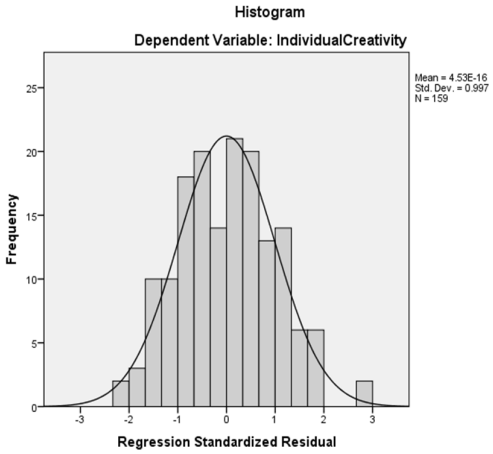


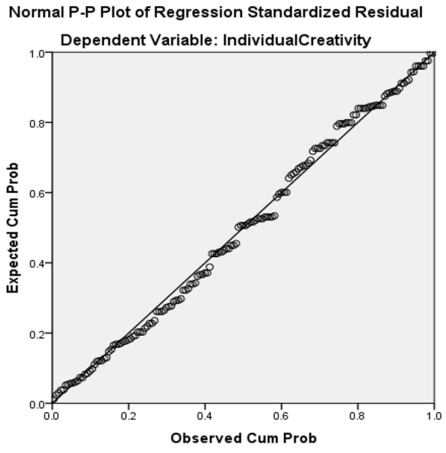
Appendix 1.5. Histogram and PP Plot Hypothesis5



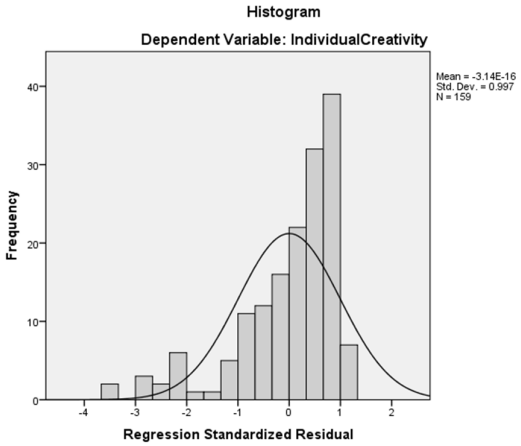


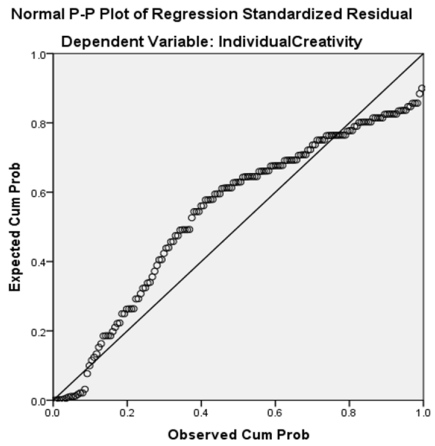
Appendix 1.6. Histogram and PP Plot Hypothesis6





Appendix 1.7. Histogram and PP Plot Hypothesis7





Appendix 2. JoJonckheere-Terpstra test for Ordered Alternatives and Hypotheses tests summary

Appendix 2.1 Hypothesis 1

Total N	159
Test Statistic	3,469.000
Standard Error	142.274
Standardized Test Statistic	7.345
Asymptotic Sig. (2-sided test)	.000

Nonparametric Tests

Hypothesis Test Summary

	Null Hypothesis	Test	Sig.	Decision
1	The distribution of OI Process is the same across categories of Individual Creativity.	Independent-Samples Jonckheere-Terpstra Test for Ordered Alternatives	.000	Reject the null hypothesis.

Asymptotic significances are displayed. The significance level is .05.

Appendix 2.2 Hypothesis 2

Nonparametric Tests

Total N	159
Test Statistic	2,417.000
Standard Error	132.539
Standardized Test Statistic	8.933
Asymptotic Sig. (2-sided test)	.000

Hypothesis Test Summary

	Null Hypothesis	Test	Sig.	Decision
1	The distribution of Individual Creativity is the same across categories of Individual- level openness.	Independent-Samples Jonckheere-Terpstra Test for Ordered Alternatives	.000	Reject the null hypothesis.

Asymptotic significances are displayed. The significance level is .05.

Appendix 2.3 Hypothesis 3

Nonparametric Tests

Total N	159
Test Statistic	4,194.000
Standard Error	180.332
Standardized Test Statistic	10.339
Asymptotic Sig. (2-sided test)	.000

Hypothesis Test Summary

	Null Hypothesis	Test	Sig.	Decision
1	The distribution of Individual Creativity is the same across categories of Motivation.	Independent-Samples Jonckheere-Terpstra Test for Ordered Alternatives	.000	Reject the null hypothesis.

Asymptotic significances are displayed. The significance level is .05.

Appendix 2.4 Hypothesis 3a

Nonparametric Tests

Total N	159
Test Statistic	4,080.000
Standard Error	182.222
Standardized Test Statistic	9.274
Asymptotic Sig. (2-sided test)	.000

Hypothesis Test Summary

	Null Hypothesis	Test	Sig.	Decision
1	The distribution of Individual Creativity is the same across categories of Intrinsic_Motivation.	Independent-Samples Jonckheere-Terpstra Test for Ordered Alternatives	.000	Reject the null hypothesis.

Asymptotic significances are displayed. The significance level is .05.

Appendix 2.5 Hypothesis 3b

Nonparametric Tests

Total N	159
Test Statistic	5,034.000
Standard Error	210.376
Standardized Test Statistic	8.411
Asymptotic Sig. (2-sided test)	.000

Hypothesis Test Summary

	Null Hypothesis	Test	Sig.	Decision
1	The distribution of Individual Creativity is the same across categories of Extrinsic_Motivation.	Independent-Samples Jonckheere-Terpstra Test for Ordered Alternatives	.000	Reject the null hypothesis.

Asymptotic significances are displayed. The significance level is .05.

Appendix 2.6 Hypothesis 4

Nonparametric Tests

Total N	159
Test Statistic	3,902.500
Standard Error	211.550
Standardized Test Statistic	3.323
Asymptotic Sig. (2-sided test)	.001

Hypothesis Test Summary

	Null Hypothesis	Test	Sig.	Decision
1	The distribution of Individual Creativity is the same across categories of Personality.	Independent-Samples Jonckheere-Terpstra Test for Ordered Alternatives	.001	Reject the null hypothesis.

Asymptotic significances are displayed. The significance level is .05.

Appendix 2.7 Hypothesis 5

Nonparametric Tests

Total N	159
Test Statistic	3,977.000
Standard Error	170.627
Standardized Test Statistic	11.018
Asymptotic Sig. (2-sided test)	.000

Hypothesis Test Summary

	Null Hypothesis	Test	Sig.	Decision
1	The distribution of Individual Creativity is the same across categories of Resources.	Independent-Samples Jonckheere-Terpstra Test for Ordered Alternatives	.000	Reject the null hypothesis.

Asymptotic significances are displayed. The significance level is .05.

Appendix 2.8 Hypothesis 6

Nonparametric Tests

Total N	159
Test Statistic	5,389.500
Standard Error	218.996
Standardized Test Statistic	8.493
Asymptotic Sig. (2-sided test)	.000

Hypothesis Test Summary

	Null Hypothesis	Test	Sig.	Decision
1	The distribution of Individual Creativity is the same across categories of Organizational Culture.	Independent-Samples Jonckheere-Terpstra Test for Ordered Alternatives	.000	Reject the null hypothesis.

Asymptotic significances are displayed. The significance level is .05.

Appendix 2.9 Hypothesis 7

Nonparametric Tests

Total N	158
Test Statistic	3,205.500
Standard Error	193.678
Standardized Test Statistic	2.540
Asymptotic Sig. (2-sided test)	.011

Hypothesis Test Summary

	Null Hypothesis	Test	Sig.	Decision
1	The distribution of Individual Creativity is the same across categories of Collaborations.	Independent-Samples Jonckheere-Terpstra Test for Ordered Alternatives	.011	Reject the null hypothesis.

Asymptotic significances are displayed. The significance level is .05.

Appendix 3. A review of the studies on intrinsic motivation and creativity.

The following review is published by Grant and Berry (2011), in the Academy of Management Journal, vol. 54, p.p. 76-77

Laboratory study with female college students making collages (Amabile, 1979)	Manipulated expected evaluation (yes/no); measured intrinsic motivation (self-report) and creativity (artist ratings).	Participants who did not expect evaluation reported higher intrinsic motivation and produced artwork judged as more creative.
Laboratory study with 1st and 2nd grade children painting (Koestner et al., 1984)	Manipulated external limits; measured intrinsic motivation (self-report, task persistence) and creativity (judge ratings).	Controlling limits decreased both measures of intrinsic motivation and both measures of creativity.
Laboratory study with young adults who self-identified as creative writers asked to write two poems (Amabile, 1985)	First poem served as baseline; manipulated attention to reasons for writing (intrinsic, extrinsic, none); measured creativity (poet ratings).	Concentrating on extrinsic reasons led to lower creativity ratings on the second poem, but intrinsic reasons did not increase creativity relative to the control (no reasons).
Laboratory study with elementary school children making collages, writing stories, and solving puzzles (Study 1, Amabile et al., 1986)	Manipulated task rewards; measured intrinsic motivation (self-report and behavioral choice to spend free time on the task a week later) and creativity (teacher ratings).	Self-reports of intrinsic motivation were not significantly correlated with creativity for collages, stories, or puzzles; behavioral choice correlated positively with creativity in stories but not collages or puzzles.
Laboratory study with college students making collages (Study 3, Amabile et al., 1986)	Manipulated task rewards; measured intrinsic motivation (self-reports of enjoyment, satisfaction, interest, and motivation) and creativity (artist ratings).	Creativity was significantly related to enjoyment and satisfaction, but not interest or motivation.
Laboratory study with college students generating solutions to two business problems (Shalley & Perry-Smith, 2001)	Manipulated expectations of external evaluation (controlling, informational); measured intrinsic motivation (self-report) and creativity (expert judges).	Informational evaluation increased intrinsic motivation and creativity, but intrinsic motivation was not significantly associated with creativity.
Laboratory study with college students suggesting creative titles for a short story (Study 3, Eisenberger & Aselage, 2009)	Manipulated rewards for creativity; measured intrinsic interest (self-report) and creativity (research assistant ratings).	Reward increased intrinsic interest and creativity, but intrinsic interest was not significantly associated with creativity.
Field study of employees in diverse jobs (Study 2, Eisenberger & Aselage, 2009)	Employees reported intrinsic interest; supervisors rated creativity.	Significant, positive correlation between intrinsic interest and creativity.
Field study of employees in a sales organization (Study 4, Eisenberger & Rhoades, 2001)	Employees reported intrinsic task interest; supervisors rated creativity.	Significant, positive correlation between intrinsic task interest and creativity.
Field study of multiple samples of students and working adults (Amabile et al., 1994)	Employees reported intrinsic motivational orientation and creativity; independent ratings of creativity on various tasks.	Intrinsic motivation was significantly associated with creativity in some tasks but not others.
Field study of R&D personnel (Dewett, 2007)	Employees reported intrinsic motivation and creativity; supervisors rated creativity.	Intrinsic motivation predicted self-reports but not all supervisor ratings of creativity.
Field study in Dutch energy supplier (Janssen & van Yperen, 2004)	Employees reported intrinsic interest (mastery orientation); supervisors rated creative/innovative performance.	Intrinsic interest predicted supervisor ratings of creativity, but not after leader-member exchange was controlled for.
Field study of scientists (Perry-Smith, 2006)	Employees reported intrinsic motivation; supervisors rated creativity.	Intrinsic motivation was not significantly associated with creativity.
Field study in R&D (Shin & Zhou, 2003)	Employees reported intrinsic motivation; supervisors rated creativity.	Intrinsic motivation predicted higher creativity.
Field study of R&D employees in a chemical company (Tierney et al., 1999)	Employees reported intrinsic motivational orientation; creativity was measured with supervisor ratings, invention disclosure forms, and creative research reports.	Intrinsic motivational orientation predicted supervisor ratings, but not the number of creative reports, and inconsistently predicted creativity on invention forms.

Appendix 4. The survey (ordered depending on the hypotheses)

Individual- level creativity in collaborative contexts

The survey aims at recording your opinion about creativity in Open Innovation activities, more specifically the way it occurs in collaborative innovation settings. The results are needed in the completion of my master's dissertation research paper, and your personal data will remain anonymous.

After submitting of the questionnaire, you can win one of the three gift vouchers valued at €30 on Amazon.com. The winners will be contacted and rewarded on April 27th, 2017. Moreover, at request, a report of this research will be sent to you as from July 2017.

Thank you so much for taking the time to complete this questionnaire. Your input is valued and highly appreciated!

Please tell me just a bit about yourself…

Your Age

- ☐ Under 18
- ☐ 18 – 30
- ☐ 30 – 50
- ☐ 51 or over
- ☐ I prefer not to respond

Your Gender

- ☐ Female
- ☐ Male

Job position

- ☐ Top management
- ☐ Middle management
- ☐ Core staff
- ☐ R&D
- ☐ Other ……..

In which business area has your involvement with Open Innovation/Collaborations been in?

- ☐ Concept generation
- ☐ R&D
- ☐ Design
- ☐ Manufacturing
- ☐ Testing
- ☐ Marketing
- ☐ Distribution
- ☐ Other……..

Country

……..

CREATIVITY SURVEY - FEBRUARY 1, 2017 1

Appendix 4.1 Open Innovation Process cluster

Open innovation process

	STATEMENT	5. Strongly Agree	4. Agree	3. Neutral	2. Disagree	1. Strongly disagree
H1	I engage/ have engaged in Open Innovation(collaborative) activities for idea development					
H2	I support open and collaborative innovation					
H3	External R&D brought significant value to my creation process					
H4	My organization has leveraged/leverages externally developed knowledge					
H5	Not all capabilities can be developed internally					
H6	I usually propose collaborative innovation projects to my organization					
H7	I have submitted or evaluated ideas on an idea platform/forums (e.g. Hype, Bright Idea, Kickstarter)					
H8	I help my organization to motivate and sustain collaborators					
H9	My company can leverage my ideas (exchange for financial benefits or other capabilities)					
H10	We can create competitive advantage by allowing outsiders use our capabilities and generate revenue as well					
H11	We must make the best use of our internal and external ideas if it advances our business model					

Appendix 4.2 Individual-level creativity

Individual-level creativity

	STATEMENT	5. Strongly Agree	4. Agree	3. Neutral	2. Disagree	1. Strongly disagree
B1	I am interested in my work and I find it rewarding/fulfilling					
B2	I'm confident that I can develop creative ideas to solve problems, and I'm motivated to implement solutions					
B3	I look for things in my environment to inspire me to find new interpretations of problems.					
B4	I see problems, complaints, and bottlenecks as opportunities rather than as issues.					
B5	I believe that my personality traits (self-esteem, respect for other individual's opinion, extrovert/introvert) makes me more creative in the workplace					
B6	My previous experience makes me more creative in the workplace					
B7	The opinion of other work colleagues has a positive effect on my individual creativity					
B8	I don't find problems and issues distracting. They don't cause me to lose focus on my real work.					
B9	I rarely ignore good ideas because I don't have the resources to implement them.					
B10	Everyday routine doesn't impede my creativity					
B11	I avoid following procedures strictly by the rules					
B12	I prefer to approach problems in logical and rational manner					

Appendix 4.3 Individual-level openness cluster

Individual- level openness

	STATEMENT	5. Strongly Agree	4. Agree	3. Neutral	2. Disagree	1. Strongly disagree
F1	I have frequent and open (trust, openness) communication with my colleagues/management					
F2	I am not afraid to express freely my ideas (in front of colleagues, collaborators, or supervisors)					
F3	When I lack ideas, I consult with other people to stimulate my creativity					
F4	I often look for new ideas outside my field, and try applying them into my creation process					
F5	I see external sources as an opportunity to enrich my knowledge					
F6	I support freedom in expressing ideas					
F7	I often interact with other external experts when solving a problem					
F8	I look for things in the external environment to stimulate my creativity					
F9	I encourage others to embrace openness (collaborations, idea sharing, getting expertise from external experts, etc.)					

Appendix 4.4 Motivation cluster

Motivation

	STATEMENT	5. Strongly Agree	4. Agree	3. Neutral	2. Disagree	1. Strongly disagree
C1	Creating allows me to pursue an activity I enjoy					
C2	My creations help me get recognized by my colleagues					
C3	Creating something is a pleasure that fulfills me					
C4	The work I do is challenging					
C5	I enjoy the process of creating new ideas whether they lead to a final product or not					
C6	I agree to engage in the creative activities in exchange for a reward					
C7	My creations should earn me money or allow me to live comfortably					
C8	Time pressure inhibits my individual creativity at work					
C9	I am satisfied with my salary/ remuneration package at work					
C10	My organization supports/should support a creativity reward system (e.g. financial/material rewards)					

Appendix 4.5 Personality cluster

Personality factors

	STATEMENT	5. Strongly Agree	4. Agree	3. Neutral	2. Disagree	1. Strongly disagree
A1	I am able to achieve most of my goals at work					
A2	I am not afraid when facing challenges at work					
A3	I feel confident that I can perform creatively on various tasks at work					
A4	I demonstrate originality at work					
A5	My colleagues think of me as a creative individual					
A6	Creativity at work is important for me					
A7	I am not easily influenced by others					
A8	I like taking risks at work					
A9	I have the ability to see how to take advantage of a certain situation					
A10	I am a versatile individual and I can easily come up with innovative solutions no matter the work field					

Appendix 4.6 Resources cluster

Resources

	STATEMENT	5. Strongly Agree	4. Agree	3. Neutral	2. Disagree	1. Strongly disagree
E1	My organization provides all the necessary resources to its employees for creativity					
E2	To solve a problem, I usually get help from external experts					
E3	I rely only on internal sources when I create					
E4	My personal contacts/network enhance my level of creativity in the workplace					
E5	My task-related skills help me in my creation process					
E6	I look for ideas in various departments from my organization					
E7	In my creation process I often rely on externally developed knowledge					
E8	I typically create by modifying existing ideas					
E9	I have access to sufficient resources, including funds, materials, facilities and information					
E10	My team supports my creative work (they provide me with resources)					

Appendix 4.7 Open Organizational Culture cluster

Organizational culture

	STATEMENT	5. Strongly Agree	4. Agree	3. Neutral	2. Disagree	1. Strongly disagree
D1	My organization supports freedom to express ideas					
D2	My organization gives a satisfying level of autonomy to employees					
D3	My organization encourages the inflow and outflow of ideas (internally or externally)					
D4	My company has a corporate culture that fosters idea sharing					
D5	My company has a systematic and organized approach to capture external ideas					
D6	My organization implements techniques for improving creativity and boosting individual performance					
D7	My organization supports open communication amongst individuals					
D8	My organization supports knowledge sharing					
D9	My organization implements creativity techniques (networking, teambuilding, brainstorming, social meetings, etc.)					
D10	In my organization, proactive behavior is encouraged					
D11	My company's network (internal or external) triggers creativity					
D12	My work environment supports creativity					

Appendix 4.8 Collaborations cluster

Collaborations

	STATEMENT	5. Strongly Agree	4. Agree	3. Neutral	2. Disagree	1. Strongly disagree
G1	I feel more creative when collaborating with other people					
G2	Externally developed knowledge has a positive impact on my creation process					
G3	I can easily integrate external knowledge into my creation process					
G4	Collaboration tools (e.g. digital tools) enhance my ability to create					
G5	In my creation process, I often get help from other departments					
G6	My creativity is stimulated by the open exchange of ideas					
G7	I prefer to work with other individuals in a team effort rather than alone					
G8	I do not see external sources as "second-best" (internally developed capabilities are superior to externally sourced ones)					
G9	I am at my creative best when I create with other individuals (co-creating)					

Appendix 5. Thoughts on creativity and collaborations from the respondents

5.1 These are the highlights of an interview I conducted with the product manager of a leading global software company based in Romania.

"I consider that everyone is creative, the only thing that differentiates us is the way we make use of our creative ideas. Creativity is an essential part in software and technology development, the focus being on product or service differentiation. The ideas must be promoted throughout the entire organization regardless of the individual's hierarchical position in the company. Since the early stages of the creative process, collaborations are beneficial. In many cases, connecting creative ideas represents the catalyst for early stage innovation. The ideas ought to be analyzed at the team level, but likewise in cross functional teams. Moreover, the support coming from colleagues and management helps in turning that creative idea into innovation. Sustaining creativity is essential for every company, therefore every individual should be empowered to contribute with their creative ideas, without any constraints. A good example of promoting creativity throughout organization are brainstorming sessions, where ideas are brought to the table and collectively discussed and tackled. "(Mrs. Catalina Albisteanu, Product manager- Consumer products at Bitdefender Romania, 2017)

5.2 Thoughts on creativity by respondents at Hannover Messe Innovation fair in Germany

"I consider that everybody is creative in a way or another. You don't have to work in research departments to come up with creative ideas. We have projects that are open to the public, and everybody is welcome to contribute. Our company even promotes several contests for robotic projects to the large public."

"I am encouraged by my company to express my ideas. And yes, I am aware that sometimes certain ideas are just not feasible for my company to be turned into actual innovation. Nevertheless, this does not mean that I fear expressing my ideas with my superiors"

"Yes, we collaborate, especially with universities. Technology is moving so fast we cannot even keep up the pace. So, if you are not taking advantage of the information other teams are willing to offer, you are left behind. We have to seize every opportunity."

"At first everything is unclear to you, and you feel that the company does not need your competencies anymore, but in time you become aware that your company cannot produce everything in-house, and certain things are insourced of course. I think companies must first transmit clearly to every employee what is the scope of the collaboration, and what are the benefits for the employee and the firm."

"I do not know about other industries, but in robotics at a B2B level there is indeed a lot of collaboration ongoing. Our company creates only the customizable software platform, on which the robotic arms operate. The hardware, marketing, and other stuff is done in collaboration with other companies that we think are better than us at doing that."

"yes, my company has a reward system. I think is relevant to have such a system, and this way everybody is motivated to attain that reward."

"I believe that creativity is about passion. No doubt. But young people nowadays also go for the highest reward. Sadly, we had cases where employees left us for a better financial package."

"My motivation is to be the best at what I do. Be yourself, express yourself, turn your ideas into actual things"

"Material rewards are definitely important for employees and their creativity. The competition is tough, and the highest bidder seems to always get the information they need. Nowadays is not a question of what you can create, rather what capabilities you can afford to buy."

"Organizational culture is important in innovation. Culture is not a thing people can easily change, it is more something you adapt to."

"We have to be open, and invite others into our innovation process, but certain rules have to be set as of the beginning of collaboration projects. Indeed, collaborations often fail because disclosure agreements are not respected."

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Voor akkoord,

Cojocaru, Alin-Dumitru

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