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in Entrepreneurship and Innovation

The relationship between innovation and creative climate:

A quantitative study on the effects of creative climate dimensions on
individual innovation behaviour

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Abstract

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Keyword:	<i>innovation, innovation output, innovation performance, creativity, creative climate, innovation measurements, individual behaviour, individual innovation, individual creativity.</i>

The aim of the research is to define which type of statistical relationship exist between the independent variables of creative climate and the dependent variable of innovation output on the individual level, and therefore defined as individual innovation behaviors. The research is assessed through quantitative study and the tool chosen to collect the data is a survey, whose aim is to measure how companies manage creative climate within their organizations and which type con effects this has on the individuals' innovation behaviors. Both innovation behaviors and creative climate dimensions are defined through the literature review of academic papers about the topics, and the data collected are analyzed through the fractional logistic regression model. 17 independent variables were selected for the model: age, gender, tenure, business line, immigrant, challenge, freedom, trust, conflict, idea support, idea time, debate, risk taking, management support, diversity, play/humor and innovation perception.

From the analysis of the data collected, an interesting insight has emerged, since some of dimensions of creative climate seem to have counterintuitive effects that at first sight can be hard to read. The results obtained from the variables of conflict, debate, idea support and risk taking seems to indicate that a more challenging environment is positively related to the innovative behaviours of the individuals. The insight offers the chance for future researcher to investigate which are the other elements and latent variables that can influence higher levels of individual innovation behaviour apart from creative climate dimensions, such as incentives and awards, R&D expenditure.

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1. Introduction

The first chapter provides the reader the background of the research, introducing the concept of innovation and creative climate. Furthermore, it illustrates the problem of discussion, the research questions and the organization of the thesis.

The aim of this research is to find a statistical correlation between the creative climate and innovation output at the individual level of employees operating in the work environment.

The study of the independent variable, the creative climate, and the dependent variable, innovation output, will be assessed through a survey, whose goal is on one hand to measure how companies manage the creative climate within their organization and how the climate is perceived by individuals; on the other hand, at the innovation output level, the goal is to measure as output the innovation behaviour, represented by those behaviours that are considered to lead to innovation by the literature, such as the number of ideas and product/services that the individual had helped generate at the work place. The reason for this choice is to determine not only if the hypothesis of the thesis is correct, hence if there is a positive correlation between the two variables, but also if changing how the dependent variable is measured produces any changes in the results.

1.1 Background

“If you always do what you’ve always done, you’ll always get what you’ve always got.” / Henry Ford

Given the highly competitive environment in which companies are confronted today because of the effects of globalisation, interconnectivity and digitalisation, the role of innovation is becoming increasingly important. Companies are required to innovate and improve their products, services and business models in order to be able to compete on the global market. However, the concept of innovation is a variegated and nuanced topic on which many authors in the past century have been focusing on and on which many authors have been trying to give a definition. The organizations that operate in today's business world are facing challenges and are influenced by external factors, but perhaps at a faster pace than before. This always changing business climate forces companies to remain highly creative and innovative in order to remain competitive (Amit and Schoemaker, 1993).

By interviewing more than 1200 companies through a survey, PwC conducted a study (“PwC’s Innovation Benchmark Report, 2017) to investigate how companies are responding to the mandatory goal of innovate, brought by an ever increasingly competitive environment that imposes companies to accomplish business digitalization and follow rapid change in the technology. In the survey it appears that in order to accomplish a successful innovation, the most important factor is considered the human factor by 60% of the sample, more precisely, the internal employees, hence not only workers dedicated to specific innovative projects.

On the other hand, innovation process is strictly connected to risk taking, since every process is a bet on the possible success of the new idea and new project. Many projects, start-ups, ideas will eventually fail in the process of reaching successful innovation, since it is in the nature of entrepreneurship. It will cause losses and issues which will influence all levels of the organization, and many people involved directly and indirectly with the failing company will be affected by the repercussions. Therefore, companies are responsible not only for their own business success, but also for the people involved. A common belief in the management of innovation is the concept of failing fast, failing cheap and failing smart, which has been significantly used as strategy in innovation hubs such as Silicon Valley. However, when dealing with the human capital involved in organizations, learning how to strategically manage the innovation process in order to avoid failure is an approach that can be followed to preserve not only the company and the managers’ wellbeing but also to preserve the employees and the people even indirectly linked to the organization.

The way the company innovation is related to performance has been widely discussed in literature. Hence, it is argued that it is necessary to understand the concept of innovation. Researchers provide different definition of innovation, but it’s generally agreed that it concerns the adoption or implementation of something new, such as an idea, a product, a service or a process. Damanpour (1996) suggests that innovation can be described as a reason of change in an organization, as a way of dealing with changes in the internal and external environment. Innovation can therefore be explained as the generation, acceptance and implementation of new ideas in the organization.

1.2 Problem discussion

Innovation is the result of many choices and decisions made from the lower to the highest level of an organization. Hence, there are many components that influence the innovation output of a company. In this research, the factor that will be taken into consideration is the creative climate, which will be deeply analysed and explained further firstly in the literature review and then in the survey and its analysis.

The reason why the author of this paper finds this specific factor interesting and chooses it among the other possible variables is the transversal importance that creativity has in all organizations. In fact, it is a fundamental element not only in departments such as marketing or in organizations that operate in environments that are considered creative based such as advertising. On the contrary, as Amabile (1997) suggests, creativity is considered to be the base for innovation and promoting it in every aspect of an organization can lead to new ways of doing things in areas where usually operations are run in a traditional way, such as for example accounting, and it seems there is no space for innovation and creativity (Amabile M. T., 1998).

1.3 Research question

Given the objective of this research, the following research question has been formulated:

Is there a statistical significant relationship between the dimensions of creative climate and the individual innovation output at the workplace?

To answer the stated research question, a quantitative research will be conducted by analysing a panel of employees working at different companies.

1.4 Disposition

The thesis begins with a theoretical section which describes and explains the meaning of innovation, creative climate and innovation output. Then, the paper outlines the method used in order to address the mentioned study problem. Following the approach, empiric results are presented, accompanied by an interpretation. Finally, conclusion, recommendations and suggestions for future research are presented.

The following table provides a description of the outline that contains the related material for each chapter.

Chapter	Description
1. Introduction	presentation of background and problem discussion and research question.
2. Literature review	portrayal of theory on innovation, innovation behavior and creativity and creative climate
3. Methodology	definition of the research strategy, research design, research method, measure of concepts and variables, research process and data collection, data analysis using the fractional logistic regression model and the research quality
4. Empirical findings and data analysis	Outline of data collected with the survey and analysis of the results compared with the theory
5. Conclusions	presentation of conclusions and answers to RQs, outline of some final remarks about case companies and future research proposals limitations discussion

Table 1 Delimitations

2. Literature Review

The second chapter provides the theories and models used in the research, and it can be helpful to the reader to understand the concepts of innovation, creative climate, how they are connected with each other and which elements influence and define the creative climate . The chapter ends with a conceptual framework that has been developed by examining previous research.

2.1 Defining innovation

The initial step to come up with an appropriate definition of the term “innovation” is taking the one given by the Cambridge dictionary. It seems easy at first: innovation means using a new idea or a new method. As Goffin, K., & Mitchell, R. (2017) try to give the same definition, it is possible to see how this concept alone is not sufficiently clear and it does not provide a fully satisfactory definition. Hence, it is necessary to dig further into the topic to reach an improved and more comprehensive definition of innovation.

In the past century, the well famous economist Joseph Schumpeter in its “The Theory of Economic Development “(1934) acknowledged the importance of innovation, defines five components that are part of it and identifies innovation as more than simply a new idea or method. The five components are:

1. The goods introduced are new for the consumer or there is an improvement of the quality of the good compared to the quality previously available;
2. The method of production is new in a particular industry, which does not necessarily mean that it is a new scientific discovery, since the method can already be used in other sectors;
3. There is an opening of new markets;
4. New sources of supplies are used;
5. There are new forms of competition that cause a big change in the industry in which the innovation is happening.

For Schumpeter the concept of novelty characterizes the idea of innovation, but Everett Rogers (2002), in his paper on innovation diffusion model specifies that an idea, a process or a good can also just be perceived as new by the adopters, hence he introduces also the concept of perception in defining innovation. Damanpour, F. (1996) gives a thoroughly and

comprehensive definition of innovation that states that “*innovation is conceived as a means of changing an organization, either as a response to changes in the external environment or as a pre-emptive action to influence the environment. Hence, innovation is here broadly defined to encompass a range of types, including new product or service, new process technology, new organization structure or administrative systems, or new plans or program pertaining to organization members.*”

Goffin, K., & Mitchell, R. (2017) describes five elements that can push a need for innovation:

- Technological advances: the opportunity given by new technologies is the chance of create new industries and new application of existing technology;
- Changing customers and needs: if the characteristics of the customers or the standards expected by the customers change, the organization is pushed to innovate to meet the customers’ need. This can also mean that market segment could be at risk of disappearing, forcing some organizations to either innovate or fail;
- Competition: with globalization the level of competition is higher, since everyday new competitors may rise and compete in the home-markets threatening well established firms, so products, services and business models have to keep striving for innovation to maintain a competitive advantage;
- Changing business environments;
- Strategic intent: when the push towards innovation is given by the leader of an organization, the result is an internal push while the other driving elements are more external factor.

Goffin, K., & Mitchell, R. (2017) go on with the discussion by defining five different dimensions in which companies can potentially innovate. The first area, which is also considered the one on which organizations tend to focus the most, is the product innovation. Next comes the process innovation, that is the innovation in the method of production, which, for example, in the case of manufacturing industries can be a fundamental area, since a well thought and hard to be imitated process can be a key advantage for the organization against competitors. Then, the dimension of service innovation that the organization offers to consumers. Next, the business process innovation, which means improving and making more efficient the internal processes, such as the processes related with the supply chain, and external processes, such as the relationship between the organization and the consumers. And lastly, the fifth dimension is business model innovation, which nowadays in the era of digitalization has

become a key topic for companies, since the market is imposing new ways of doing traditional business, such as moving from the brick and mortar store to digital store as Amazon.

In an interview with Fortune Magazine in 1981, Steve Jobs said *“Innovation has nothing to do with how many R&D dollars you have... it’s not about money. It’s about the people you have, how you’re led, and how much you get it”*. Tidd J. and Bessant J. (2014) and Goffin, K., & Mitchell, R. (2017) in their books examine how the human component from the bottom to the top of the organization is a fundamental element in the innovation success; both their books talk about the moment of the generation of an innovative idea, which is where usually the concept of creativity enter in place, and employees’ creativity (Amabile M. T. 1998) is the base from which a company can build his innovativeness.

2.2 Defining creative climate

2.2.1 Creativity

It is commonly accepted that in the hypercompetitive setting in which organizations operate nowadays, it is fundamental for companies to be able to cope with and adapt to change, in order to gain or maintain competitive advantage on their market. Given Damanpour definition, innovation seems to answer to the problem of adapting to new realities and making changes valuable to the companies who work with it. Amabile (1997) suggests that to achieve true innovation, organizations need to be creative first and exercise their creative process at its full potential.

Trying to give a definition of creativity is not trivial. Many authors give similar definitions of creativity and often they are not too distinguishable from the concept of innovation. It is possible to define creativity as the process of generating new and original ideas in the organization (Amabile, 1996; Van Dyne et al., 2002) and innovation as the process that implements those creative ideas into a valuable output. Therefore, it is possible to see creativity as a necessary condition for innovation (Ekvall, 1999).

Amabile (1997) modeled the Componential Theory of Organizational Creativity and Innovation. She suggests that it is possible to have a real exploitation of creativity the moment in which employees’ individual skills such as expertise and creative-thinking are in harmony with their intrinsic motivations and passion, and that innovation will follow from the boosting in creativity. In this theory, managers should not leave creativity only to the departments that

traditionally work with creativity. The base of the model is that each employee is considered to be gifted with a certain creative capability and that work environment can impact the creative behaviors of its workers.

Amabile (1998) divides the model in two parts. The first is made by three components of individual and team creativity of employees who works in organizations: expertise, creative-thinking and motivation. The first component, expertise, refers to employees' skills, knowledge and background. Creative-thinking is referred to the set of skills and flexibility used by employees in problem solving. These first two elements are identified by Amabile as individual resources, hence skills owned by the single employee and that are either inherited trait of his/her personality or acknowledgement from previous experiences. In the author's opinion, these two factors are more difficult to manage from the standpoint of the manager's prospective than motivation. Motivation can be seen as intrinsic motivation and extrinsic motivation. The extrinsic motivations are money incentives and rewards, which, based on Amabile's researches through the years (Amabile, T., Conti, R., Coon, H., Lazenby, J., & Herron, M. (1996), seem not to be drivers in motivation specially for employees working in big organizations, since these types of rewards can actually have opposite effects, when they are perceived as instruments of control of the employees' activity or exploitation of employees hard work. On the other hand, intrinsic motivation is considered the key factor that managers can work on to boost creativity and innovation. Intrinsic motivation happens when employees operate essentially to achieve their personal satisfaction and to fulfil their own passion and interest, while contributing to the organizations' success is not their main goals. These two types of motivations and their results are exemplified and explained in what Amabile (1998) called "Intrinsic motivation principle of creativity" and it is demonstrated with the example of the creative maze. In solving a maze, it is possible to have two approaches: one that points directly in finding the shortest and fastest way out of the maze, while the other one focuses on exploring the maze in every possible direction instead of only looking for the exit, and spending time in every intriguing path. The first method resembles the extrinsic motivation, guided by money rewards: the answer to the problem will be found rapidly, but likely will be the simplest and most straightforward solution. With the second method, even if more time-consuming, will bring a much more creative solution, which time pressured and restriction would likely not make it come out the person's mind.

The second part of the model is also composed by three elements which are referred to the work environment: resources, management practices and organizational motivation. The first, the resources consist of all the knowledge and human capital and all the assets that the organization uses in the innovation process. The second element is the management practices, which should allow individuals to be autonomous and to be under supervision of a supporting, encouraging, clear in describing and setting goals management. Lastly, the third component is the organizational motivation, which are the goals and the mission set by the highest levels of the organization management.

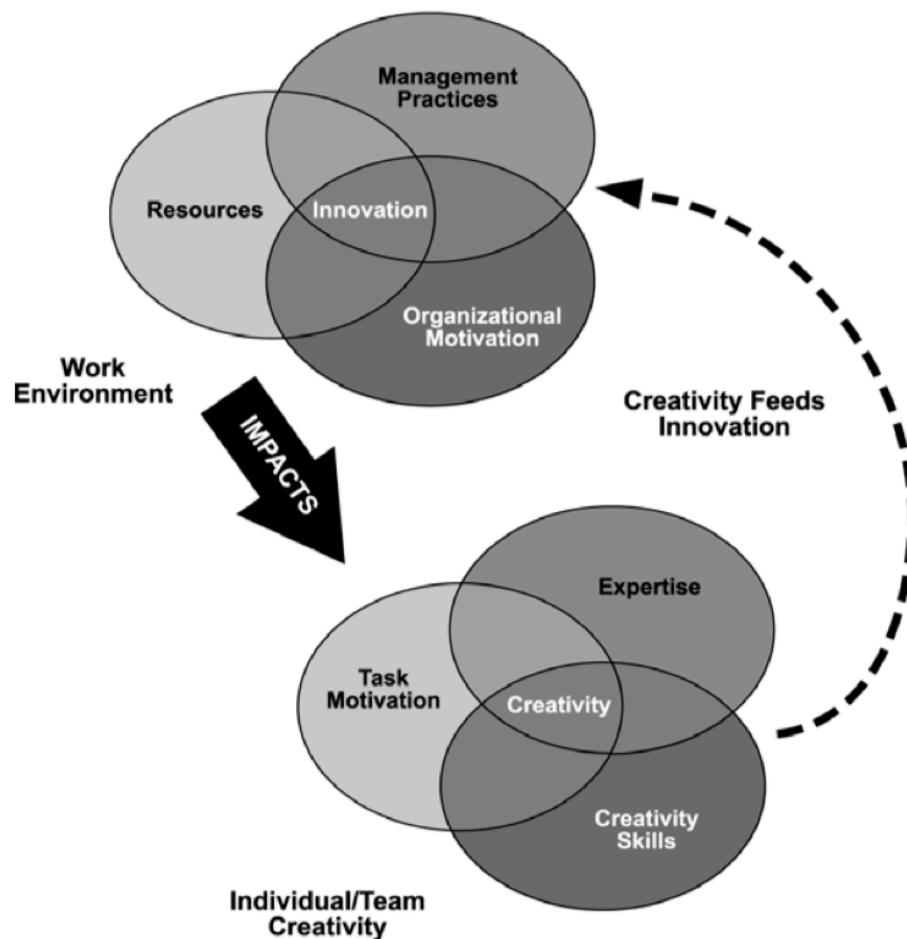


Figure 1 The Componential Theory of Organizational Creativity and Innovation (Amabile, 1997)

2.2.2 Factors that influence creativity

Reviewing literature around the topic of creativity, it is possible to identify several elements and themes that are considered by different authors to be drivers of creativity within organizations.

Amabile (1998) suggests that there are six practices that managers can use to boost and influence intrinsic motivation, which as mentioned before, it is the easiest to manage. The six practices can be identified by 6 words:

- Challenge: managers are challenged to try to match the employees with what they consider to be the right assignment for them. They should base the decision on employee's individual interests and personal motivations, but they always have to keep in mind also organization's goals.
- Freedom: managers should give employees a certain level of autonomy in order to make them feel free to let their creativity grow without the impediment of organization's bureaucracy. Examples of mismanaging freedom are: giving a false expectation of autonomy that does not match with the reality that sees most of employees' ideas thrown away by management and changing goals too frequently or not having them clearly set and explained.
- Resources: resources can be time and money. Time can boost intrinsic motivation: enough time to deliver offers employees a healthy time pressure, but when used incorrectly and when deadlines are perceived as impossible to achieve, time pressure can be both unproductive and frustrating, and can lead employees to feel themselves exploited by the organization.
- Workgroup features: managers should focus on building teams avoiding homogeneity as diversity is proven to work especially when is a background diversity, instead of a demographic diversity. Having people that come from different backgrounds, studies and approach in fact can boost creativity, while just by having demographic diversity such as age, gender and ethnic background, if mismanaged, can easily bring to conflicts that are challenging to overcome. Management should try to create teams that are excited towards team's goals, to find people that are willing to help teammates and that recognize others' contribution to the project.

- Supervisory encouragement: managers often are affected by a negativity bias that brings them to reject many creative projects, since they are mainly focused on the commercial results of the company. The critical approach to reach a strategic commercial success should always be followed, but it is important to keep in mind that it often kills creativity and therefore the possibility to innovate.
- Organizational support: managers should push sharing of knowledge and collaboration, trying to create an environment that celebrates creativity by having creative people working together, instead of using money as rewards for creativity, which it is not as effective as intrinsic motivation.

Madjar, N., Greenberg, E. & Chen, Z. (2011) and Gilson, L. L., & Madjar, N. (2011) distinguish between incremental and radical creativity, following the same logic used in innovation theory that distinguishes between radical and incremental innovation (Goffin, K., & Mitchell, R. 2017). Incremental creativity stands by those ideas that keep adding improvements without being groundbreaking, while radical creativity stands for those ideas which creates a new market or a new business model (Madjar, N., Greenberg, E. & Chen, Z. 2011). The authors Madjar, Greenberg and Chen (2011) run a research that show how radical creativity is more strongly connected to predictors such as the amount of resources used for creativity, the individual willingness to take risks, and the employee's commitment to his career, while predictors such as organizational identification (the degree of identification of the employee with the organization), presence of creative coworkers and conformity (explained as the conformity of the employee to the organization's policies and procedures) are more related to the incremental creativity.

2.2.3 Creative climate

In history there have been several examples of how sometimes innovation comes as the result of accidental inventions and mistakes. It is the case for innovations such as the Post-it adhesive or the Velcro fasteners. However, these fortunate and accidental discoveries are exceptions of the rule. The famous Latin proverb says that "*Audentes fortuna iuvat*", the fortune favours the bold, the fortune favours those who dare to try, not those that wait and hope. Hence it should be organizations' main priority to empower and free their employees' creativity and abilities (Woodman, Sawyer & Griffin, 1993), in order to hopefully achieve innovation and adapt to

change as fast as the competitive climate requires, while in the meantime those who do not pursue change are likely destined to disappear and fail.

Literature around the concept of creative climate shows that so far there is not a single definition of what the creative climate is, and authors give different descriptions of the concept. The term itself, creative climate, seems to be origin of disputes (Mathisen, et al., 2012). For some authors it is to be considered as an attribute internal of the organization, a description of the internal organization's working reality, from a sociological and psychological standpoint (Mathisen, et al., 2012). Others describe the creative climate as a set of behaviours, attitudes and feelings of the individuals that work in the organization and that interact with their peers and their management (Ekval, 1996). Ekvál (1999) describes the creative climate as a metaphor that is used to describe the combination of the single individual working in the organization, the routines and the processes set by the organization and the interactions and reactions of individuals with the other co-workers and the system of the organization. Ekvál goes further in the analysis by specifying that on one side there is the organizational culture, which is the sum of the belief system, values and goals of the organization; on the other side there is the creative climate, made by the employees, which are influenced by the organizational culture because they are affected by the norms and the values that the company stands for.

2.2.3.1 Creative climate at the individual level

Each organization has a specific creative climate and differs substantially from other organizations (Ekval,1999). At the employee level, the creative climate is defined as the “cognitive interpretation of an organization” (Scott and Bruce, 1994), hence the psychological perception and the cognitive representation that employees have of the work environment, rather than the environment per se (Scott and Bruce, 1994). This is important because, as Scott and Bruce (1994) mention in their study, the cognitive information collected by employees looking at the work environment is analysed and processed as company's expectations on their working behaviour. Hence, people respond to these expectations by trying to regulate their behaviour to match those expectations.

Individual's creativity can be considered as a function of personal characteristics, the characteristics of the work environment and context and the interactions among these factors (Shalley, Zhou & Oldham, 2004). The match between personal and contextual characteristics

results in higher levels of employees' creativity. In other words, when individuals' personal characteristics "fit" with the characteristics of the environment surrounding them, the final outcome is a higher employee's creativity (Amabile, 1996).

Personal characteristics are defined as personality and cognitive style. These characteristics influence how people take actions and strategies towards the production of creative ideas. In other words, people with certain types of predisposition of personality and cognitive style may be highly effective in recognizing opportunities for change, and implementing strategies and solutions that could lead to produce a more creative work (Shalley, Zhou & Oldham, 2004).

The Five Factor Model of personality by Costa & McCrae (1992) describes personality traits that are connected to creativity, which are neuroticism, conscientiousness, agreeableness, extraversion and openness to experiences. These have been proved to be connected with creativity. Specifically, the trait of openness to experiences is the one that has the highest connection with creativity. Hence, people open for new experiences are found to be more flexible and capable to identify opportunities of change, to generate solutions and ideas, and to look for and deal with unfamiliar situations that will give them access to new experiences and new horizons (Shalley, Zhou & Oldham, 2004). Whilst, people that are low in openness are found to be more traditional and convention thinkers, which make them eventually less creative overall.

Cognitive style is a psychological concept that is used to describe how people think, grasp and remember information. Adaptation-Innovation theory by Kirton (1994) distinguishes between two types of possible cognitive styles that people can apply. Adaptors are those that tend to not question the validity of paradigms and procedures and results less creative as an outcome. On the other hand, as the word suggests, innovators are those that are more prone to take risks, and to develop solutions out of the regular procedures, with the logical result that these people tends to be also more creative overall (Shalley, Zhou & Oldham, 2004).

The contextual characteristics are the other part of the creativity function (Shalley, Zhou & Oldham, 2004). These characteristics have been found to boost individuals' creativity by supporting and taking advantage of their intrinsic motivations and the personality traits. For instance, a high level of job complexity brings individuals to be more likely to experience higher levels of intrinsic motivations, which leads to higher levels of creativity. Complex jobs

create the opportunity to increase employee's motivation, interest and excitement about his/her work. A supportive relationship with supervisors and leadership favors and encourages innovative workers, whilst controlling supervisory has the opposite result, because by monitoring and controlling too closely it does not look for employee's involvement and it demands that individuals follow strict rules and procedures without questioning (Nam, Anderson, & Veillette, 2009). This is also the case for a supportive relationship with coworkers, hence it has the same effects on intrinsic motivation and creativity of the relationship with supervisors. Another example of contextual characteristics are rewards: which can increase creativity and motivation by recognizing individual's personal skills and competences, but they can also be perceived as a controlling method to influence individual's behavior, and therefore, they may have a counterproductive effect of creativity. Same goes for time deadlines and goals, which have to be perceived as feasible and meaningful, otherwise they work against creativity. Finally, last example of contextual characteristics is spatial configuration of work settings, which is the physical space available to the employee and that, if restricted, can lead to less creativity (Shalley, Zhou & Oldham, 2004).

In summary, an individual that works in a creative climate environment that perceives as positive and encouraging should also have a positive innovation behaviour. With this study, the researcher wants to see if there is statistically significant relation between the two elements. Therefore, firstly it is necessary to assess measurements of creative climate and innovation behaviour and output.

2.2.4 Assessing creative climate

The author of this paper had the need to define a survey to assess the creative climate; in doing that she is inspired by the two methods which are developed through a framework and are often used to measure creative climate.

2.2.4.1 Situational Outlook Questionnaire

The Situational Outlook Questionnaire (SOQ) is a framework developed by Isaksen, Laurer and Ekvall in 1999 to evaluate the organizational climate for creativity and change. It is based on a previous framework ideated from Ekvall in 1996 similarly used to assess the climate for creativity, which is called Creative Climate Questionnaire.

This tool is composed by 50 factors, that show nine different dimensions that describe and measure how a certain type of climate influence creativity and change, at individual, team and organizational level. The nine dimensions are:

- Challenge/Involvement, which measures the level emotional commitment and motivation in completing the operations and goals;
- Freedom, which measures the level of autonomy that individuals have to take the initiative and make decisions on their own work;
- Trust/Openness, which measures the level of trust that individuals have with other people in the organizations and the emotional safety found in the relationships built in the work environment;
- Idea Time, which is the amount of time that is available to individuals to develop new ideas;
- Playfulness/Humor, which measures the level of openness towards spontaneity, laughter and good-natured joking in the work environment;
- Conflict, which measures the presence of conflicts and tensions within the workplace,
- Idea Support, which measures if the work environment is open to new ideas and suggestions, if they are attended to and treated respectfully;
- Debate, which measures the degree to which it is possible to individuals to express and to share different point of views and different ideas;
- Risk-taking, which measures the tolerance of ambiguity and uncertainty

SOQ Dimensions
Challenge/ Involvement
Freedom
Trust/Openness
Idea Time
Playfulness/Humor
Conflict
Idea support
Debate
Risk taking

Table 2 Framework of the nine creative dimensions by Ekvall, 1996

Each dimension varies from three to seven items. Moreover, eight of nine dimensions have a high positive correlation between the dimension and its influence on creativity. Only one dimension, the “conflict”, has a negative correlation, which means that when its value is high, conflict compromises creativity. On the other hand, this high correlation between most of the dimensions could be due of a lack in clarity in defining and distinguishing the dimensions themselves, from which comes the main critique that has been moved toward this method of assessment (Mathiesen and Einarsen, 2004).

2.2.4.2 KEYS Framework

The KEYS framework is developed by the authors Amabile, Conti, Coon, Lazenby and Herron (1996) identify 10 dimensions used to asses creativity and based on a review of previews literature around elements that influences. The dimensions can be divided in three scales:

Stimulant scales

These scales try to capture the encouragement of creativity, the level of individual autonomy, and the resources. The dimensions for these scales are:

- Organizational encouragement, which measures if the organization’s culture encourages creativity;
- Supervisory encouragement, which measures if supervisors support individual and workgroup works and if they set reachable goals;
- Workgroup supports, which measures if the workgroups are diverse, open to communication, constructively challenging and committed to the job;
- Sufficient resources, which measures if individuals perceive the resources (described as materials, funds, information and facilities) invested in their work as appropriate as easy to reach;
- Challenging work, which measures if the important tasks are considered challenging and hard to accomplished;
- Freedom, which measures the autonomy in deciding what job and how to do it.

Obstacles scales

These scales identify dimensions that influence negatively the level of creativity. The dimensions are two:

- Workload pressure, which measures the level of pressure given form the workload that individuals feel in accomplish their tasks and jobs and the level of pressure given from time pressure;
- Organizational impediments to creativity, which measures aspects of the organization culture that work against individual creativity, through internal political problems

Criterion scales

The last scales provide the overall perception of individual working for the company in the terms of the following two dimensions:

- Creativity, which measures if the area in which the individual work is perceived as creative and if creativity is a priority people’s goals;
- Productivity, which measures if individuals consider their unit and organization productive, efficient and effective.

Each dimension has a number of items that varies from a minimum of 4 to a maximum of 15 items.

KEYS Dimensions
Organizational encouragement
Supervisory encouragement
Workgroup supports
Sufficient resources
Challenging work
Freedom
Organizational impediments
Workload pressure
Creativity
Productivity

Table 3 Framework of the 10 creative dimensions of the KEYS survey by Amabile, Conti, Coon, Lazenby and Herron, 1996

2.3 Defining Innovation Output

Innovation occupies the central role in the life of organisations, and it is the key factor that determines their survival on the long-term (Ancona and Caldwell, 1987).

In the previous paragraphs it was reached the conclusion that giving a definition of the concept of innovation is a complicated and nuanced task. Nonetheless, trying to define and measure the innovation output is an equally challenging job. Cambridge dictionary defines the word “output” as “an amount that a person, machine, or organization produces”. When talking about output produced by the innovation process, it is necessary to define what is considered to be part of the amount and how it is intended to measure it. Moreover, when talking about organisations, it is important to distinguish between the organisational level and the individual level: the first gives a measurement of the innovation performance of the company, and the latter measures the innovation behaviour of individual employees in the work place, which is the level of the discussion that this thesis wants to focus on, and will be further explore in the next paragraphs.

2.3.1. Innovation output on the organizational level

In the literature, the most common proxy used by researchers to measure the innovation output of an organization is the number of patents. As known, patents give the legal right to make or sell an idea, an invention, a process of production of the good/service. Intellectual property (IP) are intangible properties ideated by the human intellect. The owner of the property is also the owner of the legal right on the IP. In many industries, IP gives to the owners an essential competitive advantage, which has to be carefully and strategically managed. Hence, this is the reason why in the literature it is possible to find many studies and researches about this topic and how to efficiently manage IP (Reitzig, M. 2004).

Patenting is a common IP practice that gives to the owner the legal right to prohibit others from producing, using, selling and importing an invention for a limited period of years in return for the publication and public disclosure of the invention. In most cases, patent rights come under common law and the patent holder may sue anyone who infringes the patent in order to uphold the statute. In engineer-based companies, patenting is a fundamental practice, largely used to create and protect competitive advantages, hence it can be used to define the innovation output of a company. However, it is worth mentioning that this choice of measurement is lacking to

consider other elements that can describe the innovation output and that not all industries need IP to create and defend competitive advantages, hence other ways of measuring innovation output should be explored.

2.3.2 Innovation output on the individual level

Identifying individual innovation is a task just as complex as identifying the innovation output on the organisational level. When discussing in general terms the definitions of innovation and creativity, there are already some complications in identifying and distinguishing the one from the other, since the two terms are often used as synonyms. In the previous chapters we established the difference between the two: in simple words, creativity concerns the generation of new ideas, while innovation concerns the process of their implementation. The number of patents cannot be used on the individual level, since it is a number that is the results of the collective efforts of all the levels of a company. Scott and Bruce (1994) suggest that innovation on the individual level starts with a person that recognize a problem and generate ideas or solutions to solve it. These ideas can be both new or adopted. Next, the person tries to find a sponsorship and sponsors to support his/her idea and tries to prototype his/her idea. This multistage process of innovation is characterized by discontinuous activities, rather than a step-by-step process, hence innovation of the individual level can be seen as a individual innovation behaviour, rather than a process or an exact number as the number of patents.

Individual innovation behaviour differs from the team or organization level, since it is based on the individual capabilities and motivations of employees, which positively influences individual effectiveness and can result and boost the general level of creativity and effectiveness of the organization itself (Wu, Parker & de Jong, 2014). Moreover, it is possible to consider individual innovation behavior as a proactive work behavior: in fact, individual innovation requires actions set in place by individuals themselves who want to initiate some kind of change.

2.3.2.1 Assessing the innovation behaviour

The researcher of this paper had the need to construct a section of the survey which could assess innovation behaviour; in doing that she is inspired by the following method which developed through a five dimensions model, and that has the quality of including multiple elements that explain innovation behaviour. Therefore, the questions of the survey are based on Kleysen &

Street 2001's paper that had the intention of summarizing the main measures used to assess innovation behaviour in one multi-dimensional assessment model.

The authors identify five dimensions, which are used to group together similar behaviours:

1. Opportunity exploration, which are those behaviours concerning looking at the current situation and identifying problems that could be solved. The authors identify four common behaviours related to this category, which are:
 - The recognition of new opportunities,
 - Gathering information about the possibility to improve or innovate,
 - Actively looking for possible innovations,
 - Watch out for sources of unknown opportunities.

2. Generativity, which are the behaviours directed at generating a positive transformation that has the final goal of improving and growing the company, the workers, the products/services/ and the processes. This category identifies three basic common behaviours:
 - The generation of ideas and solutions that aim to solve the problem highlighted from the identified opportunity,
 - The categorization of the opportunities and their representation,
 - The combination of different information and the association of various ideas.

3. Formative investigation, which are the behaviours that give form to the ideas and solutions, that prototype them and that try them out. This category identifies three behaviours:
 - The formulation of ideas and solutions,
 - The experimentation of ideas and the solutions,
 - The evaluation of ideas and solutions.

4. Championing, which are those socio-political behaviours, whose aim is to look out for material and immaterial resources, which have the final goal of realizing the ideas generated. The four basic behaviours are:
 - The mobilization of material resources,
 - Being able to accept challenges and being open to take risks,
 - The negotiation of ideas and solutions,

- Influencing and persuading people to support ideas and changes.
5. Application, which are the behaviours regarding the implementation of ideas and solutions, with the goal of making them a regular part of the business. These behaviours are:
- Implementing solutions and ideas,
 - Modifying them if necessary,
 - Routinizing them into the usual business.

Innovation behavior dimensions	Basic behaviors
Opportunity Exploration	<ul style="list-style-type: none"> - Paying attention - Look for opportunities - Recognize opportunities - Gathering information about opportunities
Generativity	<ul style="list-style-type: none"> - Gathering information - Generating ideas - Combining ideas
Formative Investigation	<ul style="list-style-type: none"> - Formulating ideas - Experimenting - Evaluating
Championing	<ul style="list-style-type: none"> - Mobilizing sources - Influencing - Negotiating - Challenging and risk taking
Application	<ul style="list-style-type: none"> - Implementing - Modifying - Routinizing

Table 4 Framework of the multi-dimensional model of individual innovative behavior by Kleysen and Street, 2001

3. Methodology

The third chapter explains structure and the logic behind the analysis used to answer to the research question. This section starts with a summary of the research strategy, followed by a summary of how the data are gathered, analysed and assessed, and concludes with a reflection on the quality and reliability of the analysis.

3.1 Research strategy

The aim of this research is to find if there is a correlational relationship between the two variables, which are the creative climate as the independent variable, and the innovation output as the dependable one, rather than a causal relationship between the variables. The study wants to explore if the first one influence the latter at the workplace.

Aiming to find the research strategy and design that better suits the research question of this study, the quantitative methodology has been chosen, based on Bryman & Bell, 2011. Firstly, this study has implemented a deductive analysis approach to reach a generalizable understanding of the relationship between creative climate and innovation output on the individual level. The deductive methodology is consistent with a quantitative methodology which helps writer of this research to evaluate a structure that is consistent with the empirical construct that the researcher plans to evaluate (Creswell, 2009).

A quantitative approach satisfies the need of the author of dealing with a vast amount of data, which can be analysed and used to generalize the chosen population. The quantitative study offers also results that can be replicable and implemented and further developed by future studies. Moreover, on deciding which approach using in answering the question of the thesis, the researcher wanted to avoid the risk of any confirmation biases from the respondents, which could lead in a positive but biased results in studying which type of relationship runs between the creative climate and the innovation output on the individual level.

3.2 Research design

A suitable context for analytical data collection is necessary in order to address the specified hypothesis and to fulfil the overall aim of this research. The simple option of a likable research design and methodology is an insufficient approach (Bryman and Bell, 2011). Bryman and Bell (2011) claim that, depending on the approach chosen, there will be many and different

theoretical and practical consequences and implications. In the next paragraph, the selected approach will be discussed.

3.2.1 Cross-sectional Design

Aiming to select the best approach to conduct the collection and the analysis of the empirical findings, the researcher has decided upon the cross-sectional design, which is a method used to define the relationship between two or more variables, whose data have been collected on a given occasion through a measurable questionnaire (Bryman and Bell, 2011). This method meets the researcher's necessity of selecting an approach that can meet three basic requirements. Firstly, the design selected has to allow for variation, in order to measure patterns and potential relationship between variables, which means that the design requires the assessment of more than one case. This is possible through the application of a survey, which also allows to meet the next basic requirement: the necessity of narrowing the focus of the study on a single point in time. This need is due to the short time frame and resources given to the development of this master's thesis. Lastly, the cross-sectional design allows to simplify the analysis of the empirical findings, by providing a standardized design (Bryman and Bell, 2011).

3.3 Research method

The research method discusses the approach used in the study to collect the empirical data. To gather the necessary data for the research, the information has been collected both from primary and secondary sources.

3.3.1 Primary data

The tool selected to collect the primary data is an online questionnaire (see Appendix 1). By using a survey, the author of the paper is able to collect vast volume of data. Surveys are the most common way of gathering quantitative data because they are inexpensive, confidential and simple to use (Creswell, 2009). By selecting a survey with solely closed questions, the respondents are forced to directly answering to the question asked (Bryman and Bell, 2011). Therefore, when this method is chosen, it is fundamental to clearly and appropriately define and plan the format and the content of the questionnaire, by keeping in mind the desirable results and the focus of the study (Dillman, 1983). In practical terms, the survey was distributed in an online form through the LinkedIn platform. The web-based choice allows for respondents

to reply when they have available time to spend focusing on the questionnaire, whilst a pitfall of the online feature of the survey is a significant level of unfinished questionnaires (Bryman & Bell, 2011). Therefore, research theory emphasizes how fundamental the method of distribution, the layout and the content are to increase as much as possible the response rate (Dillman, 1983). For this reason, the survey was structured as shown in the appendix 1, and as it is discussed in following paragraph from top to bottom.

First of all, the tool selected to create the survey is called *Qualtrics*, which is an online survey creator platform. Differently from other similar survey platforms, it offers numerous features and advises on how to make the survey as much appealing and effective as possible, it gives an estimation of the duration of the survey and allows to export the results rather easily.

Moving to the general outline of the survey, the questionnaire is divided in the 16 sections/blocks. The first block that appears to the respondent is a message from the researcher of this study, in which she is introducing herself and the aim of the survey. Following, the next section's goal is to gather general demographic information about the respondent. From the third to the fifteenth block all the questions are articulated in Likert scale questions. In each one the respondents have to give their level of accordance with the statement of the question and can choose between five alternatives: "*Strongly disagree*", "*Disagree*", "*Neutral*", "*Agree*", "*Strongly agree*". The choice of a Likert scale is due not only to the standardize answers that this method provides, which suit with the aim of this study. In fact, this scale is selected also because of the considerable amount of questions of the survey and the consequent considerable duration, which are both elements that can decrease the already low response rate of online surveys. With the intent of increasing the rate, throughout the survey are placed encouraging messages that indicate the level of progress, in reaching the end of the survey. These twelve Likert-based blocks represent the dimensions identified in literature review (see chapter 2) about creative climate and innovation behaviour. Lastly, the final section is articulated in two questions, asking an approximating number of ideas, and products/services that the individual contributed to generate.

3.3.2 Sampling strategy

The sampling strategy for this research has been chosen considering the limited time and resources of the writer of this paper. Aiming to reach a sufficient number of responses in the

limited time frame from at least 50 respondents, the researcher had decided to use different strategies.

Since this study was carried out through an online questionnaire (Appendix 1), the survey was shared via social networks and instant messaging applications. No convenience sampling was carried out, so the choice of the sample was purely random and not distributed ad hoc.

The first tool used is the social network of LinkedIn. The survey has been shared through this tool, because it provides direct and accessible communication with a large number of people and employees. Aiming to narrow down the search for appropriate respondents, the researcher had shared a post on her own LinkedIn profile and asked to repost the survey, so that it could reach a bigger network than the researcher's one. The post of the survey has collected 1242 views in the time the survey was open. Moreover, on LinkedIn the survey was shared also on the platform of the Swedish consultancy company called First to Know, which is an innovation hub that connects students with the job market and works with them to create creative solutions and innovative projects.

The other strategy to sample the questionnaire to a large number of people was the use of the university of Gothenburg's email accounts. The university responsible for the sharing of the students' surveys was contacted by the writer of the thesis, and consequently the survey was forwarded to all the university's email accounts with a message from the writer of this paper that was introducing the survey and the study to the plausible respondents.

3.3.3 Secondary Data

Secondary data are collected through a literature review and it is the base on which the research is conducted on, since it is the original source of the theory. Academic journals, books, reports and case studies have been collected through the LUISS and the University of Gothenburg library's portals and through the material suggested by professors and supervisors. The research on the library portals has been done through a selection of appropriate keywords such as: *innovation, innovation output, innovation performance, creativity, creative climate, innovation measurements, individual behaviour, individual innovation, individual creativity.*

The selection of the relevant sources has been conducted by choosing academic papers, journals and articles that have been marked as *peer reviewed*, in order to guarantee the reliability of the sources selected.

For this thesis, it has been used a systematic review rather than a narrative review, because the latter one is considered more feasible for a student research that uses a qualitative approach, while the first can be used for a quantitative research method.

3.4 Measure of concepts and variables

The questions of the survey chosen to conduct this study is based on the systematic review of the existing literature about the concepts of creative climate and innovation, and the combination of different measurement tools used to define these topics.

The first section asks questions about the respondent herself. In the regression study these initial questions are reported as control variables. These variables are the following and has been measured in the following way:

- Gender: a dummy variable was created and the number 0 for men or 1 for women has been assign based on the gender of the respondent,
- Age: the age was divided in ranges 18 to 24, 25 to 34, 35 to 44, 45 to 54, 55 to 64 and 65+. Aiming to study the age variable in the regression, a number from 1 to 6 was assigned to each age range, from 1 being the youngest range, to 6 being the oldest one.
- Tenure: the tenure measures the number of years the employee has been working for the current company. The ranges were for: less than 1 year, less than 2 years, less than 3 years, less than 5 years, less than 10 years and more than 10 years. Assuming a nonlinear relationship of the responded, the tenure variable has been computed as the natural logarithm of each range in the following manner:
 - o Less than 1 year = $\ln(1)$
 - o Less than 2 years = $\ln(2)$
 - o Less than 3 years = $\ln(3)$
 - o Less than 5 years = $\ln(5)$
 - o Less than 10 years = $\ln(10)$
 - o More than 10 years = $\ln(20)$

To exemplify it, if the respondent answered that he has been work for less than 1 year, the response has been recorded in the data set as the $\ln(1)$.

- Immigrant: the immigrant variable is a dummy variable. In the questionnaire there are one question about the country the respondent currently works and one question about the country the respondent is from. If the respondent works in the country he is from, in the data set it was given the number of 0, since he is not considered an immigrant. If the country he works in and the country he comes from do not match, the respondent is considered an immigrant, and the number of 1 is given to her.
- Business line: the respondent is asked the optional question of which company he works for and the mandatory question of the business line he works in. If the business line is considered innovative and creative, the response is registered in the data set with the value of 1, otherwise the number of 0. For example, the number 1 was given to someone with a position in marketing or product development, while the number 0 was given to someone with a position in accounting.

The variable of creative climate is assessed by the sections from the third to the fifteenth, which are based on the SOQ framework and the KEY framework (see respectively 2.2.4.1 and 2.2.4.2 in chapter 2). The results of the researcher's elaboration are 12 sections articulated in 3 or 4 Likert questions each. The sections identify 12 dimensions of the individual creative climate: challenge/involvement, freedom, trust, idea time, play/humour, conflicts, idea support, debates, risk taking, management support, diversity and innovation perception.

The variable of innovation output is assessed in two ways. In the sixteenth section, innovation behaviour is measured by Likert questions based on Kleysen & Street method (see 2.3.2.1 in chapter 2). In the last section the innovation output is assessed by asking to the respondents an approximating number of ideas, and products/services that the individual contributed to generate.

The choice of the Likert scale allows to collect ordinal results, which allow the creation of overall scores of creative climate and innovation behaviour per individual. Each dimension's score is computed as the sum of the answers given for each item in the dimension, divided by the sum of the maximum that was possible to answer to each item. For example, imagine that in the section about the dimension of Debates an imaginary respondent answered in the following way:

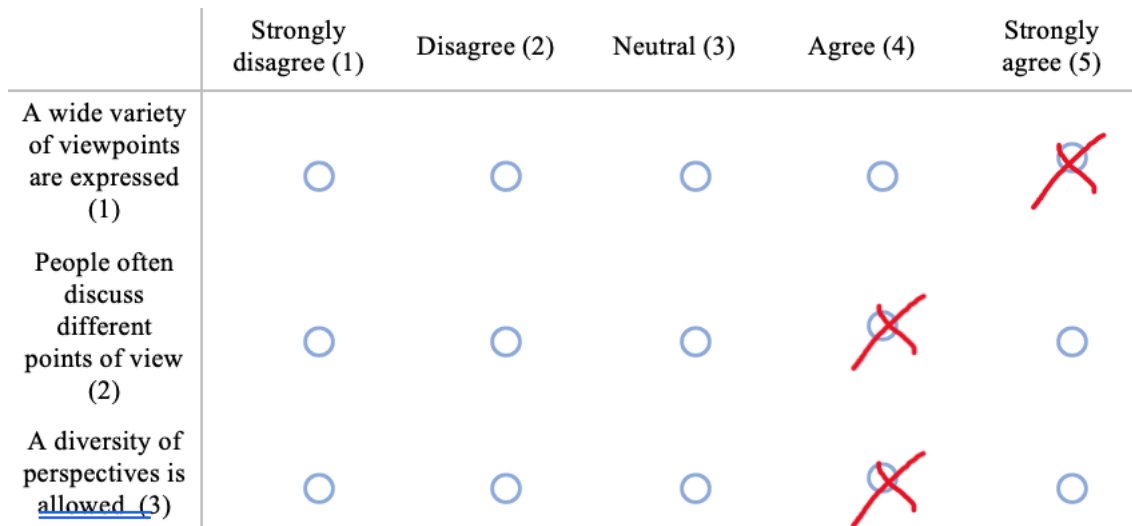


Figure 2 Example of responses of the survey form the section of the dimension of Debates

The respondent has answered strongly agree to the first statement, agree to the second and to the third. The overall score for the dimension of debated for this respondent it is calculated as $(5+4+4)/(5+5+5)=0,8667$

The following table (Table 4) shows a summary of the variables and the number of items.

Control Variables	N° Items
Gender	1
Age	1
Tenure	1
Business Line	2
Immigrant	2
Dimensions Creative climate	N° Items
Challenge/Involvement	4
Freedom	3
Trust	3
Idea Time	4
Play/Humour	4
Conflict	4
Idea Support	4

Debate	3
Risk Taking	4
Management Support	4
Diversity	4
Innovation Perception	3
Dimension of Innovation Output	N° Items
Innovation Behaviour	4

Table 5 Summary of variables and number of items per variable

3.5 Research process and data collection

Within this study, different tools have been used to collect and analyse the data collected through the questionnaire.

The online platform Qualtrics was used to create the survey and collect the results. The survey was published and shared on the 17th of May 2020 and has been open until the 31st of May 2020. After 10 days since the first sharing, the post on LinkedIn was published again to collect more responses.

Then, the results have been exported in a document and elaborated in Microsoft Excel. In the spreadsheet tool, the data set was created: the control variables and the overall score for the dimensions have been computed like shown in the paragraph 3.4.

The data set has been moved to the statistical software package Stata, which has facilitated the researcher to analyse the results. This software has been chosen over the more commonly used IBM's SPSS, due to the regression model chosen, which is not present in SPSS, that will be illustrated in the next paragraph.

3.6 Data analysis

The design of the research establishes a set of criteria that has influenced the choice of the regression model picked for this study. The selected model is the fractional logit model.

The model was firstly introduced in 1996 by Leslie E. Papke and Jeffrey M. Wooldridge. The reason behind this choice is that this model can be used to run a fractional regression that has all the values of the dependent variable in a range between 0 and 1. This is the case for the innovation behavior score, computed as previously illustrated. The selected model influenced also the choice of the software used to analyze the data set for this research. In fact, the most commonly used statistical tool SPSS do not run fractional regressions, while the software Stata run this type of model.

3.7 Research quality

One of the main elements of a research quality is the replicability of the study. The term replicability indicates the possibility to recreate the study by other researchers (Bryman & Bell, 2011). For this reason, in conducting this research, the researcher has described step by step, clearly and explicitly all the methodology behind the study. In fact, it is possible to find in the appendix the actual questionnaire sent, based on the literature proposed in chapter 2 of this thesis, and the reasoning behind the choices taken throughout the whole research process.

Aiming to avoid personal biases that could influence the study, each step of the research was premeditated and not heavily modified during the research process, in order to maintain objectivity, which is a fundamental element of a quantitative study.

Another element of research quality is validity. The term validity indicates how sound the research is. For this reason, to reach a sufficient level *face validity* and *measurement validity* (Bryman & Bell, 2011), the researcher has confronted his supervisor about the survey and the statistical model chosen for the study, and had modified the survey accordingly to the suggestions given to her before sending out the questionnaire and conducting the analysis.

4. Empirical Findings and Data Analysis

The fourth chapter presents and explains the collected results of the study. Initially, in this section the sample used will be introduced and described, the robustness of the model will be verified through the exposure of the analysis and finally the interpretation of the results.

4.1 Descriptive statistics

After describing the proposed model in the previous chapter with the aim of determining the relationship between creative climate and innovation output, this chapter will be entirely devoted to the quantitative analysis of the model.

Through the survey 81 responses have been collected. The online survey platform Qualtrics registered not only the completed surveys, but also the ones that have been initiated, but not concluded. The total iterations were 110, while the final completed and answered surveys are the 81 responses, which has been used to build the data set for this research.

The first block of the survey was used to investigate the composition of the sample.

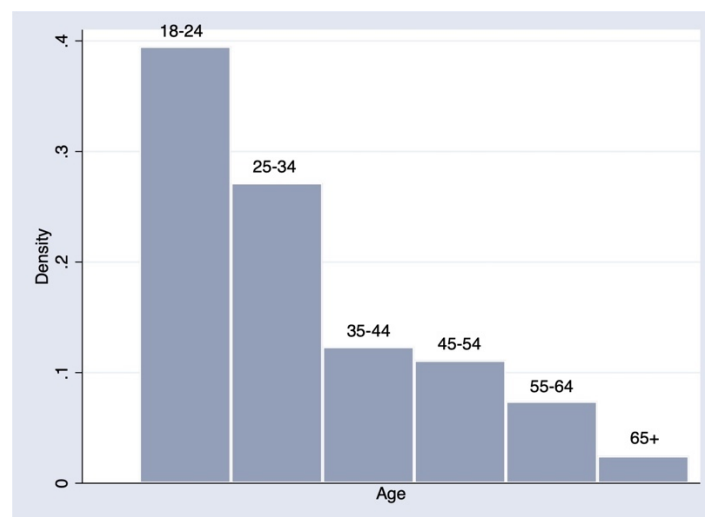


Figure 3 Distribution of the age of the respondents

The questionnaire was submitted by a sample of respondents largely distributed in the group between 18 and 24 (39% of respondents) (Table 5). In addition, the distribution between female and male is almost even, with respectively 47% and 53%). When asked how many years the respondent has been working for the current company, the results are as shown in

the Figure 4 below. As it is possible to see, the majority of the sample has been working in the current company for less than 5 years, which might be due to the young age of the respondents.

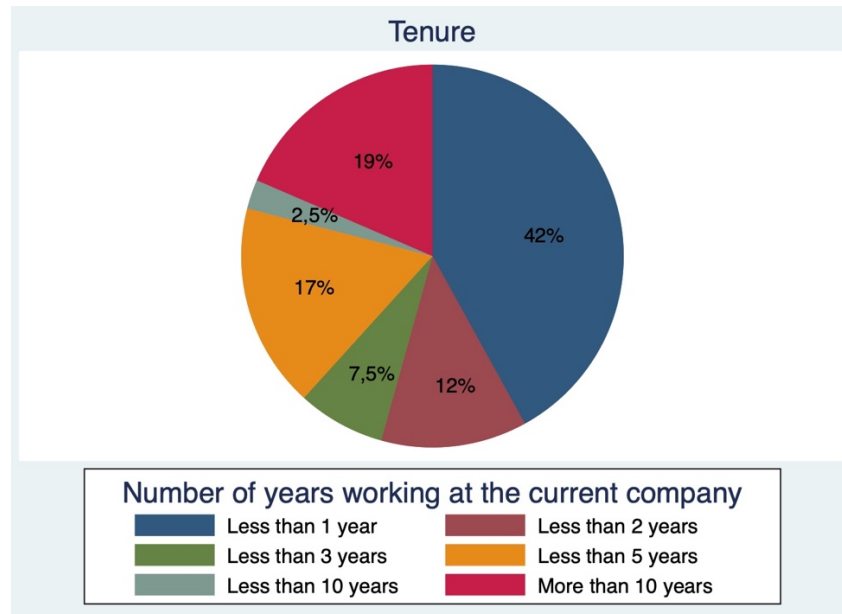


Figure 4 Tenure of the respondents

Moreover, the results for the variable of business line, which indicates if the respondents work in an innovative and creative position (Figure 3), shows that the 60,5% of the sample of respondents works within an innovative business line.

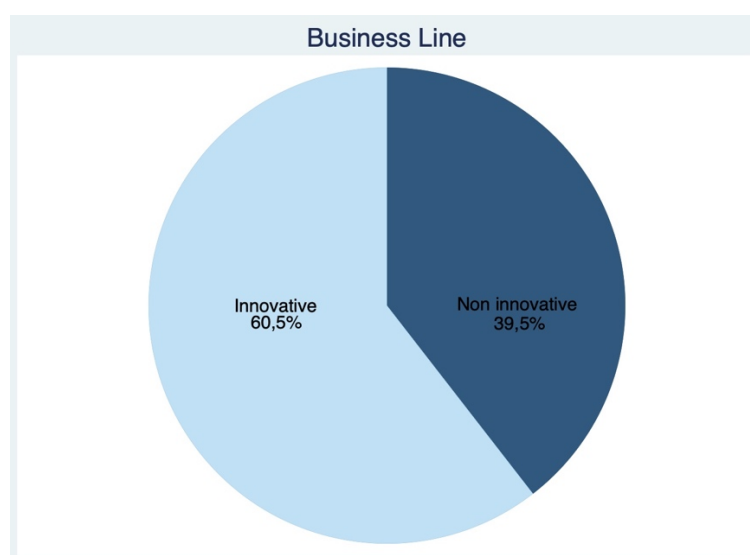


Figure 5 Distribution of Business Line

Lastly, the 87,7% of the sample work in the country he is from. Therefore, he/she has not been labelled as immigrant.

4.2 Responses

Table 6 below shows the collected answers' average mean and standard deviation, for each dimension of creative climate and innovation behaviour.

Variable	Obs	Mean	Std. Dev.
dim_challe~e	81	.5783951	.1728327
dim_freedom	81	.5407408	.1719173
dim_trust	81	.544856	.2048821
dim_idea_t~e	81	.4888889	.1412002
dim_play	81	.5759259	.1982913
dim_conflict	81	.4296296	.133177
dim_idea_s~t	81	.5253086	.1630037
dim_debates	81	.5465021	.1860167
dim_risk	81	.517284	.1325614
dim_manage~t	81	.5827161	.1914028
dim_divers~y	81	.5802469	.1923017
dim_innov_~p	81	.5580247	.2135531
dim_innov_~v	81	.6123457	.2265958

Table 6 Measure of concepts and underlying indicators

By reviewing overall the indicators for each dimension, it is possible to say that:

- The challenge/Involvement variable shows that the majority of the respondents experience medium high levels of emotional commitment and motivation in completing the operations and goals for the company they work for;
- The freedom dimension shows that most respondents feel to have a positively moderate level of autonomy in taking initiative and making decisions on their own work;
- Trust/Openness, which measures the level of trust and the emotional safety found in in the work environment, is positively moderate;
- Idea Time shows that the amount of time that is available to individuals to develop new ideas is on average on the lower side;

- Playfulness/Humor shows that on average individuals experience a work environment that is open towards spontaneity, laughter and good-natured joking;
- The conflict variable shows that the presence of conflicts and tensions within the workplace on average is low and it is also the lowest average of these indicators,
- Idea Support variable is on average positively moderate, meaning that generally individuals feel that the work environment is open to new ideas and suggestions, whilst management support is perceived generally medium high.
- Debates seem to be generally present in the work environment, and individuals feel free to exchange opinions in a respectful environment,
- Risk-taking is moderate, which means that there is not a high tolerance of ambiguity and uncertainty.
- Diversity, on average the work environment is medium high diverse
- Innovation perception, which measures if the respondent perceives the company he works for as innovative or not, is medium high, indicating that generally the companies are perceived as innovative;
- Innovation behavior, on average people feel to have medium high innovative behavior.

In the Appendix II, it is possible to find a more detailed descriptive statistic.

4.3 Reliability

Next analysis to be carried out is the reliability test, which represents the consistency of the model. Internal reliability is a criteria used when the research studies multiple measures, and therefore the internal reliability need to be tested in order to test the coherence of the dimension with the model. In other words, this test is necessary to see if the variables are related to the same things or not. Cronbach's Alpha is a common tool used to test the reliability of the model (Bryman & Bell, 2011). Traditionally an acceptable alpha is considered to range between 0,8 to 1, where 1 means perfect correlation and reliability. Some other researchers suggest as a rule of thumb to accept alphas that are from 0,7 up (Fornell & Larcker, 1981). The table 7 below shows the reliability level and their acceptability.

Cronbach's alpha	Reliability level
$0.9 \leq \alpha$	Excellent
$0.8 \leq \alpha < 0.9$	Good
$0.7 \leq \alpha < 0.8$	Acceptable
$0.6 \leq \alpha < 0.7$	Questionable
$0.5 \leq \alpha < 0.6$	Poor
$\alpha < 0.5$	Unacceptable

Table 7 Range of reliability levels by L. Cronbach, 1951

In the present study, as shown in the table 8 below, it was found that the dimensions are all entirely acceptable, since they results all in the range between 0,8 and 0,9.

Dimension	Cronbach's alpha	Acceptability
Challenge/Involvement	0.8107	Yes
Freedom	0,8112	Yes
Trust	0,8127	Yes
Idea Time	0,8144	Yes
Conflict	0,8161	Yes
Idea Support	0,8004	Yes
Debates	0,8031	Yes
Risk Taking	0,8057	Yes
Management Support	0,8031	Yes
Diversity	0,8142	Yes
Innovation Perception	0,8155	Yes
Play/Humour	0,8126	Yes

Table 8 Cronbach's alpha of the model

The correlation matrix is presented in table 9 below. Pearson's r ranges between -1 and +1. The rule of thumb to interpret the level of correlation states that for $|r| \leq 0,3$ there is weak

correlation, for $0.3 < |r| \leq 0.7$ there is moderate correlation, and for $|r| > 0,7$ there is a strong correlation.

	gender	age	tenure	dim_challe~e	dim_fr~m	dim_tr~t	dim_id~e
gender	1.0000						
age	-0.4267	1.0000					
tenure	-0.3819	0.6849	1.0000				
dim_challe~e	-0.0578	0.2792	0.1716	1.0000			
dim_freedom	0.0279	0.1916	0.0488	0.4135	1.0000		
dim_trust	-0.0113	0.1163	-0.0194	0.4696	0.2042	1.0000	
dim_idea_t~e	0.0903	0.0122	-0.0831	0.2474	0.4926	0.3271	1.0000
dim_play	-0.0829	0.1247	0.0109	0.4351	0.1520	0.4459	0.1689
dim_conflict	0.0662	-0.1738	0.0368	-0.4457	-0.1844	-0.5792	-0.2548
dim_idea_s~t	-0.0668	0.3243	0.2076	0.5166	0.4348	0.4740	0.4686
dim_debates	0.0241	0.1041	0.0732	0.3394	0.3131	0.4275	0.3070
dim_risk	0.0208	0.2328	0.0906	0.3098	0.3892	0.3009	0.3293
dim_manage~t	0.2201	-0.0683	-0.0637	0.5289	0.3028	0.3834	0.3686
dim_divers~y	0.1402	-0.0516	-0.1132	0.2568	0.2805	0.2385	0.2393
dim_innov~p	0.1269	-0.0421	-0.1204	0.1998	0.4171	0.1191	0.3892
dim_innov~v	0.0708	0.2209	0.1026	0.1425	0.4565	0.1441	0.2397
immigrant	0.1087	-0.1982	-0.1691	-0.0201	-0.1781	-0.1800	-0.0901
number_pro~s	-0.2583	0.1756	0.1430	0.3043	0.1778	-0.0164	0.0437
number_ideas	-0.1127	0.2426	0.2019	0.1834	0.3216	0.2619	0.2920
business_l~e	0.1834	-0.1141	-0.0129	0.1115	-0.0438	0.0623	-0.1180
	dim_play	dim_co~t	dim_id~t	dim_de~s	dim_risk	dim_ma~t	dim_di~y
dim_play	1.0000						
dim_conflict	-0.3856	1.0000					
dim_idea_s~t	0.5054	-0.4352	1.0000				
dim_debates	0.4538	-0.2901	0.6553	1.0000			
dim_risk	0.2954	-0.3250	0.5117	0.5601	1.0000		
dim_manage~t	0.5192	-0.3597	0.5451	0.5741	0.5538	1.0000	
dim_divers~y	0.3766	-0.3625	0.3890	0.4814	0.3139	0.5501	1.0000
dim_innov~p	0.3517	-0.1550	0.2667	0.3357	0.3380	0.4591	0.2464
dim_innov~v	0.2418	-0.1096	0.3079	0.4192	0.4641	0.4474	0.3793
immigrant	-0.0381	-0.0423	-0.0269	-0.1936	-0.1539	0.0190	0.0849
number_pro~s	0.2192	0.0792	0.1795	0.1085	0.3578	0.2794	0.0283
number_ideas	0.2395	-0.2012	0.3568	0.2914	0.4636	0.2567	0.2544
business_l~e	0.0999	-0.1053	-0.0063	-0.0973	-0.1048	0.0129	-0.0901
	dim_in~p	dim_in~v	immigr~t	numbe~ts	numbe~as	busine~e	
dim_innov~p	1.0000						
dim_innov~v	0.4853	1.0000					
immigrant	-0.0798	-0.0458	1.0000				
number_pro~s	-0.0102	0.0812	-0.0495	1.0000			
number_ideas	0.0864	0.2148	-0.0757	0.4270	1.0000		
business_l~e	-0.0964	-0.0847	-0.1311	-0.1320	-0.1411	1.0000	

Table 9 Correlation matrix

The correlation's indexes of the dimensions show that among the variables the correlation is mostly weak, with some moderate exceptions.

4.4 Regression Analysis

As mentioned in the chapter 3 about the Methodology, the model selected for the study is the fractional logit model, due to the fractional nature of dependent variable, which ranges between 0 and 1.

Firstly, the regression with all the 17 variables is presented in the table 10 below. The independent variables are divided in 5 control variables, gender, age, tenure, business line and immigrant, and the 12 dimensions of creative climate. The independent variable is the innovation behaviour. The regression is conducted to determine whether the dimensions of creative climate and the control variables are correlated with the dependent variable of innovation behaviour, at maximum the 10% of significance level.

Fractional logistic regression		Number of obs	=	81	
Log pseudolikelihood = -48.555709		Wald chi2(17)	=	96.78	
		Prob > chi2	=	0.0000	
		Pseudo R2	=	0.1022	
dim_innov_behav	Coef.	Robust Std. Err.	z	P> z	[95% Conf. Interval]
gender	.1004533	.2070347	0.49	0.628	-.3053273 .5062339
age	.2967107	.1277294	2.32	0.020	.0463656 .5470558
tenure	.0380245	.1263281	0.30	0.763	-.2095741 .285623
dim_challenge	-2.417471	.7608873	-3.18	0.001	-3.908783 -.9261593
dim_freedom	2.870096	.8387904	3.42	0.001	1.226097 4.514095
dim_trust	.8720932	.6227327	1.40	0.161	-.3484404 2.092627
dim_idea_time	-.6241252	.9149586	-0.68	0.495	-2.417411 1.169161
dim_conflict	1.139768	.8242195	1.38	0.167	-.4756729 2.755208
dim_idea_support	-1.49765	.912832	-1.64	0.101	-3.286767 .2914683
dim_debates	1.078134	.6812867	1.58	0.114	-.2571632 2.413432
dim_risk	1.922295	1.059461	1.81	0.070	-.1542111 3.998801
dim_management	1.92106	.9482891	2.03	0.043	.0624481 3.779673
dim_diversity	.9282218	.5861504	1.58	0.113	-.2206118 2.077055
dim_innov_percep	1.098997	.6537035	1.68	0.093	-.182238 2.380232
immigrant	.4207099	.2246667	1.87	0.061	-.0196287 .8610484
business_line	.2007251	.2057634	0.98	0.329	-.2025637 .6040139
dim_play	.0349178	.6998257	0.05	0.960	-1.336715 1.406551
_cons	-4.304528	.9918776	-4.34	0.000	-6.248573 -2.360484

Table 10 Fractional logit regression with 17 dimensions

The parameters of good fit of the model of log pseudolikelihood, Wald chi squared, the p value= 0 indicate that the current model exhibits significant improvements in fit over a no model, while the pseudo R2 is low but it is coherent with the nature of the research, which is in the socio economical field. Hence, R2 is on the lower spectrum because there are many other variables that influence positively or negatively innovation behaviors that could not be taken into consideration in this study, because of the limited resources and time available to the writer. With all this in mind, we can look at each dimension's p-value.

Control Variables	p-value	Significance
Gender	0,628	no
Age	0,020**	yes
Tenure	0,763	no
Business Line	0,329	no
Immigrant	0,061*	yes
Challenge/Involvement	0,001***	yes
Freedom	0,001***	yes
Trust	0,161	no
Idea Time	0,495	no
Play/Humour	0,960	no
Conflict	0,167	no
Idea Support	0,101	no
Debate	0,114	no
Risk Taking	0,070*	yes
Management Support	0,043**	yes
Diversity	0,113	no
Innovation Perception	0,093*	yes

* $p < .10$, ** $p < .05$, *** $p < .01$

Table 11 P-values and significance relationship of the model with 17 variables

Overall among the 17 variables, only 7 resulted to have a significant relationship with the dependent variable. This can depend to the levels of correlation between the independent variables showed in the correlation matrix in table 9.

Therefore, the researcher had proceeded with the modification of the variables to see if it was possible to improve the regression model. The results are presented in table 11, and from now on all the considerations will be referred to these results.

Fractional logistic regression		Number of obs	=	81	
Log pseudolikelihood = -48.608449		Wald chi2(13)	=	86.91	
		Prob > chi2	=	0.0000	
		Pseudo R2	=	0.1012	
dim_innov_behav	Coef.	Robust Std. Err.	z	P> z	[95% Conf. Interval]
age	.3178157	.0867839	3.66	0.000	.1477224 .4879091
dim_challenge	-2.374026	.7393179	-3.21	0.001	-3.823062 -.9249893
dim_freedom	2.694601	.8384122	3.21	0.001	1.051343 4.337859
dim_trust	.8283833	.5945208	1.39	0.164	-.3368561 1.993623
dim_conflict	1.289512	.7801267	1.65	0.098	-.2395079 2.818533
dim_idea_support	-1.655441	.8307497	-1.99	0.046	-3.28368 -.0272013
dim_debates	1.14942	.694983	1.65	0.098	-.212722 2.511561
dim_risk	1.842832	.9493162	1.94	0.052	-.0177939 3.703457
dim_management	1.988476	.8659378	2.30	0.022	.2912689 3.685683
dim_diversity	.9383747	.5865749	1.60	0.110	-.211291 2.08804
dim_innov_percep	1.010248	.5827351	1.73	0.083	-.1318916 2.152388
immigrant	.4371123	.2198991	1.99	0.047	.006118 .8681065
business_line	.2502078	.1711549	1.46	0.144	-.0852498 .5856653
_cons	-4.471445	.9203557	-4.86	0.000	-6.275309 -2.667581

Table 12 Fractional logit regression with 13 dimensions

Overall, the model improved, and the variables that show significant relationship with innovation behavior are 10 out of 13.

The dimensions of creative climate that have been confirmed having the significant relationship with innovation behavior are challenge involvement, freedom, conflict, idea support, debate, risk taking, management support and innovation perception. The ones that did not show a significant relationship are the dimension of trust and diversity, while the two omitted from the original fractional regression with 17 variables are play/humor and idea time.

The control variables that have been omitted from the previous 17 variables model are gender and tenure, while in the 13 variables model, age, business line and immigrant have been included. Out of these three, age and immigrant confirmed to have a significant relationship with innovation behavior.

Control Variables	p-value	Significance
Age	0,000***	yes
Business Line	0,144	no
Immigrant	0,047**	yes
Challenge/Involvement	0,001***	yes
Freedom	0,001***	yes
Trust	0,164	no
Conflict	0,098*	yes
Idea Support	0,046**	yes
Debate	0,098*	yes
Risk Taking	0,052*	yes
Management Support	0,022**	yes
Diversity	0,110	no
Innovation Perception	0,083*	yes

* $p < .10$, ** $p < .05$, *** $p < .01$

Table 13 P-values and significance relationship of the model with 13 variables

4.5 Discussion of the results of the creative climate dimensions

Since determining the meaning of the coefficients in a fractional regression model can imply a complicated and ambiguous interpretation of the results, it is possible to use the marginal effects on the dependent variable due to a 1% increase of one of the independent variables,

which are shown in table 14. In the table are reported only the creative climate variables the marginal effect on innovation behavior.

	Delta-method					[95% Conf. Interval]	
	dy/ex	Std. Err.	z	P> z			
dim_challenge	-.2817991	.0837845	-3.36	0.001	-.4460137	-.1175845	
dim_freedom	.2864613	.0832024	3.44	0.001	.1233876	.449535	
dim_trust	.0919063	.0649849	1.41	0.157	-.0354618	.2192743	
dim_conflict	.1173822	.0700578	1.68	0.094	-.0199286	.2546929	
dim_idea_support	-.174636	.08589	-2.03	0.042	-.3429772	-.0062947	
dim_debates	.1242258	.0743647	1.67	0.095	-.0215263	.2699779	
dim_risk	.1891972	.0980504	1.93	0.054	-.002978	.3813725	
dim_management	.2286908	.0952447	2.40	0.016	.0420145	.415367	
dim_diversity	.1085892	.0665608	1.63	0.103	-.0218676	.239046	
dim_innov_percep	.1103631	.0615501	1.79	0.073	-.0102727	.230999	

Table 14 Marginal effects

4.5.1 Challenge /Involvement

The variable of challenge/involvement has been introduced in this paper such as the measure of the level emotional commitment and motivation in completing the operations and goals. The research had demonstrated the significant relationship of this variable ($p < 0,001$) with the dependent variable of innovation behavior. Nonetheless, if the theory illustrated in the chapter 2 of this thesis, seems to suggest a positive relationship between the two variables, the results obtain from this study seems to suggest a negative relationship. Therefore, the marginal effect indicates that an individual that at the workplace experience a challenging environment might exhibit less innovative behaviors. Specifically, the table 14, suggests that the increase of 1% in challenge will make the innovation behavior of the individual decrease by 28%.

4.5.2 Freedom

The dimension of freedom has been defined as the measure of the level of autonomy that individuals have to take the initiative and make decisions on their own work. The study had found the significant relationship of this variable ($p < 0,001$) with the individual innovation behavior. The results seem to confirm the theoretical literature, hence there is a positive relationship between the two variables, and from table 4 it is possible to see that when there is an increase of 1% in the level of freedom, it can be expected a consequential increase of the

individual innovation behavior of 28%. Therefore, when an individual is freer and can act more autonomously, his innovation behavior can be expected to increase as well.

4.5.3 Conflict

The variable of conflict has been described as the measure of the presence of conflicts and tensions within the workplace. The study shows that there is significant relationship with the dependent variable ($p < 0,1$), although it is weak. This result seems to go on the opposite direction compared to the concepts given in the literature review in chapter 2, since conflict and creative climate are expected to be negatively correlated, meaning that the lower the conflict the higher the creative climate. Nonetheless, in this research the marginal effect of an increase of 1% of the conflict variable seems to cause an increase equal to 11% in the innovation behavior of individuals. This could suggest that an environment with tensions and conflict among coworkers could result in an increase of individual innovative behaviors, due to the competition between the two conflictual sides.

4.5.4 Idea Support

Idea Support has been defined as the level of openness to new ideas and suggestions, within the work environment. The study had found that there is significant relationship ($p < 0,05$) with individual innovation behavior. The marginal effect shows a negative relationship between the two variables: an increase by 1% in idea support is expected to generate a decrease in the individual innovation behavior by 17%. This suggests that a work environment that welcomes and support ideas, on the individual level can determine a decrease in the innovative behavior. This element should be further explored in future research. The researcher of this paper suggests that this could be due to the lack in incentives in competing with coworkers. This suggestion comes from the results shown in the previous paragraph.

4.5.5 Debate

The dimension of debate measures the degree to which it is possible to individuals to express and to share different point of views and different ideas. The research shows that there is significant relationship with the dependent variable ($p < 0,1$). This suggests that an environment open to debates and confrontation is positively related to the presence of individual innovation

behaviors. More specifically, for an increase of 1% in the debate variable, it is expected an increase of 12% in the innovation behaviors.

4.5.6 Risk Taking

The variable of risk-taking measures the tolerance of ambiguity and uncertainty at the workplace. The study had shown the significant relationship of this variable ($p < 0,1$) with the individual innovation behavior. An increase of 1% in risk taking is expecting to match with an increase of 19% in the individual innovation behavior. Therefore, an environment that is more open to an uncertain result, pushes the individual to be perform more innovative behaviors. The result seems to agree with the literature that stated that in a more risk-taking environment creativity and innovation are incentivized on the individual level. Moreover, this result seems to follow the previous considerations made for the variable of conflict and, debate and idea support. In the eyes of the researcher, these results seem to suggest that a more unstable and individually challenging work environment favors individuals' innovative behaviors.

4.5.7 Management Support

The dimension of management support is defined as the level of support to the employees from the higher levels of the management of the company. The study indicates the existence of the significant relationship of this variable ($p < 0,05$) with the dependent variable. An increase by 1 % in the management support corresponds to an increase by 23% in the individual innovation behavior. The results follow the importance of the support from the management in the creative climate and innovation behavior of the employees. Where the management supports and pushes the employees, the single individual performs more innovatively.

4.5.8 Innovation Perception

The variable of innovation perception measures whether the individual perceive the company he/she works for as innovative. The research had shown the significant relationship of this variable ($p < 0,1$) with the individual innovation behavior. When the person perceives the company, he works for as innovative, the individual tends to perform more innovative as well. More precisely, the marginal effect of an increase in innovation perception produces an increase in individual innovation behavior of 11%.

5. Conclusion

The fifth and last chapter presents the conclusions. Initially, a summary of the work is discussed, followed by the explanation of the implications of the study, its limitations and possible future research on this topic.

Originally, at the beginning of this study the aim of the research was to answer to the following key question: *“Is there a statistically significant relationship between the dimensions of creative climate and the individual innovation output at the workplace?”*.

Firstly, the literature about the two main topics of this research, creative climate and innovation output, has been explored and illustrated. From the review, the dimensions to measure creative climate and individual innovation output were elaborated. The first is composed by 12 dimensions: challenge, freedom, trust, idea time, play/humour, conflict, idea support, debate, risk, management, diversity and innovation perception. On the other hand, the most appropriate measurement found to study the innovation output on the individual level was the dimension of individual innovation behaviour.

Secondly, a survey has been conducted, aiming to reach a sample of respondents and to collect the data for the research. Following this step, a fractional logistic regression model has been chosen to analyse the collected data. The choice of the model is due to the nature of the values of the dependent variable, which are a fractional number, included between 0 and 1.

Lastly, the results from the analysis have been discussed. Briefly, 8 out of the 12 dimensions of creative climate has been confirmed to have a significant relationship with the individual innovation behaviour. These dimensions are challenge/involvement, freedom, conflict, idea support, debate, risk taking, management support and innovation perception.

5.1 Implications and future research

In the current times, where competitiveness and being fast paced are basic requirements that companies have to meet and pursue to maintain their position or to gain more value in the market, continuously aiming to be innovative is a key factor to determine the life or the death of the players in the market.

With the aim of increasing the company's competitive advantage with regard to the implementation of an effective innovation strategy, this paper identifies the factors on which the company should focus when aiming to be innovative, starting from paying attention to the creative climate inside the company, and aiming to boost the individual innovative behavior of his employees. These elements should be used as drivers of business strategy.

An interesting insight that has emerged from the analysis is that the dimensions of creative climate seems to have effects that at first sight can be seen as counterintuitive. The results obtained from the variables of conflict, debate, idea support and risk taking seems to indicate that a more challenging environment is positively related to the innovative behaviours of the individuals. The insight offers the chance for future researcher to investigate which are the other elements and latent variables that can influence higher levels of individual innovation behaviour apart from creative climate dimensions, such as incentives and awards, R&D expenditure.

5.2 Limitations

There are few considerations to be taken in account when approaching this paper.

Firstly, the reader should keep in mind the limited amount of time and data available for the researcher, whose intent is to run a quantitative study using the resources accessible on the university library and information publicly shared by the companies. Data and analysis will have to be further tested to give more accurate results. Nonetheless, the author has followed a rigorous methodology, in order to make possible this research to be conducted again and improved as needed.

Secondly, the author acknowledges the fact that innovation output is the result of the combination of many variables, and that choosing only one, in this case the creative climate, brings the inner risk to have results that do not fully represent the reality, but again this choice has been made due to the above mentioned limitations and constraints.

Another limitation of the research depends on the sample selected and the characteristics of the respondents: nationality, age, gender and historical period. The sample includes mainly people belonging to the age group between 18 and 24 years, therefore, it cannot be said that this result is applicable to all age groups.

Lastly, looking for an empirical method to quantify innovation output, it is likely to come across the concept of intellectual property rights. It is common practice to use the number of patents as the proxy for the estimation of how and how much innovative an organization is. However, as the definition of innovation is considered a complex task, a method for measuring the innovation output is a complex task too, a task that should not be based only on the number of patents, since this number does not include other aspects and components that in the writer's opinion should be included in the valuation. For this reason, focus of this research is on individual innovation output, which can be assessed by innovation behaviours, which can be easily measured by the methodologies offered by the regarding literature.

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Appendix 1

Survey

Hi!

It's Giulia here.

I am a graduate student in Innovation and Industrial Management, grappling with writing my thesis.

By answering this survey, you'll help me study the relationship between creative climate and innovation at the workplace.

It will take less than 10 minutes.

Your contribution will be crucial, so please answer with an open mind.

Thank you for your help and time!

General Information: Get to know you

Q1 Gender

- Male (1)
- Female (2)
- Other (3)

Q2 Age

- 18 - 24 (1)
- 25 - 34 (2)
- 35 - 44 (3)
- 45 - 54 (4)
- 55 - 64 (5)
- 65+ (7)

Q3 In which country do you currently reside?

▼ Afghanistan (1) ... Zimbabwe (1357)

Q4 What country do you come from?

▼ Afghanistan (1) ... Zimbabwe (1357)

Q5 What company do you work for? (or if you rather, answer the next question)

Q6 In which line of business do you work?

Q7 How long have you worked at this organization?

- Less than 1 year (1)
- Less than 2 years (2)
- Less than 3 years (3)
- Less than 5 years (4)
- Less than 10 years (5)
- More than 10 years (6)

Q8 Challenge/Involvement

Think about your organization.

From here, all you have to do is read the sentences below and indicate how much you agree with them.

Don't overthink it.

The answers are anonymous, so please answer as truthfully as possible.

	Strongly disagree (1)	Disagree (2)	Neutral (3)	Agree (4)	Strongly agree (5)
People feel deeply committed to their jobs (1)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
People are well-informed of the company's goals and mission (2)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
People take a sincere interest in their work (3)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Most people enjoy contributing to the success of the organization (4)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q9 Freedom

	Strongly disagree (1)	Disagree (2)	Neutral (3)	Agree (4)	Strongly agree (5)
People make choices about their own work (1)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
People tend to define their own work projects (2)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
People feel free to take individual initiatives (3)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q10 Trust

	Strongly disagree (1)	Disagree (2)	Neutral (3)	Agree (4)	Strongly agree (5)
People do not talk behind each other's' backs (1)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
People do not steal each other's ideas (2)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
There is no fear of being "stabbed in the back" (3)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q11 Idea Time

25% completed! Good job!

	Strongly disagree (1)	Disagree (2)	Neutral (3)	Agree (4)	Strongly agree (5)
One has the opportunity to stop work in order to test new ideas (1)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Time is available to explore new ideas (2)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The pace of work allows for the testing of new ideas (3)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Most people have time to think through new ideas (4)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q12Play/Humor

	Strongly disagree (1)	Disagree (2)	Neutral (3)	Agree (4)	Strongly agree (5)
People here often engage in laughter (1)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
A playful atmosphere prevails (2)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Good-natured joking and teasing occur frequently (3)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The atmosphere is easy-going and light-hearted (4)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q13 Conflicts

	Strongly disagree (1)	Disagree (2)	Neutral (3)	Agree (4)	Strongly agree (5)
There are quite a few people who cannot tolerate each other (1)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
It is common to have people plot against each other (2)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
There are power and territory struggles here (3)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The atmosphere here is filled with gossip and slander (4)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q14 Idea support

You are halfway!

	Strongly disagree (1)	Disagree (2)	Neutral (3)	Agree (4)	Strongly agree (5)
People receive support and encouragement when presenting new ideas (1)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
People are usually accepting of new ideas (2)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
People generally share their ideas because they are listened to and encouraged (3)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Initiative often receives a favorable response, so people feel encouraged to generate new ideas (4)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q15 Debates

	Strongly disagree (1)	Disagree (2)	Neutral (3)	Agree (4)	Strongly agree (5)
A wide variety of viewpoints are expressed (1)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
People often discuss different points of view (2)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
A diversity of perspectives is allowed (3)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q16 Risk Taking

	Strongly disagree (1)	Disagree (2)	Neutral (3)	Agree (4)	Strongly agree (5)
People can move forward even in the face of uncertainty (1)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
People feel as though they can take bold action even if the outcome is unclear (2)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
People often venture into unknown territory (3)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Uncertainty and ambiguity are tolerated (4)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q17 Management Support

	Strongly disagree (1)	Disagree (2)	Neutral (3)	Agree (4)	Strongly agree (5)
People are encouraged to solve problems creatively in this organization (1)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Supervisors serve as a good work model (2)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
People are supported in their job (3)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
People are free to reach the organization's support (4)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q18 Diversity

75%! Be strong!

	Strongly disagree (1)	Disagree (2)	Neutral (3)	Agree (4)	Strongly agree (5)
People come from different educational backgrounds (1)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
People come from different countries (2)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
People are used to work in a variegated environment (3)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The organization welcomes diversity (4)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q19 Innovation Perception

	Strongly disagree (1)	Disagree (2)	Neutral (3)	Agree (4)	Strongly agree (5)
Here I am pushed to be innovative (1)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Innovation is considered a priority in the organization (2)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Generally, the organization is perceived to be innovative (3)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

	Strongly disagree (1)	Disagree (2)	Neutral (3)	Agree (4)	Strongly agree (5)
I look for opportunity to innovate (1)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I generate solutions and ideas (2)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I experiment with ideas and solutions (3)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I encourage the creation of ideas and solutions (4)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

We are almost done. Let me just ask you these last two questions.

Q21 We are almost done! Let me just ask you these last two questions.

How many products/services have you personally contributed to develop? Give an approximative number

Q22 How many ideas have you personally contributed to develop? Give an approximative number

Appendix 2 – Detailed descriptive statistics

Gender				
	Percentiles	Smallest		
1%	0	0		
5%	0	0		
10%	0	0	Obs	81
25%	0	0	Sum of Wgt.	81
50%	0		Mean	.4567901
		Largest	Std. Dev.	.501233
75%	1	1		
90%	1	1	Variance	.2512346
95%	1	1	Skewness	.1734886
99%	1	1	Kurtosis	1.030098
Age				
	Percentiles	Smallest		
1%	1	1		
5%	1	1		
10%	1	1	Obs	81
25%	1	1	Sum of Wgt.	81
50%	2		Mean	2.271605
		Largest	Std. Dev.	1.405457
75%	3	5		
90%	4	5	Variance	1.975309
95%	5	6	Skewness	.9496858
99%	6	6	Kurtosis	2.873505
Tenure				
	Percentiles	Smallest		
1%	0	0		
5%	0	0		
10%	0	0	Obs	81
25%	0	0	Sum of Wgt.	81
50%	.6931472		Mean	1.056746
		Largest	Std. Dev.	1.135102
75%	1.609438	2.995732		
90%	2.995732	2.995732	Variance	1.288457
95%	2.995732	2.995732	Skewness	.6448094
99%	2.995732	2.995732	Kurtosis	1.987688

dim_challenge

Percentiles		Smallest		
1%	.4	.4		
5%	.4	.4		
10%	.4	.4	Obs	81
25%	.45	.4	Sum of Wgt.	81
50%	.55		Mean	.5783951
		Largest	Std. Dev.	.1728327
75%	.65	1		
90%	.85	1	Variance	.0298711
95%	1	1	Skewness	1.150733
99%	1	1	Kurtosis	3.435769

dim_freedom

Percentiles		Smallest		
1%	.2666667	.2666667		
5%	.4	.3333333		
10%	.4	.3333333	Obs	81
25%	.4	.4	Sum of Wgt.	81
50%	.4666667		Mean	.5407408
		Largest	Std. Dev.	.1719173
75%	.6	1		
90%	.8	1	Variance	.0295556
95%	1	1	Skewness	1.337501
99%	1	1	Kurtosis	4.161018

dim_trust

Percentiles		Smallest		
1%	.2	.2		
5%	.2666667	.2		
10%	.3333333	.2	Obs	81
25%	.4	.2	Sum of Wgt.	81
50%	.4666667		Mean	.544856
		Largest	Std. Dev.	.2048821
75%	.6	1		
90%	.8666667	1	Variance	.0419767
95%	1	1	Skewness	.850112
99%	1	1	Kurtosis	3.154606

dim_idea_time

Percentiles		Smallest		
1%	.2	.2		
5%	.25	.2		
10%	.4	.2	Obs	81
25%	.4	.25	Sum of Wgt.	81
50%	.45		Mean	.4888889
		Largest	Std. Dev.	.1412002
75%	.55	.85		
90%	.65	.85	Variance	.0199375
95%	.85	.85	Skewness	.861308
99%	.9	.9	Kurtosis	4.563295

dim_play

	Percentiles	Smallest		
1%	.4	.4		
5%	.4	.4		
10%	.4	.4	Obs	81
25%	.45	.4	Sum of Wgt.	81
50%	.5		Mean	.5759259
		Largest	Std. Dev.	.1982913
75%	.6	1		
90%	1	1	Variance	.0393194
95%	1	1	Skewness	1.227966
99%	1	1	Kurtosis	3.102135

dim_conflict

	Percentiles	Smallest		
1%	.2	.2		
5%	.2	.2		
10%	.25	.2	Obs	81
25%	.4	.2	Sum of Wgt.	81
50%	.45		Mean	.4296296
		Largest	Std. Dev.	.133177
75%	.5	.65		
90%	.6	.7	Variance	.0177361
95%	.65	.85	Skewness	.4633796
99%	.85	.85	Kurtosis	4.22654

dim_idea_support

	Percentiles	Smallest		
1%	.2	.2		
5%	.4	.3		
10%	.4	.3	Obs	81
25%	.4	.4	Sum of Wgt.	81
50%	.5		Mean	.5253086
		Largest	Std. Dev.	.1630037
75%	.55	1		
90%	.7	1	Variance	.0265702
95%	1	1	Skewness	1.51137
99%	1	1	Kurtosis	5.408786

dim_debates

	Percentiles	Smallest		
1%	.2	.2		
5%	.4	.4		
10%	.4	.4	Obs	81
25%	.4	.4	Sum of Wgt.	81
50%	.4666667		Mean	.5465021
		Largest	Std. Dev.	.1860167
75%	.6	1		
90%	.8	1	Variance	.0346022
95%	1	1	Skewness	1.327232
99%	1	1	Kurtosis	4.044241

dim_risk				
	Percentiles	Smallest		
1%	.2	.2		
5%	.4	.4		
10%	.4	.4	Obs	81
25%	.45	.4	Sum of Wgt.	81
50%	.5		Mean	.517284
		Largest	Std. Dev.	.1325614
75%	.55	.9		
90%	.65	1	Variance	.0175725
95%	.7	1	Skewness	1.971846
99%	1	1	Kurtosis	8.285353
dim_management				
	Percentiles	Smallest		
1%	.2	.2		
5%	.4	.35		
10%	.4	.4	Obs	81
25%	.45	.4	Sum of Wgt.	81
50%	.55		Mean	.5827161
		Largest	Std. Dev.	.1914028
75%	.7	1		
90%	.85	1	Variance	.036635
95%	1	1	Skewness	.7433058
99%	1	1	Kurtosis	2.520885
dim_diversity				
	Percentiles	Smallest		
1%	.3	.3		
5%	.4	.35		
10%	.4	.35	Obs	81
25%	.45	.35	Sum of Wgt.	81
50%	.5		Mean	.5802469
		Largest	Std. Dev.	.1923017
75%	.7	1		
90%	.85	1	Variance	.0369799
95%	1	1	Skewness	.8585998
99%	1	1	Kurtosis	2.704679
dim_innov_percep				
	Percentiles	Smallest		
1%	.2	.2		
5%	.2666667	.2		
10%	.4	.2	Obs	81
25%	.4	.2	Sum of Wgt.	81
50%	.5333334		Mean	.5580247
		Largest	Std. Dev.	.2135531
75%	.6	1		
90%	1	1	Variance	.0456049
95%	1	1	Skewness	.8203465
99%	1	1	Kurtosis	3.030909

immigrant					
	Percentiles	Smallest			
1%	0	0			
5%	0	0			
10%	0	0	Obs		81
25%	0	0	Sum of Wgt.		81
50%	0		Mean		.2716049
		Largest	Std. Dev.		.4475585
75%	1	1			
90%	1	1	Variance		.2003086
95%	1	1	Skewness		1.026986
99%	1	1	Kurtosis		2.0547
Number_Products					
	Percentiles	Smallest			
1%	0	0			
5%	0	0			
10%	0	0	Obs		76
25%	1.25	0	Sum of Wgt.		76
50%	3		Mean		10.24342
		Largest	Std. Dev.		25.60319
75%	5	99			
90%	15	100	Variance		655.5233
95%	99	100	Skewness		3.925834
99%	150	150	Kurtosis		18.11683
Number_Ideas					
	Percentiles	Smallest			
1%	0	0			
5%	0	0			
10%	0	0	Obs		79
25%	2	0	Sum of Wgt.		79
50%	4		Mean		145.5506
		Largest	Std. Dev.		1124.645
75%	10	100			
90%	50	200	Variance		1264826
95%	100	500	Skewness		8.678673
99%	10000	10000	Kurtosis		76.54345
business_line					
	Percentiles	Smallest			
1%	0	0			
5%	0	0			
10%	0	0	Obs		81
25%	0	0	Sum of Wgt.		81
50%	1		Mean		.6049383
		Largest	Std. Dev.		.4919099
75%	1	1			
90%	1	1	Variance		.2419753
95%	1	1	Skewness		-.4293148
99%	1	1	Kurtosis		1.184311

dim_innov_behav

Percentiles		Smallest		
1%	.3	.3		
5%	.4	.4		
10%	.4	.4	Obs	81
25%	.45	.4	Sum of Wgt.	81
50%	.55		Mean	.6123457
		Largest	Std. Dev.	.2265958
75%	.7	1		
90%	1	1	Variance	.0513457
95%	1	1	Skewness	.8142711
99%	1	1	Kurtosis	2.149218

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1. Introduction

The aim of the research is to define which type of statistical relationship exist between the independent variables of creative climate and the dependent variable of innovation output on the individual level, and therefore defined as individual innovation behaviors. The study is assessed through a survey, whose aim is to measure how companies manage creative climate within their organizations and which type con effects this has on the individuals' innovation behaviors. Both innovation behaviors and creative climate dimensions are defined through the literature review of academic papers about the topics.

The reason behind the choice of the topic of the paper is due to the relevance of innovation in the current market landscape, where companies are required to be innovative and to always keep improving their products/services and business models if they want to be able to compete in the globalized, interconnect and digitalized business world that is in constant transformation. In this landscape of continuous challenges, successful companies are the ones that embrace the innovation process, accepting the risks and the possible failures that inevitably come with the process of trial and error that is at the core of a sustainable innovation strategy. A common belief in the innovation management theory is the concept of failing fast, failing cheap and failing smart. However, considering that individuals are the core fundament of an organization, and that a company's failure has direct and indirect repercussions on its human capital, it if a must for managers and organizations to learn how to strategically manage innovation processes, aiming to avoid or diminish failure as much as possible and to preserve not only managers' wellbeing but also employees'.

The topic of innovation has been largely discussed in the literature and it has been given different definitions. A common theme among the definitions is the idea that innovation concerns the implementation or the adoption of something new, such as an idea, a product, a service or a process. Organizations can be forced to cope with internal and external changes in the environment, hence innovation can be explained as the generation, acceptance and implementation of new ideas in the organization.

Innovation is the result of many choices and decisions made from the lower to the highest level of an organization. Hence, there are many components that influence the innovation output of a company. In this research, the factor that will be taken into consideration is the creative

climate, which will be deeply analysed and explained further firstly in the literature review and then in the survey and its analysis.

The reason why the author of this paper finds this specific factor interesting and chooses it among the other possible variables is the transversal importance that creativity has in all organizations. In fact, it is a fundamental element not only in departments such as marketing or in organizations that operate in environments that are considered creative based such as advertising.

Given the objective of this research, the following research question has been formulated:

Is there a statistical significant relationship between the dimensions of creative climate and the individual innovation output at the workplace?

To answer the stated research question, a quantitative research will be conducted by analysing a panel of employees working at different companies.

2. Literature review

Defining innovation

The initial step to come up with an appropriate definition of the term “innovation” is taking the one given by the Cambridge dictionary. It seems easy at first: innovation means using a new idea or a new method. As Goffin, K., & Mitchell, R. (2017) try to give the same definition, it is possible to see how this concept alone is not sufficiently clear and it does not provide a fully satisfactory definition. Hence, it is necessary to dig further into the topic to reach an improved and more comprehensive definition of innovation.

In the past century, the well famous economist Joseph Schumpeter in its “The Theory of Economic Development “(1934) acknowledged the importance of innovation, defines five components that are part of it and identifies innovation as more than simply a new idea or method. The five components are:

1. The goods introduced are new for the consumer or there is an improvement of the quality of the good compared to the quality previously available;
2. The method of production is new in a particular industry, which does not necessarily mean that it is a new scientific discovery, since the method can already be used in other sectors;
3. There is an opening of new markets;
4. New sources of supplies are used;

5. There are new forms of competition that cause a big change in the industry in which the innovation is happening.

For Schumpeter the concept of novelty characterizes the idea of innovation, but Everett Rogers (2002), in his paper on innovation diffusion model specifies that an idea, a process or a good can also just be perceived as new by the adopters, hence he introduces also the concept of perception in defining innovation. Damanpour, F. (1996) gives a thoroughly and comprehensive definition of innovation that states that *“innovation is conceived as a means of changing an organization, either as a response to changes in the external environment or as a pre-emptive action to influence the environment. Hence, innovation is here broadly defined to encompass a range of types, including new product or service, new process technology, new organization structure or administrative systems, or new plans or program pertaining to organization members.”*

Five elements that can push a need for innovation: technological advances, changing in customers and needs, competition, changing business environments and strategic intent.

Moreover, there are five different areas in which companies can potentially innovate: product innovation, process innovation, service innovation, business process innovation and business model innovation

Defining the creative climate

Trying to give a definition of creativity is not trivial. Many authors give similar definitions of creativity and often they are not too distinguishable from the concept of innovation. It is possible to define creativity as the process of generating new and original ideas in the organization and innovation as the process that implements those creative ideas into a valuable output. Therefore, it is possible to see creativity as a necessary condition for innovation.

Amabile modeled the Componential Theory of Organizational Creativity and Innovation. She suggests that it is possible to have a real exploitation of creativity the moment in which employees' individual skills such as expertise and creative-thinking are in harmony with their intrinsic motivations and passion, and that innovation will follow from the boosting in creativity. In this theory, managers should not leave creativity only to the departments that traditionally work with creativity. The base of the model is that each employee is considered to be gifted with a certain creative capability and that work environment can impact the creative behaviors of its workers.

The model is divided in two parts: the first is made by three components of individual and team creativity of employees who works in organizations: expertise, creative-thinking and

motivation. The first component, expertise, refers to employees' skills, knowledge and background. Creative-thinking is referred to the set of skills and flexibility used by employees in problem solving. Motivation can be seen as intrinsic motivation, which is the one that happens when employees operate essentially to achieve their personal satisfaction and to fulfil their own passion and interest, and extrinsic motivation, which consists in money incentives and rewards. The first is considered to be the one that makes the higher difference in terms of individuals' creativity. The second part of the model is also composed by three elements which are referred to the work environment: resources, management practices and organizational motivation. The first, the resources consist of all the knowledge and human capital and all the assets that the organization uses in the innovation process. The second element is the management practices, which should allow individuals to be autonomous and to be under supervision of a supporting, encouraging, clear in describing and setting goals management. Lastly, the third component is the organizational motivation, which are the goals and the mission set by the highest levels of the organization management.

Literature around the concept of creative climate shows that so far there is not a single definition of what the creative climate is, and authors give different descriptions of the concept. Ekvall (1999) describes the creative climate as a metaphor that is used to describe the combination of the single individual working in the organization, the routines and the processes set by the organization and the interactions and reactions of individuals with the other co-workers and the system of the organization. Ekvall goes further in the analysis by specifying that on one side there is the organizational culture, which is the sum of the belief system, values and goals of the organization; on the other side there is the creative climate, made by the employees, which are influenced by the organizational culture because they are affected by the norms and the values that the company stands for.

At the employee level, the creative climate is defined as the cognitive interpretation of an organization, hence the psychological perception and the cognitive representation that employees have of the work environment, rather than the environment per se. This is important because, as Scott and Bruce (1994) mention in their study, the cognitive information collected by employees looking at the work environment is analysed and processed as company's expectations on their working behaviour. Hence, people respond to these expectations by trying to regulate their behaviour to match those expectations.

Individual's creativity can be considered as a function of personal characteristics, the characteristics of the work environment and context and the interactions among these factors. The match between personal and contextual characteristics results in higher levels of

employees' creativity. In other words, when individuals' personal characteristics "fit" with the characteristics of the environment surrounding them, the final outcome is a higher employee's creativity.

Assessing creative climate

The author of this paper had the need to define a survey to assess the creative climate; in doing that she is inspired by the two methods which are developed through a framework and are often used to measure creative climate.

The Situational Outlook Questionnaire (SOQ) is a framework developed by Isaksen, Laurer and Ekvall in 1999 to evaluate the organizational climate for creativity and change. It is based on a previous framework ideated from Ekvall in 1996 similarly used to assess the climate for creativity, which is called Creative Climate Questionnaire.

This tool is composed by 50 factors, that show nine different dimensions that describe and measure how a certain type of climate influence creativity and change, at individual, team and organizational level. The nine dimensions are:

- Challenge/Involvement, which measures the level emotional commitment and motivation in completing the operations and goals;
- Freedom, which measures the level of autonomy that individuals have to take the initiative and make decisions on their own work;
- Trust/Openness, which measures the level of trust that individuals have with other people in the organizations and the emotional safety found in the relationships built in the work environment;
- Idea Time, which is the amount of time that is available to individuals to develop new ideas;
- Playfulness/Humor, which measures the level of openness towards spontaneity, laughter and good-natured joking in the work environment;
- Conflict, which measures the presence of conflicts and tensions within the workplace,
- Idea Support, which measures if the work environment is open to new ideas and suggestions, if they are attended to and treated respectfully;
- Debate, which measures the degree to which it is possible to individuals to express and to share different point of views and different ideas;
- Risk-taking, which measures the tolerance of ambiguity and uncertainty

The second tool used to assess creative climate is the KEYS framework, developed by the authors Amabile, Conti, Coon, Lazenby and Herron (1996). It identifies 10 dimensions used to

asses creativity and based on a review of previous literature around elements that influence. The dimensions can be divided into three scales:

Stimulant scales

These scales try to capture the encouragement of creativity, the level of individual autonomy, and the resources. The dimensions for these scales are:

- Organizational encouragement, which measures if the organization's culture encourages creativity;
- Supervisory encouragement, which measures if supervisors support individual and workgroup works and if they set reachable goals;
- Workgroup supports, which measures if the workgroups are diverse, open to communication, constructively challenging and committed to the job;
- Sufficient resources, which measures if individuals perceive the resources (described as materials, funds, information and facilities) invested in their work as appropriate as easy to reach;
- Challenging work, which measures if the important tasks are considered challenging and hard to accomplish;
- Freedom, which measures the autonomy in deciding what job and how to do it.

Obstacles scales

These scales identify dimensions that influence negatively the level of creativity. The dimensions are two:

- Workload pressure, which measures the level of pressure given from the workload that individuals feel in accomplish their tasks and jobs and the level of pressure given from time pressure;
- Organizational impediments to creativity, which measures aspects of the organization culture that work against individual creativity, through internal political problems

Criterion scales

The last scales provide the overall perception of individual working for the company in the terms of the following two dimensions:

- Creativity, which measures if the area in which the individual work is perceived as creative and if creativity is a priority people's goals;
- Productivity, which measures if individuals consider their unit and organization productive, efficient and effective.

Each dimension has a number of items that varies from a minimum of 4 to a maximum of 15 items.

Defining Innovation Output

In the previous paragraphs it was reached the conclusion that giving a definition of the concept of innovation is a complicated and nuanced task. Nonetheless, trying to define and measure the innovation output is an equally challenging job. Cambridge dictionary defines the word “output” as “an amount that a person, machine, or organization produces”. When talking about output produced by the innovation process, it is necessary to define what is considered to be part of the amount and how it is intended to measure it. Moreover, when talking about organisations, it is important to distinguish between the organisational level and the individual level: the first gives a measurement of the innovation performance of the company, and the latter measures the innovation behaviour of individual employees in the work place, which is the level of the discussion that this thesis wants to focus on, and will be further explore in the next paragraphs.

Innovation output on the organizational level

In the literature, the most common proxy used by researchers to measure the innovation output on the organization level is the number of patents.

Patenting is a common IP practice that gives to the owner the legal right to prohibit others from producing, using, selling and importing an invention for a limited period of years in return for the publication and public disclosure of the invention. In most cases, patent rights come under common law and the patent holder may sue anyone who infringes the patent in order to uphold the statute. In engineer-based companies, patenting is a fundamental practice, largely used to create and protect competitive advantages, hence it can be used to define the innovation output of a company. However, it is worth mentioning that this choice of measurement is lacking to consider other elements that can describe the innovation output and that not all industries need IP to create and defend competitive advantages, hence other ways of measuring innovation output should be explored.

Innovation output on the individual level

Identifying individual innovation is a task just as complex as identifying the innovation output on the organisational level. When discussing in general terms the definitions of innovation and creativity, there are already some complications in identifying and distinguishing the one from the other, since the two terms are often used as synonyms. In the previous chapters we established the difference between the two: in simple words, creativity concerns the generation

of new ideas, while innovation concerns the process of their implementation. The number of patents cannot be used on the individual level, since it is a number that is the results of the collective efforts of all the levels of a company. Scott and Bruce (1994) suggest that innovation on the individual level starts with a person that recognize a problem and generate ideas or solutions to solve it. These ideas can be both new or adopted. Next, the person tries to find a sponsorship and sponsors to support his/her idea and tries to prototype his/her idea. This multistage process of innovation is characterized by discontinuous activities, rather than a step-by-step process, hence innovation of the individual level can be seen as a individual innovation behaviour, rather than a process or an exact number as the number of patents.

Individual innovation behaviour differs from the team or organization level, since it is based on the individual capabilities and motivations of employees, which positively influences individual effectiveness and can result and boost the general level of creativity and effectiveness of the organization itself (Wu, Parker & de Jong, 2014). Moreover, it is possible to consider individual innovation behavior as a proactive work behavior: in fact, individual innovation requires actions set in place by individuals themselves who want to initiate some kind of change.

Assessing the innovation behaviour

The researcher of this paper had the need to construct a section of the survey which could assess innovation behaviour; in doing that she is inspired by the following method which developed through a five dimensions model, and that has the quality of including multiple elements that explain innovation behaviour. Therefore, the questions of the survey are based on Kleysen & Street 2001's paper that had the intention of summarizing the main measures used to assess innovation behaviour in one multi-dimensional assessment model.

The authors identify five dimensions, which are used to group together similar behaviours:

- Opportunity exploration, which are those behaviours concerning looking at the current situation and identifying problems that could be solved.
- Generativity, which are the behaviours directed at generating a positive transformation that has the final goal of improving and growing the company, the workers, the products/services/ and the processes.
- Formative investigation, which are the behaviours that give form to the ideas and solutions, that prototype them and that try them out.

- Championing, which are those socio-political behaviours, whose aim is to look out for material and immaterial resources, which have the final goal of realizing the ideas generated.
- Application, which are the behaviours regarding the implementation of ideas and solutions, with the goal of making them a regular part of the business.

3. Methodology

Research strategy

Aiming to find the research strategy and design that better suits the research question of this study, the quantitative methodology has been chosen, based on Bryman & Bell, 2011. Firstly, this study has implemented a deductive analysis approach to reach a generalizable understanding of the relationship between creative climate and innovation output on the individual level. The deductive methodology is consistent with a quantitative methodology which helps writer of this research to evaluate a structure that is consistent with the empirical construct that the researcher plans to evaluate (Creswell, 2009).

A quantitative approach satisfies the need of the author of dealing with a vast amount of data, which can be analysed and used to generalize the chosen population. The quantitative study offers also results that can be replicable and implemented and further developed by future studies. Moreover, on deciding which approach using in answering the question of the thesis, the researcher wanted to avoid the risk of any confirmation biases from the respondents, which could lead in a positive but biased results in studying which type of relationship runs between the creative climate and the innovation output on the individual level.

Research design

Aiming to select the best approach to conduct the collection and the analysis of the empirical findings, the researcher has decided upon the cross-sectional design, which is a method used to define the relationship between two or more variables, whose data have been collected on a given occasion through a measurable questionnaire (Bryman and Bell, 2011). This method meets the researcher's necessity of selecting an approach that can meet three basic requirements. Firstly, the design selected has to allow for variation, in order to measure patterns and potential relationship between variables, which means that the design requires the assessment of more than one case. This is possible through the application of a survey, which also allows to meet the next basic requirement: the necessity of narrowing the focus of the study on a single point in time. This need is due to the short time frame and resources given to

the development of this Master's thesis. Lastly, the cross-sectional design allows to simplify the analysis of the empirical findings, by providing a standardized design (Bryman and Bell, 2011).

Research method

The research method discusses the approach used in the study to collect the empirical data. To gather the necessary data for the research, the information has been collected both from primary and secondary sources.

The tool selected to collect the primary data is an online questionnaire (see Appendix 1). By using a survey, the author of the paper is able to collect vast volume of data. Surveys are the most common way of gathering quantitative data because they are inexpensive, confidential and simple to use (Creswell, 2009). By selecting a survey with solely closed questions, the respondents are forced to directly answering to the question asked (Bryman and Bell, 2011). In practical terms, the survey was distributed in an online form through the LinkedIn platform. The web-based choice allows for respondents to reply when they have available time to spend focusing on the questionnaire, whilst a pitfall of the online feature of the survey is a significant level of unfinished questionnaires.

First of all, the tool selected to create the survey is called *Qualtrics*, which is an online survey creator platform.

Moving to the general outline of the survey, the questionnaire is divided in the 16 sections/blocks. The first block that appears to the respondent is a message from the researcher of this study, in which she is introducing herself and the aim of the survey. Following, the next section's goal is to gather general demographic information about the respondent. From the third to the fifteenth block all the questions are articulated in Likert scale questions. In each one the respondents have to give their level of accordance with the statement of the question, and can choose between five alternatives: "*Strongly disagree*", "*Disagree*", "*Neutral*", "*Agree*", "*Strongly agree*". The choice of a Likert scale is due not only to the standardize answers that this method provides, which suit with the aim of this study.

Secondary data are collected through a literature review and it is the base on which the research is conducted on, since it is the original source of the theory. Academic journals, books, report and case studies have been collected through the LUISS and the University of Gothenburg library's portals and through the material suggested by professors and supervisors. The research on the library portals has been done through a selection of appropriate keywords such

as: *innovation, innovation output, innovation performance, creativity, creative climate, innovation measurements, individual behaviour, individual innovation, individual creativity.*

Measure of concepts

The questions of the survey chosen to conduct this study is based on the systematic review of the existing literature about the concepts of creative climate and innovation, and the combination of different measurement tools used to define these topics.

The first section asks questions about the respondent himself. In the regression study these initial questions are reported as control variables. These variables are the following and has been measured in the following way:

- Gender: a dummy variable was created and the number 0 for men or 1 for women has been assign based on the gender of the respondent,
- Age: the age was divided in ranges 18 to 24, 25 to 34, 35 to 44, 45 to 54, 54 to 64 and 65+. Aiming to study the age variable in the regression, a number from 1 to 6 was assigned to each age range, from 1 being the youngest range, to 6 being the oldest one.
- Tenure: the tenure measures the number of years the employee has been working for the current company. The ranges were for: less than 1 year, less than 2 years, less than 3 years, less than 5 years, less than 10 years and more than 10 years. Assuming a nonlinear relationship of the responded, the tenure variable has been computed as the natural logarithm of each range in the following manner:
 - o Less than 1 year = $\ln(1)$
 - o Less than 2 years = $\ln(2)$
 - o Less than 3 years = $\ln(3)$
 - o Less than 5 years = $\ln(5)$
 - o Less than 10 years = $\ln(10)$
 - o More than 10 years = $\ln(20)$

To exemplify it, if the respondent answered that he has been work for less than 1 year, the response has been recorded in the data set as the $\ln(1)$.

- Immigrant: the immigrant variable is a dummy variable. In the questionnaire there are one question about the country the respondent currently works and one question about the country the respondent is from. If the respondent works in the country he is from, in the data set it was given the number of 0, since he is not considered an immigrant. If the country he works in and the country he comes form do not match, the respondent is considered an immigrant, and the number of 1 is given to him.

- Business line: the respondent is asked the optional question of which company he works for and the mandatory question of the business line he works in. If the business line is considered innovative and creative, the response is registered in the data set with the value of 1, otherwise the number of 0. For example, the number 1 was given to someone with a position in marketing or product development, while the number 0 was given to someone with a position in accounting.

The variable of creative climate is assessed by the sections from the third to the fifteenth, which are based on the SOQ framework and the KEY framework (see respectively 2.2.4.1 and 2.2.4.2 in chapter 2). The results of the researcher's elaboration are 12 sections articulated in 3 or 4 Likert questions each. The sections identify 12 dimensions of the individual creative climate: challenge/involvement, freedom, trust, idea time, play/humour, conflicts, idea support, debates, risk taking, management support, diversity and innovation perception.

The variable of innovation output is assessed in two ways. In the sixteenth section, innovation behaviour is measured by Likert questions based on Kleysen & Street method (see 2.3.2.1 in chapter 2). In the last section the innovation output is assessed by asking to the respondents an approximating number of ideas, and products/services that the individual contributed to generate.

The choice of the Likert scale allows to collect ordinal results, which allow the creation of overall scores of creative climate and innovation behaviour per individual. Each dimension's score is computed as the sum of the answers given for each item in the dimension, divided by the sum of the maximum that was possible to answer to each item. For example, imagine that in the section about the dimension of Debates an imaginary respondent answered in the following way:

	Strongly disagree (1)	Disagree (2)	Neutral (3)	Agree (4)	Strongly agree (5)
A wide variety of viewpoints are expressed (1)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>
People often discuss different points of view (2)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>
A diversity of perspectives is <u>allowed</u> (3)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>

Example of responses of the survey form the section of the dimension of Debates

The respondent has answered strongly agree to the first statement, agree to the second and to the third. The overall score for the dimension of debated for this respondent it is calculated as $(5+4+4)/(5+5+5)=0,8667$

The following table shows a summary of the variables and the number of items.

Control Variables		N° Items
Gender		1
Age		1
Tenure		1
Business Line		2
Immigrant		2
Dimensions Creative climate		N° Items
Challenge/Involvement		4
Freedom		3
Trust		3
Idea Time		4
Play/Humour		4
Conflict		4
Idea Support		4
Debate		3
Risk Taking		4
Management Support		4
Diversity		4
Innovation Perception		3
Dimension of Innovation Output		N° Items
Innovation Behaviour		4

Summary of variables and number of items per variable

Data analysis

The design of the research establishes a set of criteria that has influenced the choice of the regression model picked for this study. The selected model is the fractional logit model. The model was firstly introduced in 1996 by Leslie E. Papke and Jeffrey M. Wooldridge. The reason behind this choice is that this model can be used to run a fractional regression that has all the values of the dependent variable in a range between 0 and 1.

4. Empirical findings and data analysis

Descriptive statistics

Through the survey 81 responses have been collected.

The first block of the survey was used to investigate the composition of the sample.

The questionnaire was submitted by a sample of respondents largely distributed in the group between 18 and 24 (39% of respondents). In addition, the distribution between female and male is almost even, with respectively 47% and 53%. When asked how many years the respondent has been working for the current company, the majority of the sample has answered that has been working in the current company for less than 5 years, which might be due to the young age of the respondents. Moreover, the results for the variable of business line, which indicates if the respondents work in an innovative and creative position, shows that the 60,5% of the sample of respondents works within an innovative business line.

Lastly, the 87,7% of the sample works in the country he is form. Therefore, he/she has not been labelled as immigrant.

Reliability

To test the reliability of the model, the Cronbach's alpha was used and it was found that the dimensions are all entirely acceptable, since each alpha results all in the range between 0,8 and 0,9.

Regression analysis

Firstly, the regression with all the 17 variables of gender, age, tenure, challenge, freedom, trust, time, conflict, support, debates, risk taking, management support, diversity, innovation perception, immigrant, business line and play/humour. The independent variables are divided in 5 control variables, gender, age, tenure, business line and immigrant, and the 12 dimensions of creative climate. The independent variable is the innovation behaviour. The regression is

conducted to determine whether the dimensions of creative climate and the control variables are correlated with the dependent variable of innovation behaviour, at maximum the 10% of significance level.

The parameters of good fit of the model of log pseudolikelihood, Wald chi squared, the p value= 0 indicate that the current model exhibits significant improvements in fit over a no model, while the pseudo R2 is low but it is coherent with the nature of the research, which is in the socio economical field. Hence, R2 is on the lower spectrum because there are many other variables that influence positively or negatively innovation behaviors that could not be taken into consideration in this study, because of the limited resources and time available to the writer. With all this in mind, we can look at each dimension's p-value. Overall among the 17 variables, only 7 resulted to have a significant relationship with the dependent variable. This can depend to the levels of correlation between the independent variables showed in the correlation matrix. Therefore, the researcher had proceeded with the modification of the variables to see if it was possible to improve the regression model. The results are presented in the table below with the p-values.

Control Variables	p-value	Significance
Age	0,000***	yes
Business Line	0,144	no
Immigrant	0,047**	yes
Challenge/Involvement	0,001***	yes
Freedom	0,001***	yes
Trust	0,164	no
Conflict	0,098*	yes
Idea Support	0,046**	yes
Debate	0,098*	yes
Risk Taking	0,052*	yes
Management Support	0,022**	yes
Diversity	0,110	no
Innovation Perception	0,083*	yes

* $p < .10$, ** $p < .05$, *** $p < .01$

Overall, the model improved, and the variables that show significant relationship with innovation behavior are 10 out of 13.

The dimensions of creative climate that have been confirmed having the significant relationship with innovation behavior are challenge involvement, freedom, conflict, idea support, debate, risk taking, management support and innovation perception. The ones that did not show a significant relationship are the dimension of trust and diversity, while the two omitted from the original fractional regression with 17 variables are play/humor and idea time.

The control variables that have been omitted from the previous 17 variables model are gender and tenure, while in the 13 variables model, age, business line and immigrant have been included. Out of these three, age and immigrant confirmed to have a significant relationship with innovation behavior.

Discussion of the results of the creative climate dimensions

Challenge /Involvement: The variable of challenge/involvement has been introduced in this paper such as the measure of the level emotional commitment and motivation in completing the operations and goals. The research had demonstrated the significant relationship of this variable ($p < 0,001$) with the dependent variable of innovation behavior. Nonetheless, if the theory illustrated in the chapter 2 of this thesis, seems to suggest a positive relationship between the two variables, the results obtain from this study seems to suggest a negative relationship. Therefore, the marginal effect indicates that an individual that at the workplace experience a challenging environment might exhibit less innovative behaviors. Specifically, the table 14, suggests that the increase of 1% in challenge will make the innovation behavior of the individual decrease by 28%.

Freedom: The dimension of freedom has been defined as the measure of the level of autonomy that individuals have to take the initiative and make decisions on their own work. The study had found the significant relationship of this variable ($p < 0,001$) with the individual innovation behavior. The results seem to confirm the theoretical literature, hence there is a positive relationship between the two variables, and from table 4 it is possible to see that when there is an increase of 1% in the level of freedom, it can be expected a consequential increase of the individual innovation behavior of 28%. Therefore, when an individual is freer and can act more autonomously, his innovation behavior can be expected to increase as well.

Conflict: The variable of conflict has been described as the measure of the presence of conflicts and tensions within the workplace. The study shows that there is significant relationship with the dependent variable ($p < 0,1$), although it is weak. This result seems to go on the opposite direction compared to the concepts given in the literature review in chapter 2, since conflict and creative climate are expected to be negatively correlated, meaning that the lower the conflict the higher the creative climate. Nonetheless, in this research the marginal effect of an increase of 1% of the conflict variable seems to cause an increase equal to 11% in the innovation behavior of individuals. This could suggest that an environment with tensions and conflict among coworkers could result in an increase of individual innovative behaviors, due to the competition between the two conflictual sides.

Idea Support: Idea Support has been defined as the level of openness to new ideas and suggestions, within the work environment. The study had found that there is significant relationship ($p < 0,05$) with individual innovation behavior. The marginal effect shows a negative relationship between the two variables: an increase by 1% in idea support is expected to generate a decrease in the individual innovation behavior by 17%. This suggests that a work environment that welcomes and support ideas, on the individual level can determine a decrease in the innovative behavior. This element should be further explored in future research. The researcher of this paper suggests that this could be due to the lack in incentives in competing with coworkers. This suggestion comes from the results shown in the previous paragraph.

Debate: The dimension of debate measures the degree to which it is possible to individuals to express and to share different point of views and different ideas. The research shows that there is significant relationship with the dependent variable ($p < 0,1$). This suggests that an environment open to debates and confrontation is positively related to the presence of individual innovation behaviors. More specifically, for an increase of 1% in the debate variable, it is expected an increase of 12% in the innovation behaviors.

Risk Taking: The variable of risk-taking measures the tolerance of ambiguity and uncertainty at the workplace. The study had shown the significant relationship of this variable ($p < 0,1$) with the individual innovation behavior. An increase of 1% in risk taking is expecting to match with an increase of 19% in the individual innovation behavior. Therefore, an environment that is more open to an uncertain result, pushes the individual to be perform more innovative behaviors. The result seems to agree with the literature that stated that in a more risk-taking

environment creativity and innovation are incentivized on the individual level. Moreover, this result seems to follow the previous considerations made for the variable of conflict and, debate and idea support. In the eyes of the researcher, these results seem to suggest that a more unstable and individually challenging work environment favors individuals' innovative behaviors.

Management Support: The dimension of management support is defined as the level of support to the employees from the higher levels of the management of the company. The study indicates the existence of the significant relationship of this variable ($p < 0,05$) with the dependent variable. An increase by 1 % in the management support corresponds to an increase by 23% in the individual innovation behavior. The results follow the importance of the support from the management in the creative climate and innovation behavior of the employees. Where the management supports and pushes the employees, the single individual performs more innovatively.

Innovation Perception: The variable of innovation perception measures whether the individual perceive the company he/she works for as innovative. The research had shown the significant relationship of this variable ($p < 0,1$) with the individual innovation behavior. When the person perceives the company, he works for as innovative, the individual tends to perform more innovative as well. More precisely, the marginal effect of an increase in innovation perception produces an increase in individual innovation behavior of 11%.

5. Conclusions

Originally, at the principle of the this study the aim of the research was to answer to the following research question: *“Is there a statistically significant relationship between the dimensions of creative climate and the individual innovation output at the workplace?”*.

Firstly, the literature about the two main topic of this research, creative climate and innovation output, has been explored and illustrated. From the review, the dimensions to measure creative climate and individual innovation output were elaborated.

Secondly, a survey has been conducted, aiming to reach a sample of respondents and to collect the data for the research. Following this step, a fractional logistic regression model has been chosen to analyse the collected data.

Lastly, the results from the analysis has been discussed. Briefly, 8 out of the 12 dimensions of creative climate has been confirmed to have a significant relationship with the individual innovation behaviour. These dimensions are challenge/involvement, freedom, conflict, idea support, debate, risk taking, management support and innovation perception.

In the current times, where competitiveness and being fast paced are basic requirements that companies have to meet and pursue, to maintain their position or to gain more value in the market, continuously aiming to be innovative is a key factor to determine the life or the death of the players in the market.

With the aim of increasing the company's competitive advantage with regard to the implementation of an effective innovation strategy, this paper identifies the factors on which the company should focus when aiming to be innovative, starting from paying attention to the creative climate inside the company, and aiming to boost the individual innovative behavior of his employees. These elements should be used as drivers of business strategy.

An interesting insight that has emerged from the analysis is that in the dimensions of creative climate seems to have effects that at first sight can be seen as counterintuitive. The results obtained from the variables of conflict, debate, idea support and risk taking seems to indicate that a more challenging environment is positively related to the innovative behaviours of the individuals. The insight offers the chance for future researcher to investigate which are the other elements and latent variables that can influence higher levels of individual innovation behaviour apart from creative climate dimensions, such as incentives and awards, R&D expenditure.

Finally, there are few considerations to keep in mind when approaching this paper.

Firstly, the reader should keep in mind the limited amount of time and data available for the researcher. Nonetheless, the author has followed a rigorous methodology, in order to make possible this research to be conducted again and improved as needed.

Secondly, the author acknowledges the fact that innovation output is the results of the combination of many variables, and that choosing only one, in this case the creative climate, brings the inner risk to have results that do not fully represent the reality, but again this choice has been made due to the above mentioned limitations and constraints.

Another relevant limitation of the research depends on the sample selected and the characteristics of the respondents: nationality, age and gender, therefore it cannot be said that this result is applicable to all age groups.

Lastly, looking for an empirical method to quantify innovation output, it is likely to come across the concept of intellectual property rights, which are commonly used as the proxy for the estimation of how and how much innovative an organization is. However, as the definition of innovation is considered a complex task, a method for measuring the innovation output is a complex task too, a task that should not be based only on the number of patents, since this number does not include other aspects and components that in the writer's opinion should be included in the valuation. For this reason, focus of this research is on individual innovation output, which can be assessed by innovation behaviours, which can be easily measured by the methodologies offered by the regarding literature.

Key references

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