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DMI – DESIGN MANAGEMENT, INNOVATION AND ENTREPREUNERSHIP

How creative are you?

A framework to assess creative people identity in innovation

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"Belief in your creative capacity lies at the heart of innovation."

David Kelley, Creative Confidence: Unleashing the Creative Potential Within Us All, 2013

Abstract

Nowadays, innovation is an important driver for enterprises as it is able to make companies grow up in order to add value to the market they operate and overcome barriers. Innovation involves creativity as the early stage of this process, including the generation and evaluation of novel ideas. Considering that the resource able to perform innovation is people, it is important to know how people behave in order to find personal characteristics committed to innovation. During the literature review, it was assessed that the issue for organizations is that the research of people able to perform innovation is a difficult task, as it is missing a methodology to help companies to find people with creative characteristics. The problem is not the missing tools, but the no clear comprehension about how to use those tools in order to find people able to manage the factors that impact creativity. Creativity is not an easy measurable aspect, it depends on diverse factors that impact it, like personality traits, cognitive skills, and social psychology. Those factors involve drivers that impact them, making possible the measurement of creativity through tools. Once these drivers are measured, results in the level of creative behaviour of people can be achieved. Nonetheless, it was found that those tools are not clustered in such a way that they can be sought knowing the main factor of creativity they involve in. They are not accurately classified by the drivers they measure, which makes the selection of tools a difficult task to achieve. Regarding this, the main issue for companies is a missing tool to manage easily and clearly the search and assessment of the creative behaviour of people in order to develop innovation accurately.

Therefore, the research of this report aims at assessing a possible solution to this gap for companies, developing a framework able to manage this issue. Throughout the investigation of meaningful factors and their respective drivers that impact creativity, it was carried out the development of a solution aimed at building a framework capable to cluster creativity measurement tools considering those drivers, in order to show a clear way of what those tools measure, in which way, and what is the main creative factor involved in them. In this way, the development of a framework gives an accurate solution in order to point clearly the researches carried, clustering the measurement creativity tools in an organized way to bring a better comprehension about the selection of them. Thus, companies can be able to find creative people identity who can help in the development and improvement of innovation. It should be noted that the built framework was divided into two models where the tools are placed in one regarding cognitive skills, considering as main drivers the convergent thinking and divergent thinking, and in the other one regarding the social environment and individual aspect, as personality traits are indirectly related to the cognitive skills.

Keywords: innovation in an organization, grassroots of innovators, creative personality, creativity, psychology, creativity measurement tools.

Abstract in italiano

L'innovazione è un fattore essenziale nelle aziende perché ne implementa lo sviluppo e allo stesso tempo il valore sul mercato, e in più aiuta a superare le barriere causate dai cambiamenti nella società. L'innovazione è anche collegata alla creatività in quanto quest'ultima è necessaria per generare e valutare le idee delle persone e sviluppare la stessa. In questo sviluppo, le persone sono la principale risorsa, perciò è importante conoscere i loro comportamenti al fine di trovare le caratteristiche personali relazionate all'innovazione. Dopo un'ampia revisione della letteratura, si è potuto evincere che il problema per le aziende è trovare delle persone che hanno queste caratteristiche in quanto non esiste una metodologia che possa raggruppare gli strumenti di misurazione della creatività al fine di valutarne la stessa. Questa mancanza si deve al fatto che ci sono molti fattori coinvolti nella misurazione del comportamento creativo che rendono più difficile la ricerca.

Inoltre, la creatività non è un aspetto facilmente misurabile, dipende da diversi fattori che la influenzano, come la personalità, le capacità cognitive e la psicologia sociale. Questi fattori coinvolgono su drivers che li influenzano, dove quest'ultimi rendono possibile la misurazione della creatività attraverso gli strumenti che possono evidenziare il livello creativo delle persone. Tuttavia, questi strumenti non sono raggruppati ne sono classificati di maniera precisa dai fattori che misurano, perché la selezione degli stessi è un compito difficile da raggiungere.

In questo modo, il problema principale per le aziende è la mancanza dello strumento che gestisce in modo semplice e chiaro la ricerca e la valutazione del comportamento creativo delle persone al fine di svilupparne con precisione l'innovazione.

Dunque, si è rivolto lo sviluppo di una soluzione durante l'indagine dei fattori significativi che incidono sulla creatività presentando la costruzione di un framework in grado di raggruppare quegli strumenti in un modo chiaro. Così, lo sviluppo del framework fornisce una soluzione precisa al fine di indicare chiaramente le ricerche condotte per seguire il problema principale del report:

- considerando i fattori di creatività misurati dagli strumenti
- raggruppando questi strumenti in modo organizzato per ottenere una migliore comprensione su questa selezione.

Il framework costruito è stato diviso in due modelli in cui gli strumenti sono collocati da un lato, per quanto riguarda le capacità cognitive e nell'altro per quanto riguarda l'ambiente sociale e l'aspetto individuale.

Parole chiave: innovazione nelle aziende, innovatori, personalità creativa, creatività, psicologia, strumenti di misurazione della creatività.

INDEX

INDEX OF FIGURES

INDEX OF TABLES

1. Executive summary

Nowadays, companies have the main issue to overcome barriers in order to add value and to lead the market they operate. Innovation is a meaningful process to overcome the barriers to continuous global changes. In order to go ahead with innovation, it should be necessary for companies to have people who can deal with this process (Henderson,2017). The main problem that enterprises have found is that the research of people able to perform innovation is a difficult task, as it is missing a methodology to help companies to find people with these characteristics. The problem is not the missing tools, but the no clear comprehension about how to use those tools in order to find people able to manage the factors of creativity that impact on the innovation process.

Creativity is the main factor to develop the innovation process, as it is part of the early stage of this process in the generation and evaluation of ideas. Amabile (1996) argued that creativity is the seed of innovation, as well as Cropley (2019), argued that creativity is a vital component of solving problems. Creativity is the ability to generate new and effective ideas, while innovation is the process to use them in the best way. For this reason, the effective implementation of innovation inside companies depends on the level of creativity that people are able to perform. In this way, it can be said that creativity is generated by people as they are who can think, reason and carry out ideas to the real world. How is it possible to know if a person is creative or not? It was the first question to start the development of the research, the answer was found throughout the literature review and analysed within the development of the report.

Creativity

Mostly, creativity comes from the genetic composition of people. Studies to analyse this statement were developed to measure the reliability of it, confirming that between 50% and 70% of creativity is regarded with nature creativity. As the percentage is not seen to be 100%, it was considered that other factors influence creativity. Through the research was found that creativity can be taught, and this kind of creativity is called nurtured creativity. In this way, creativity is not something that depends on the personality of people, but also on external factors that can make possible the teaching of creativity, like with acquired knowledge, lived experiences and the surrounded environment where people are related every day (Griggs, 2012).

Therefore, it was seen that creativity can be measured by different factors, and not just through personality skills. But, a second question took place. Which are those other factors that impact creativity? In order to answer this question, research was carried out, focusing on the search for those factors.

One of the most accurate ways to measure creativity is through the behaviour of people. The creative behaviour includes the way in which a person interacts with the environment, how a person thinks, understands and acquires knowledge. A person and context interaction foster creativity when individuals with certain personal characteristics related to creativity assess opportunities provided by contextual factors (Shalley, Zhou, & Oldham, 2004). In order to better understand how the creative behaviour of people performs, it was carried out a study by Plattner et. al. (2015). It was proposed the

completion of changes inside a company, taking off people from their comfort zone and their routines, in order to analyse how they behave through the development of these changes. It was realized the diverse ways of creative behaviour in terms of how people dealt with changes and with the new.

Moving further with the research, it was found that three main factors are the main influential ones in creativity. **Those are the personality traits, cognitive style and social environment** (Csikszentmihalyi, 1997). Consequently, the research started to focus on how factors impact on creative behaviour, in order to know the positive and negative correlation that they could have with creativity.

Factors

First of all, the analysis of the personality traits took place. People with creative behaviour tend to be curious, open-minded, fluent, independent, flexible, original and risk-taking. Creative people are always looking for the new, to solve problems in a unique way. Nonetheless, personality is a complex factor and it is still in the investigation, as it depends on one person, and each person is different than another. For instance, if one person has the same personality skills than another, it does not mean that the level of creativity in each person will be the same because these traits can be managed differently by a person. Moreover, throughout the research, it was seen that creative personality skills can be clustered into five main categories. These categories are presented on The Big Five model and they are openness to experience, conscientiousness, extraversion, agreeableness, and neuroticism.

Then, the cognitive style was analysed. Cognition is the mental action of acquiring knowledge and understanding through thinking and experiences. It is mostly related to the solution of problems and the generation of new and novel ideas. The perspective is on how people express themselves using their own creative capacity. In other words, it is one of the factors that most impact creative behaviour (Mumford, 2012). The cognitive style includes two main drivers, convergent thinking and divergent thinking.

- Divergent thinking: it is referred to the level of flexibility, fluency, and originality within the creative behaviour of people. The process of divergent thinking seeks to see the novelty and new opportunities, seeks to change perspectives, taking risks and producing a large number of ideas which solve a problem in general, and it is the process with which its results are unusual solutions, new ways of dealing with problems, feeling of excitement, and the capability to associate ideas from the remote field.
- Convergent thinking: it is referred to the analytical thinking. It involves critical processes in terms of involving criticism of the results of divergent thinking. Although, it is useful because of the possibility to explore, evaluate or criticize the variability of ideas and identifying its effective factors.

It was seen that those thoughts impact the basis of creativity, as it was seen that they are present in all the stages of creativity. In the following figure, it is depicted as the path to reach effective creativity taking into account convergent and divergent thinking (Cropley A. , 2006).
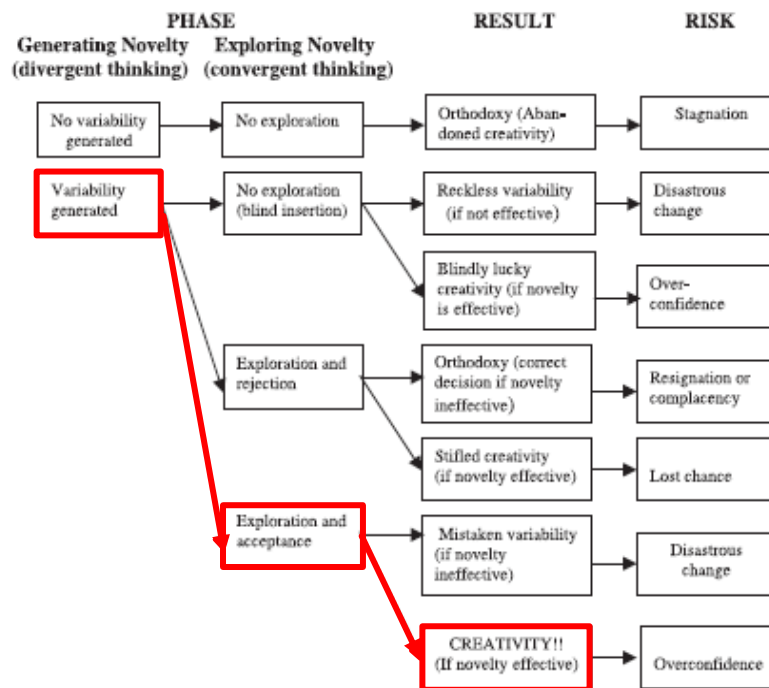
Figure 1 Example of relation convergent and divergent thinking (Cropley A. , 2006)

Creativity is not just a matter of divergent thinking to generate ideas, but it requires convergent thinking to evaluate ideas. Bot thoughts are necessary because convergent thinking aims at assessing and select just one correct idea from the large number of ideas generated by divergent thinking. To better explain the production of ideas through the convergent and divergent as a whole, it can be said that convergent thinking is a prerequisite for obtaining effective divergent thinking. Nonetheless, in order to reach greater levels of creativity, a person should be able to perform effectively both thoughts.

According to Simonton (2000), the research process on creativity has focused on four main phases: cognitive, distinctive characteristics, the development of creativity in people and the social environment. As two of the main factors are already described, the research started to focus on the last factor, the social environment and how it impacts creativity.

The research about the impact of the social environment on creativity was not easy because most of the literature is focused on the individual aspect and not on the environment. It was analysed that the reason for this situation was that there are a lot of drivers related to the social environment that can impact creativity in different ways that the measurement of all of these would be a difficult task.

Moreover, Amabile (1988) argued that those drivers can be measured taking just one part of the environment that is required to be analysed. For instance, Amabile (1988) carried out a componential model of creativity where the study that she developed was based on the field of organizations, and she considered all drivers only related to this field.

The literature review was mostly focused on this model by Amabile (1988), as throughout the research was seen that this model was one of the most popular ones and used by researchers and scholars. Furthermore, other researchers as Sternberg et. al (1991), Conti et. al. (1996), Csikszentmihalyi (1997), Shalley et. al. (2004) among others, supported this model in their research.

As was stated above, the study was carried out in an organization, in which people who worked there were interviewed in order to make them tell creative situations and no creative situations that happened inside the company. The obtained results could be grouped into two categories, qualities of the environment and qualities of the problem-solver. Qualities of an environment are referred to as any factor outside of the problem solvers that influence creativity, and the concept of quality of problem-solver is related to any factor of ability or personality within problem solvers that influence on creativity either positively or negatively.

In this way, Amabile was able to develop two main aspects where each one impacts creativity through different drivers.

- Individual aspect: it involves all characteristics that are distinctive of individuals.
  - Creativity-relevant skills: it includes the cognitive and personality processes conducive to novel thinking, independence, risk-taking and taking new perspectives on problems, considering also the generation of ideas through skills and work style of individuals. As it was stated above, they are relevant for creativity and to measure creative behaviour on people.
  - Domain-specific skills: it includes knowledge, intelligence, expertise and talent and technical skills. The knowledge and intelligence impact creativity following an inverted U-shaped curve. When the breakpoint is reached, the creativity and knowledge are positively related, but once the knowledge is still increasing, the creativity starts to go down, because too much knowledge can become a curious and risk-taken person into the opposite of these characteristics, almost the same occurs with intelligence. Moreover, expertise and talent are positively related to creativity.
  - Intrinsic motivation: it is related to the inner motivation of individuals. This kind of motivation is based on their own satisfaction when goals are achieved by this person. Moreover, a special analysis of extrinsic motivation took place, as it can impact negatively or positively on creativity.
- Social environment: The environment influences the creativity of people through factors such as autonomy, freedom, effective leadership, adequate resources, a favourable environment, and an adequate rewards system. The creation of an accurate environment is needed for innovators in order to help them to come up with new ideas, take risks and think in a positive way, making them feel more motivated and putting all their effort to make things well. The change in the environment causes a change in the minds of people. For this reason, it is an essential factor for creativity. In order to be creative, the environment should encourage the person to be able to think novel ideas and make easier the way in

which the person can be curious, openness to experience, risk-taking. It is important to have good connections, a place with positive energy.

Moving further with the research, two other models have been analysed which support the model of Amabile (1988). The first one is the model developed by Treffinger et. al. (2002), who also argued that creativity can be measured by the factors of cognitive skills, personality traits, and motivation, showing in which way he made a study in order to make the model reliable. The second model was developed by Anderson et. al. (2014) who argued that within an organization there are four main levels to considerer in order to carry out with creativity inside it, these levels involve each other. The model begins with the explanation of the individual aspect and it follows with the understanding of how the individual and the external environment should be related to reaching creativity within the organization.

Once the analysis of these models was developed, it was observed that to measure the impact of factors on creativity, it was needed the development of studies through tools that are able to measure creativity according to the results obtained. The tools are not equal, they measure the drivers in a different way, therefore the classification of tools is also important.

Tools

Researchers have had the purpose of identifying strategies to understand the creative behaviour of people. Thus, different tools emerged for a better understanding of creativity, through which is possible the measurement of creative drivers. The approaches used to measure creativity allow an evaluation of judger reliability of creativity ratings. The analysed tools were those with a high percentage of validity and reliability. On one hand, the creative behaviour of people can be measured by drivers throughout the implementation of tools. On the other hand, the tools are classified into two main categories, the close-ended tools and open-ended tools, explained the main objective of each one and to which drivers they can be related.

The selection of tools was made based on the literature review, considering the most used by the authors, and with a high level of reliability.

- Personality: these tests are carried pout generally by surveys, through which the measurement of results is easy to assess, as well as to group them in categories.
    - The Big Five: It has five meaningful categories which are openness to experience, conscientiousness, extraversion, agreeableness, and neuroticism. It is a question-answer test which assesses the personality traits of people in order to get results about the percentage of each category that people obtained in order to get results about the level of creativity. The creative behaviour is related to high levels of openness to experience, extroversion and agreeableness (Griggs, 2012).
- Divergent thinking: these tools measure the fluency, flexibility, originality, and elaboration of ideas.
    - TTCT (Torrance Test Creative Thinking): According to Mumford (2012), Plucker et. al. (2016), Clapham (2004), among others, TTCT is the most used tool to measure divergent thinking because of the high reliability.

The methodology involves the measurement of the capacity of people to measure the involved drivers in a different way. It consists of three stages for figural and five stages for verbal where the drivers are analysed, and it aims at making people think deep and narrow but also quick and broad.

- Convergent thinking: the drivers involved are reasoning, logic, evaluation, and intelligence.
    - RAT (Remote Associates Test): It consists of a test with just one answer. It presents three unrelated words where each word can form a word or phrase composed of a fourth sought-for word. This observation suggests that this test takes advantage of more than a different component of creativity, where the best solution appears in conscious awareness. The test RAT requires finding an association between diverse or seemingly unrelated concepts, having correct responses for each task, and involves convergent and evaluative skills to measure (Mumford, 2012).
- Social creativity environment test: it aims at showing the relation between social environment and individual, in the sense that how a person perceives the creative environment.
    - KEYS: It is a tool developed by Amabile (1996) in research about how the environment impacts creativity. It aims at measuring the encouragement of creativity, autonomy and freedom, resources, pressure and organizational impediments to creativity as conservatisms.

Creativity assessment is not an easy process. It might identify different categories for test development in order to see a broad view of the different factors that impact on creativity (Feldhusen & Eng Goh, 1995).

Throughout the literature review it was analysed how creativity is part of innovation, and in which way creativity can be measured in people, analysing the different factors and their respective drivers. It was found that many factors impact on creativity, and these factors include drivers with which the measurement of creativity is possible throughout tools. But one last question was considered. Is there a framework with which is able to visualize the relation between all tools and the drivers they measure?

<u>The framework</u>

Some papers argued studies and researches about theoretical frameworks, showing the relation between tools, and drivers and factors, but the reliability of these ones was poor. Then, it was observed that it was a missing tool to manage easily and clearly the search and assessment of the creative behaviour of people in order to develop innovation accurately. There is information about this relation, but the missing part is a dynamic framework with which companies, in this case, can visualize and obtain a better comprehension about what kind of driver they are measure through the selected tool, and in which way it is measured in order to find creative people. Considering the literature review was possible to develop a framework, relating the main mentioned concepts and models which help with the building of this framework, aimed at placing tools on it, considering as main axis the main drivers that impact creativity.

The framework was developed considering the main categories that Amabile (1988) argued, and it was divided into two models. The first one is about the individual aspect

and the social environment. In this way, they were positioned in the main axis, each one in one extreme. The extremes mean 100% of one category, while at the center of the axis it is located the mix between both aspects, as it was seen that both of those are important in order to reach high levels of creativity. The vertical axis corresponds to the classification of tools into open-ended and close-ended. Once this model of the framework was developed, all mentioned tools were placed. In this way, the dynamic model can help companies to better understand which tool should choose to measure a desired factor of creativity depending on the social environment they want to build or the individual characteristics they want to enhance.
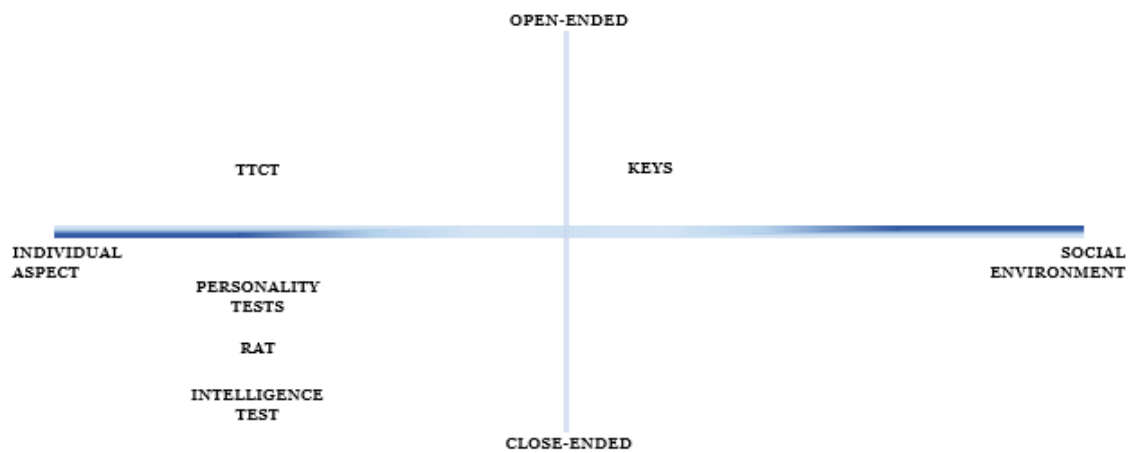
Figure 2 Framework of individual aspect and social environment

The second model goes into more detail in order to assess deeper the individual aspect. It was built considering the two-step process of creativity, based on cognitive style. The model was developed considering only the divergent and convergent thinking because it was explained above that both thoughts can be indirectly related to the components of individual aspect that Amabile (1988) mentioned (domain-specific, creativity-relevant, and intrinsic motivation). For example, domain-specific skills are related to the convergent thinking, as they include knowledge, intelligence, reasoning. Then, intrinsic motivation is related to divergent thinking as it is related to the own satisfaction and achievement of goals. But one main factor is still missing. The personality traits is an important factor to measure creativity but as it was stated, it is difficult to measure just in one framework all the traits of a person and their respective levels, so the consideration of personality traits in a model of the framework which aims at visualizing clearly the tools, would be awkward. Nonetheless, the tools were placed considering the relation between them and the two-step process.

OPEN-ENDED

TTCT   KEYS

CONVERGENT   DIVERGENT
THINKING   THINKING

RAT

                                        PERSONALITY
INTELLIGENCE   TESTS: openness
TEST   to experience

CLOSE-ENDED
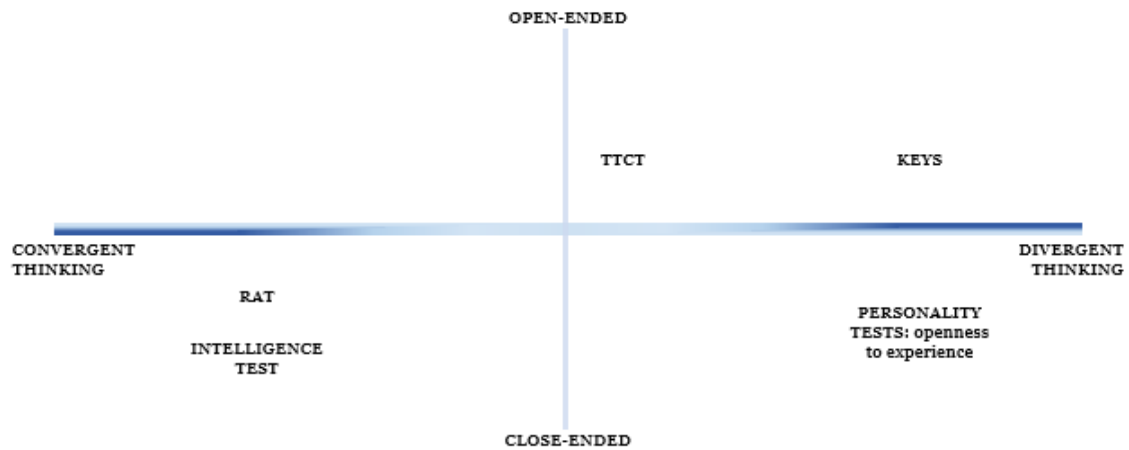
Figure 3 Framework of convergent and divergent thinking

It worth noticing that TTCT is almost in the middle because there is measured the mix between convergent and divergent thinking, as in the extremes are considered the 100% of just one thinking. Furthermore, it can be noticed how convergent thinking aims at involving close-ended tools, as divergent thinking open-ended, except for personality traits because of the statement mentioned before.

The utilization of this framework can give a possible solution to the gap that companies are suffering, in the way in which it could be easier to identify which tool is the most accurate in order to determine the capable person to perform creativity in a specific field of the company. For instance, a company found people that develop well in creativity, but the same, the development of innovation inside it is not the expected one. It could be possible because those people have a high level of creativity but all of them in the same influential driver of creativity, for example, all divergent thinking. But, in order to reach greater creativity, it is needed more than one driver impacted on creativity to reach effective innovation. For example, it should be needed two kinds of creative behaviour, divergent and convergent thinking. Thus, the framework can help in this situation as different kind of tools are placed throughout the axes of the drivers in order to know which tool measures better one driver than the other, finding people with a high level of creativity but within different drivers of it, reaching an equilibrium between these different kinds of creative behaviour of people.

In conclusion, it was possible to build a framework in order to show a clear methodology for companies to better understand how to use tools in order to know which driver that impact on creativity is measured, and help enterprises to find people able to perform well in all the process of innovation.

2. Methodology

The focus of the report was, first of all, to find how companies are able to find creative people as they need them to improve the innovation process. Therefore, the literature review started with innovation in order to understand the relation between creativity and innovation. Moving further with the research, it was noticed that creativity is a broad field to analyse. For this reason, the main focus was in creativity throughout the development of the report. All the conclusions were obtained from state-of-the-art literature, with which the development of the researches was possible to carry out. The main data engine used was Scopus, and the obtention of articles was though the publisher companies of science journals as Springer, IEEE Xplore, ScienceDirect, among others, taking into account the reading of sixty papers of literature.

The main fields in order to go ahead with the research were innovation, creativity and creativity measurement tools.

First of all, through the research made from innovation, it was looked for the relation between this one and creativity, wondering why companies need innovation and, at the same time, why creativity is important to reach this process. In this way, the first part of the research was performed, obtaining many papers related to innovation, but mostly with creativity from the researched papers.

Secondly, many papers were collected about creativity. It was realised that it is a broad field to analyse and that it should find a way about how to find creative people can be achieved. That was one of the second questions which was answered throughout the report. Many papers focused on the roots of creativity and how it is composed. So, in this part, the research was not difficult to carry out because of the large amount of obtained papers.

Consequently, it was seen that creativity depends on more than one factor, so the research was focused on finding which other factors impact creativity, and how they impact it in order to continue with the understanding of creativity to find creative people.

In this way, going ahead with the research of which could be those factors, it was found a model with a high percentage of reliability. This model was the componential model of creativity by Amabile (1988), as well as the papers of Amabile (1996) where within the model is explained the study she developed and how she found the categories in which this model can be divided in order to better understand all factors put into play on creativity.

This model was considered as a guideline in order to get other models that can help also with understanding. Most of them support the model of Amabile and two other models were considering, Treffinger et. al. (2002) and Anderson et. al. (2014). Where the impact of factors on creativity remained clear in order to show a clear knowledge about this topic.

Once the models and factors were analysed and understood, the third topic was to seek which were the main tools to measure creativity. In this case, throughout the literature review of the first two topics, it was realised that not any tools can be used to measure

creativity. Tools should have a high level of reliability and validity in order to show correct results. In this way, the research was more difficult to carry out because it was made a relation between the read literature in order to know which tool was the most used by those authors, and in which it would summarize the level of reliability of them. A common partner was found which involves reliability and the sought driver of creativity.

Finally, the last question to develop was that if it exists a framework capable of showing the relationship between tools and factors of creativity. The research in order to ask this question was poor, with a lack of reliability. Therefore, it was noticed that it was a missing tool able to cluster tools in a framework based on creative factors. And this gap makes develop the final framework of the report. It worth saying that the framework was built with the help of existing models that have shown a relation between creative factors and drivers, and the development of tools in order to understand which driver is measured.

In conclusion, considering all the literature review the development of the framework was built in order to bring to companies a better understanding about which tool to use when they want to find specific creative factors, and in turn, knowing a desirable tool to use, which factor it is going to measure and how it is related with creativity.

Data selection

The main basis for choosing reliable sources was the ranking of the bibliography, taking into account the number of citations and related articles. The number corresponds to such a high number of researches in order to analyse innovation and creativity and how both can be developed. The studies on these topics started a long time ago and some aspects are still being investigated because of the broad fields that are innovation and creativity. For this reason, old models as Amabile (1988), Treffinger et. al. (1991), Csikszentmihalyi (1997), Runco et. al (1999) were considered as they have developed the relation between innovation and creativity, as well as the explanation of factors that impact on creativity. The research of finding a framework that relates creative measurement tools with the factor of creativity was general and poor. For this reason, the focus was to summarize in a framework of this relationship as it was a missing methodology in this field. Heterogeneous sources of information were used and detailed below.

The primary data source, papers and books over 1000 citations were considered to start the research based on those papers. The secondary data sources were taken into account including papers and journals, which ones did not have such a large number of citations but validated and added opinions and studies on the topics discussed in the main sources, recognizing the tools used to build on the described papers, and proposing new studies carried out with these tools to different groups of people, with different cultures and languages, validating that the results of these tools are reliable. Finally, the tertiary data sources were used, which refers to newspapers and which ones were used to understand more current issues such as the implementation of innovation in organizations and why today it is considered extremely important for them.

3. Introduction

The importance of innovation has been taken place on companies because of the greater capacity to make themselves overcome barriers, being able to adapt to recurrent changes and placed as leaders on the market they operate. Innovation is a process that involves the contribution of people, environment, and resources in order to make possible the growth of a company. The aim of the research was to find how innovation is carried out inside companies and why all companies cannot develop innovation in an accurate and effective way. During the reading of the literature was assessed that nowadays, companies are dealing with the problem to reach innovation, as it was noted that the research of people able to perform innovation is a difficult task to carry out. This difficult task is because of a missing tool able to present a clear methodology to perform an accurate selection of tools to measure the level of creative behaviour of people, considering the drivers and factors that impact on it. In turn, the missing tool is because of the large amount of existing creativity measurement tools but the missing of a clear framework where those tools can be clustered to establish what the measured driver is, based on the impact it generates on the factor of creativity. Regarding this, the main gap is not the utilization of a tool to measure creativity but the no clear comprehension about which tool is the most accurate to determine the influential factor on creativity, in order to know how to find and label people with creative behaviour. The research was begun wondering why there is not a tool able to solve this gap yet. The issue was that creativity does not depend on just one factor, but in three main factors which are personality traits, cognitive skills, and social environment, regarding creativity emerges from the interaction of individual, field and domain. These three main factors, in turn, have influential drivers measured by tools through which the creativity of people can be measured. Moving further with the research, it was found that Amabile (1988) developed a componential model of creativity where she got the point of this division of factors, developing the related drivers to each one in order to make a clearer model, thus knowing how those factors impact on the creativity of people, but it was still missing a methodology able to develop a relation between those factors and drivers with the measurement creativity tools.

In this way, the investigation about how to solve this gap between factors that impact creativity and tools which measure creativity took place in this report. The direction of the assessment of a possible solution of this gap is to summarize the information obtained throughout the research in a dynamic framework able to relate the meaningful drivers which impact on factors of creativity and to place in this framework the measurement creativity tools, building not a static but dynamic model with which companies can interact and choose which are the tools able to measure an influential driver of creativity making easier to find creative behaviour on people in diverse factors. In other words, the research focuses on a framework of placed tools that measure the creative behaviour of people to offer a simpler and easier way to visualize their results, identifying through these the type of people that a company wants to find and contribute to the area of innovation and creativity or to observe a better way the characteristics and attitudes of people and know who are those who have a high level of creativity inside them, understanding what kind of tools to use and in which way. As well as understanding that not only depends on the characteristics of individuals but also depends on external factors that relate to them, being able to improve this type of

behaviour. The most frequented models carried out by researchers were analysed to clarify that creativity is not only an aspect of personality skills but also cognitive skills and motivation of people, furthermore that creativity is not just a matter of individuals but the surrounded environment where people is involved, taking into account how a person is able to perceive this environment creatively. It should be noted that the framework was based on cognitive skills and the relation between the social environment, considering that it was not develop a framework with personality traits as they are difficult to cluster in just one axis, as they depend on each person. Nonetheless, many of the personality traits are indirectly related to cognitive skills as many of them that measure creativity can be related to the main drivers that affect this factor.

The following chapters will explain the importance of innovation, how creativity is committed with it and the explanation about how the factors of creativity, and their respective drivers, impact on it. In turn, the investigation of existing models which help with the development of the final framework to explain how this framework will develop a possible solution to the issue that was found. Consequently, the explanation about how tools measure the drivers which impact the factors of creativity, as well as the importance along years about those tools useful to measure creativity in people and the classification of these ones as they are not equal to each other and they tend to have a different kind of results to be analysed, depending on the way in which they are taken. Finally, the development of a framework was carried out in order to help companies to better understand which is the factor that they should take into account when they want to find creative people able to perform innovation inside their companies.

4. Literature

1. Innovation

According to economist Klaus Schwab, many economic researchers have tried to discover what makes some countries more successful and prosperous than others. Recurring growth and population income are indicators, these are nothing more than results of processes. But the issue is, what is the process that leads to this growth? And that is where innovation comes into play. Innovation is one of the drivers of growth as the process focuses on obtaining products, processes and business models with greater added value. This definition not only focuses on countries, but the same thing happens with organizations (Schwab, 2013).

Nowadays, the issue of any company is to survive the great technological, social and economic changes that are occurring in a global society. Through evaluation and analysis of the market and competitors, companies have noted that the development of these changes grows exponentially and non-linearly, to which they must be aligned with this growth in order to survive. Innovation is one of the most important aspects to keep in line with this growth. Therefore, organizations are pushed to create innovators, reduce costs, increase markets and solve customer needs by creating dramatic changes in activities on work, management and employee behaviour (Jeschke, Isenhardt, Hees, & Trantow, 2011). Innovation is a fundamental field for companies since it offers fast entry to new markets and to be able to develop better. This situation generates new opportunities where it also teaches companies to take risks and be managed by a better competitive advantage in order to grow aligned with the new changes and to survive (Henderson, 2017).

There are several definitions of innovation, all focused on the concept of adaptation to change and implementation of new, novel and unique ideas, altering the distribution of power and structure that have established companies. Companies that apply innovation are those that continue in the market, updating and adapting themselves to new changes. However, it is not an easy process to apply. Not all companies have the ability or resources to perform innovation either in products, services or processes they develop. Inside companies, more and more attention is paid to the capacity to solve problems finding innovators, considering the assessment of knowledge, skills, abilities and other personal characteristics (Williamson, Lounsbury, & Han, 2013). The innovation process consists of five stages: ideation, exploration, transfer, production and development, and market introduction. The stage of ideation includes innovators and creators where both have creative characteristics in their personalities, where it can be seen that creativity is the first step to promote innovation and place a company as a leader in the market (Huber, Kaufmann, & Steinmann, 2017). It is the critical stage because ideas begin to emerge, seeking a new direction within the company and it involves people with creative behaviour who can generate these new ideas or opportunities. The creative capacity is critical in the current context where the market acceleration implies that professionals deliver innovative solutions to complex situations to predict (Hernandez Barajas, Garzon, Serrano Cardenas, & Bravo Ibarra, 2015).

The creative capacity is composed of people in an attitude and conviction to strive to overcome the limitations that are generated in their position to create (Hernandez Barajas, Garzon, Serrano Cardenas, & Bravo Ibarra, 2015). It can be said that creativity is the basis of innovation. Creativity is also defined in many ways, always considering that it is related to the generation of novel and unique ideas. According to Mumford (2012), "*Creativity is defined as the production of high quality, original and elegant solutions to problems*", this concept also has to do with the behaviour of people, that is to say, people who can think and generate new ideas, and from trial and error processes, it is known if they will succeed and have a positive impact on the company and society. Treffinger (2002) argued that creativity can be expressed in a wide number of ways in human behaviour and has its origins in several components of individuals and social experiences. Creativity can be presented in people in their personalities, called nature creativity, but also it can be trained throughout years by knowledge, lived experiences or necessity. The taught creativity is called nurtured creativity. It should be borne in mind that in nurture creativity the personality of people must be observed to understand if there are creative traits, which could be enhanced. But the basis is centred on the natural creativity of people because they are traits with which a person is born. However, there are factors, both internal and external to people, that affect creative behaviour in people.

In conclusion, it is observed that companies need to implement innovation to survive, and this innovation is provided by people with a creative behaviour with characteristics such as tolerance to the ambiguous and openness to experience, which makes them generate novel and unique ideas and opportunities to distinguish themselves in the market and meet new needs of society. The main focus is on finding people who present creative behaviour, ability, and attitude to make a company reaches innovation.

2. Innovation process

In recent years, companies have observed the importance of the role of innovation in order to succeed in the market where they operate. The importance of innovation is everywhere, and it is not possible to get away from it (Amabile, A model of creativity and innovation in organizations, 1988). The innovation applied within organizations is not usually an easy process. It refers to a complex interaction between humans, technology, and enterprises, giving rise to the innovation process when they relate to each other (Jeschke, Isenhardt, Hees, & Trantow, 2011). According to Huber (2017) to achieve innovation it is required the development of five stages which comprise the innovation process. The stages are ideation, exploration, transfer, development and production, and market introduction. These stages are divided into three main categories: preparation, translation, and implementation. Some authors focus on four stages where the missed one is transferred. Nowadays, the transfer is considered because of the lack of good communication between the categories of preparation and implementation, and this lack of communication leads to a negative impact on a project that arrives at the final instance. In the innovation process, it is not ensured to reach innovation within a company just with an idea or opportunity. The process needs to define a new direction that involves the generation of several ideas. Many of the ideas that lead a project tend to fail in the preliminary stages as well as in advanced stages. This situation happens because sometimes there are issues on those ideas that in advanced stages can be noticed more than in preliminary stages, and these details can negatively impact the value of the company.

Within the category of preparation is where innovators, who present creative personality traits, tend to achieve the well-being and survival of companies, but sometimes they generate ideas that tend to be very risky, threatening or costly. These are the issues that managers notice in the implementation category and, therefore, dismiss projects, turning them into failed projects. Henceforth, most development projects are abandoned or never brought to successful situations. For this reason, the transfer stage was included in the innovation process (Huber, Kaufmann, & Steinmann, 2017).

The stages are going to be explained below in order to understand the activities and actors that are involved in each one.

Preparation category

- Ideation: this stage consists of the generation of ideas in which should be used appropriate methods to generate them. The purpose is not just generating ideas but finding out new problems in the real world that should be solved and can be relevant for enterprises in order to bring value to them satisfying new people's needs. In this stage, creativity is really useful, because the ability to be creative is an advantage for succeeding. Therefore, it can be said that in this stage creativity of a person is put into play. It seems to be the most awkward phase because many ideas arise but may not follow the same direction, leaving room to the paradox of ideas effect arises, because a large number of ideas can make important aspects be lost and taken another direction which cannot lead to the right one.
- Exploration: the purpose of this stage is to determine which innovative idea is to be forwarded to the development stage. The evaluation of the ideas aims at being more in an external way, analysing the cost-benefits that those can bring to the enterprise. Huber (2017) argued that the value of an innovation is not defined by the idea itself, but by the business context in which the idea is introduced. Where instead of running through a straightforward idea competition, it will be required to determine the commercial value of ideas embedded in various business contexts.

Translation category

- Transfer: this stage was implemented in order to enhance the relationship between the other stages. It was observed that two areas of a company do not speak the same language in terms of the culture of the company. For this reason, it is needed an interpreter in the form of key account management. In other words, Huber (2017) argued that the development department needs a functional specification document at the beginning of the development stage. This stage consists of generating an improvement in the communication between both the preparation and implementation category, thus innovators and managers do not disagree with generated ideas to be able to produce them and introduce them in the market.

Implementation category

- Development and production: this stage is really important for organizations because of the development of a new product which implies a great challenge. It could lead a project termination because of some difficulties that ideas can

present. Many of the ideas generated never become part of serious development efforts or tend to lose relevance as other project development gains greater attention.

- Market introduction: while serious differences of opinion emerge in the run-up to market introduction, just a few project terminations occur in this stage. This stage is referred to put on practice the innovative idea and introduce it into the market, analysing the behaviour of people with the innovative idea, thus verifying if it works in order to know the adding value that it can bring to the company itself.
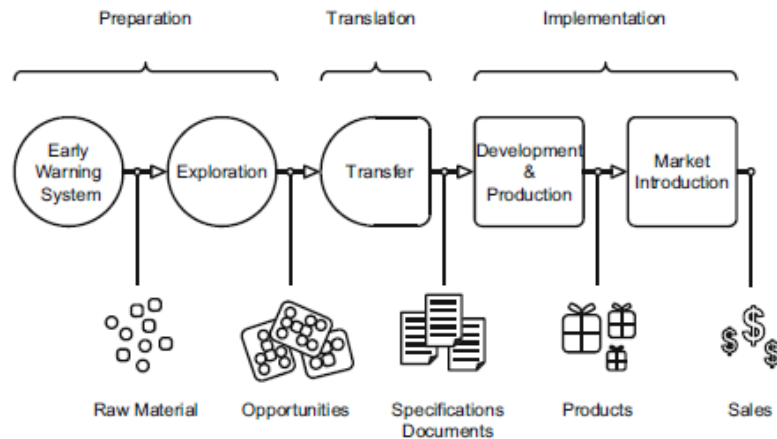

Figure 4 Innovation process model (Huber, Kaufmann, & Steinmann, 2017)

As described above, in the preparation category, the creativity of people is needed in the development of this stage in order to achieve innovation. Creativity is presented in the behaviour of people. It is the first step in innovation where new products, services or processes are carried out from the generation of ideas. Creativity leads innovation which is the successful implementation of those new and novelty ideas (Amabile, Entrepreneurial Creativity through Motivational Synergy, 1997). Also, Anderson (2014) and Shalley et al. (2004) argued that because creativity focuses on idea generation and innovation emphasizes idea implementation, creativity is often the first step of innovation, where the creative behaviour of researchers in this phase is the main driver. Amabile (1996) argued that *"creativity is the seed of innovation"*. Therefore, creativity is put on practice more in the first stage because it is where innovators and creators are needed in order to have plenty of ideas that can reach innovation within the organization. The creative actions made by these people are those which will distinguish successful innovations from the less noteworthy efforts (Ford, 1996). Novel and unique ideas tend to be the basis of a product or service that can satisfy the needs of people and contribute to social progress, also generating competitive advantage in the market. The relation between creativity and innovation is based on the necessity to predict the future, trying to reduce insecurity and taking the risk of change as a factor of opportunity (AECA, 2014).

Creativity has a lot of importance in innovation as it is the impulse to generate ideas that can make an enterprise survive. In order to maximize innovation, researchers have paid special attention to the phase of production of novel and useful ideas as well as creativity at work (Jaussi, Randel, & Dionne, 2007). The focus of this report will be the manner to find people with creative behaviour to help companies to innovate, generating ideas that

will work and not waste time and money in generating and evaluating ideas that will be dismissed in the future. For this reason, the focus is on the stage of ideation in which the main actor is the creativity and is the one will be analysed in term of personality and attitudes of individuals.

As David H. Cropley (2019) argued in his book Problem solving man *"creativity is a vital component of solving problems. Creativity is the ability to generate new and effective ideas, while innovation is the ability to use them in the best way"*. Hence, the focus will be on creativity because it is the main driver of innovation (Cropley, 2019).

It is important to clarify that as innovators as creators have creative behaviour. Creativity is directly related to the behaviour of innovators because they are distinguished for developing useful and original ideas in their workplace just what creativity needs in order to make new products, services or processes (Chau, Zhu, Shen, & Huang, 2018). According to Wellner (2015), innovators are people who developed a new or significant product or process, marketing method or new organizational method within an organization. The creators tend to be autonomous, original, open to new experiences, flexible, self-confidence, anxious, dominant, imaginative, risk-taking. And innovators are self-confidence, perseverance, visionaries, flexible, open to new experience, tolerance to ambiguity. It can be noted that both creators and innovators' characteristics are quite similar because they think similarly when it comes to generating new ideas (AECA, 2014). This concept does not mean that innovators and creators have similar development in the areas of the process, but both can contribute to the production of ideas. For this reason, the research will be focused on the creative behaviour of people, since researchers have been based on finding how creativity works in people, which leads to generating innovative processes.

3. Creativity

Creative capacity is a distinctive competence in the current dynamic context since it is considered a fundamental factor in the field of innovation and competitiveness. This capacity facilitates the generation of disruptive solutions to the needs of the environment (Hernandez Barajas, Garzon, Serrano Cardenas, & Bravo Ibarra, 2015). Creativity is part of the innovation process and its main actor, as it is the driver to generate new ideas and make a company survive. It is referred to as the production of something novel and valuable (Ford, 1996). It should be kept in mind that creativity is an originated phenomenon in individuals because people have the ability to think and reason in order to solve problems. The thing is that they should have developed their creative traits to make those solutions creatively, considering that individuals must relate with their environment where to apply these creative solutions, and perceive it in a creative way (Vartanian, Bristol, & Kaufman, 2013).

With creativity an individual can deal with newness and novelty situations that are presented in the real world, connecting the problem and solution together to make room for innovation. Creativity is the capacity of finding a new solution to current or new problems, thus making enterprises grow aligned with the technological, social and economic changes (Cropley, 2019). According to Guilford, "*Creativity refers to the skills that are characteristic of creative individuals, such as fluency, flexibility, originality and divergent thinking*". When creativity is developed at work by employees, new ideas

about products, services or processes emerge. Creativity involves the development of novelty and potential ideas about products, services, practices or processes (Shalley, Zhou, & Oldham, 2004). Its definition refers to the production of high quality, original and elegant solutions to problems (Mumford, 2012). In the study of creativity, concepts related to personality, cognition, psychosocial influences, genetics, among others are analysed. As well as this phenomenon is studied in companies where creativity arouses great interest in its relationship with innovation and competitiveness (Aguilera Luque, 2016).

According to MacKinnon (1962), creativity involves a response or an idea that is novel or is not ordinary. The novelty and originality thoughts are not enough to reach those issues. If a response is to lay claim to being part of the creative process, it must some extent be adapted to reality. It must serve to solve a problem or fit a situation or to achieve goals. Creativeness involves sustaining of the original insights, and evaluation and elaboration of it, according to this creativity is a process extended in time and characterized by originality, adaptiveness, and realization (MacKinnon, 1962). The concept of creativity must be well understood in order to apply it in the real world.

The following items are proposed for a better comprehension of applying creativity. First, creativity is not about product but decisions. Second, knowledge is one of the most important drivers of creativity. Third, creative behaviour is intentional. Fourth, personal identity and creativeness are emergent and dependent. Fifth, the creative behaviour of individuals is involved at the personal level of their identities and abilities (Feldhusen & Eng Goh, 1995). On the other hand, Amabile (1988) defines creativity in terms of product, as creativity is related to the generation of new products from novel ideas. The failures or successes of creative activities depend on the way in which products or efforts are defined (Feldhusen & Eng Goh, 1995).

Besides, creativity is related to cognition. This factor contributes to the productive thinking, which is based on information, skills, motivation, and metacognitive systems, or problem-solving, which is related with the divergent thinking in order to generate ideas to solve problems or make decisions, and problem finding, related with the convergent thinking (Feldhusen & Eng Goh, 1995). One important aspect that is related to creative behaviour is the personality in terms of being self-confident, self-motivated, self-efficient. Self-efficacy is the confidence of individuals to be creative in certain tasks (Jaussi, Randel, & Dionne, 2007). Self-efficacy can be defined as the ability to produce creative outcomes, and a high level of it can lead to creative performance (Tierney & Farmer, 2002). According to Shalley et al. (2004), self-efficacy of individuals impacts positively on creativity and it is defined as the belief of individuals having the ability to achieve specific goals. Also, complexity is one of the most important characteristics of creative people because they are encouraged to use their full set of traits. They take risks and are spontaneous, moving from one extreme to another one without hesitating. Creativity is not only necessary to generate positive growth in companies, but it is an essential aspect for people as it is a way of feeling satisfied with oneself. Creativity is also about feeling free, proud, motivated because of the solution to problems with novelty ideas (Csikszentmihalyi, 1997).

As stated above, the individual is the one who is able to generate creative ideas or solutions with the surrounded environment where the main factor is how people behave. Creative behaviour is usually referred by traits as risk-taking and openness to experience,

but there is also the sensing of novelty-seeking which tends to be a genetic factor, data that is not still something sure. The novelty-seeking is a personality trait associated with exploratory activity in response to novel stimulation, impulsiveness in decision making, extravagance towards rewarding, and rapid loss of temperament, as well as avoidance of frustration. Thus, when a person behaves with these traits, it is almost sure that the level of creativity is high (Vartanian, Bristol, & Kaufman, 2013).

Creative behaviour has been recognized as one of the most important forms of individuals. Its role in innovation, design, invention, and advance in a wide range of domains is broadly recognized (Runco, Paek, Alsuwaidi, Abdulla, & Al-Jasim, 2016). Therefore, it can be said that the best way to understand creativity is through creative behaviour which is interpreted through three perspectives: personality, cognitive style, and social psychology. First, the characteristics of creative behaviour take place in the study of personality framework for example within theories that include psychological thoughts and behaviouristic which tend to explain the nature of human creativity. Second, past researches have argued that cognitive factors are very related to creativity because the cognitive style of individuals leads to generate original and novel ideas, problem-solving, creative thinking and so on. Third, the social and environmental conditions influence creativity as well positively as negatively, depending on the creative perception of people within the environment (Woodman & Schoenfeldt, 1990). A creative individual is one who is able to solve problems regularly and offer solutions that have great weight in the context in which they are required (AECA, 2014). Simonton (2000) argued that the phenomenon of creativity has a fourth perspective which is the development of creativity in the life span of people. Researchers have realized that the creative potential in people comes from experiences lived in childhood or adolescence, as well as in adulthood this level can continue to be enhanced. It was demonstrated that some factors have a greater impact on potential creativity as parental loss, birth order, marginality, availability of role models. Creativity emerges from experiences that lead to weakening the limits imposed by society and the motivation that these experiences tend to generate in people to overcome obstacles. The author said that is almost clear that potential creativity requires the contribution of nature and nurture traits in people (Simonton, 2000).

Woodman et al. (1990) proposed an interactionist model of creative behaviour. This model involves important components of creative behaviour as personality, cognitive and social psychology explanations of creativity. It helps to better understand the interaction between person and situation to produce creativity. In figure 4-3-1, it is depicted the model. It starts with antecedent conditions (A) that involve experiences, learning about life and background characteristics. They impact on the person (O) who his or her basis are personality traits (P) and cognitive style (CS). This person can be affected by contextual influences (CI) such as physical environment, organization climate, and culture, or by social influences (SI) such as rewards, role modelling or evaluation expectation. All these factors that impact a person lead to creative behaviour (B) with which it is possible to obtain consequences (C) of creating actions.
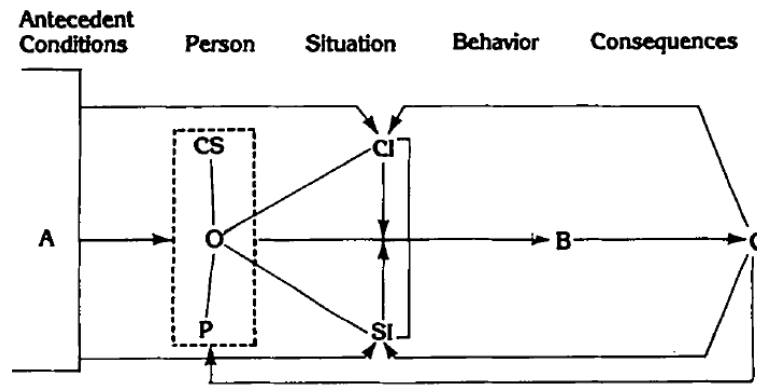
Figure 5 Interactionist model of creative behaviour (Woodman & Schoenfeldt, An Interactionist Model of Creative Behavior, 1990)

According to neuroscience researchers, all humans have the potential to create, it is a capacity and its impulse depends on the emotional system of people. Therefore, the creative process can be defined as an unconscious mechanism that becomes conscious and by knowing the available matter and the reasoning processes of oneself, this process develops (AECA, 2014). The creative process shows the way in which people develop ideas. This process involves five main stages. First, identification of problem or opportunity called preparation. Second, gathering information or resources, called incubation. It is the most creative part because it makes people understand how one problem starts to see part of one novel solution. Third, generate ideas, called illumination. Fourth, the evaluation when it is decided that the insightful is worth and valuable. Fifth, modify and communicate ideas, called elaboration and verification. An individual can have a better performance in one stage than in another because the creative performance depends on the personality of them. For example, a person who has a high level of openness to experience is more likely to generate ideas (Shalley, Zhou, & Oldham, 2004), (Csikszentmihalyi, 1997). The phases of illumination and incubation are related to the creative brain. The incubation stage facilitates the relaxation of the mind and after reflection, the cognitive unconscious emerges with the rational mind already resting and the phase of illumination emerges, which is important to be able to obtain outcomes (AECA, 2014). The insights are brought from people who have been thinking hard about solving problems and presenting novel ideas, considering that personal experience, social pressure, and domain knowledge are part of the problem. A curious person has the capacity to be involved in new experiences, always looking for the new. Creativity has room when there is a conflict in the domain and each domain has its own pattern that characterized it, at the same time social pressure may push to act in a creative way (Csikszentmihalyi, 1997).

Ford (1996) and Feldhusen et al. (1995) argued that creativity is focused on social systems and it is not an attribute of individuals, but the society through changing domains attributes creativity to individuals. Other researchers argued the same as Mihaly Csikszentmihalyi (1997) who proposed that creativity is a result of the interaction between an individual, the domain and the field. The domain is a set of opportunities or limitations noticed to a person, defined as rules, the language of an area of action, where it is created order with its own symbolic elements. The person produces new approaches and serves, as the source of variation and changes introduced to a field. The field is the set of experts who decide whether the new approaches meet the criteria of the domain, that is, the field where novel ideas will be implemented, and society must accept. It gives

rise to new situations and radical changes in society where people should be prepared to face these developments. Fields and domains represent the context that influences the actions of individuals. The person introduces changes to the field, who carries out creative acts that elaborate the domain, thus the domain communicates information and actions back to the person. In other words, the individual is who is able to think and to reason novelty ideas, he or she is able to adapt himself or herself to current changes or find other ways to solve current problems (Csikszentmihalyi, 1997). This relation between the three components goes cyclically. It can be said that creativity is an external process for creative people (Feldhusen & Eng Goh, 1995).

Creativity depends on the personal characteristics of people, the characteristics of the context or environment where they work and the interaction between both components. Personal characteristics involve personality traits and cognitive skills that together facilitate the production of creative ideas through varied applied strategies. Person and context interaction foster creativity when individuals with certain personal characteristics related to creativity assess opportunities provided by contextual factors (Shalley, Zhou, & Oldham, 2004). The action of creating is done from a situation and an individual or individuals managed in an environment in which values, affections, and ideas that compete with each other coincide with the desire to achieve success (AECA, 2014).

4. Roots of creativity

Among years, researchers started the dispute between whether creativity is genetic or not. Over time it has been possible to perform an analysis where it can be observed that between 50% and 70% of creativity in people has genetic characteristics. But since it is not 100% then it is said that many times the environment is the one who also helps to develop each other's creativity even better, also giving an important part to the reasoning capacity. Therefore, many researchers agree that both origins influence creativity, both genetic and that of the surrounded environment (Griggs, 2012).

The main driver of creativity is genetic and lies in memory, but the creative potential can be developed. The genetic inheritance is what facilitates that most of the information is processed internally automatically. Creativity is both innate and learnt. Therefore, it can be said that creativity germinates in memory because something cannot be created from anything, it is nurtured by experience and observation. The creative capacity belongs to the brain and comes from memory. Through this, humans evoke information about an occurred situation as well as being able to experience certain solutions from memories or recognition of a particular situation (AECA, 2014). Some researchers agreed that the brain has two hemispheres of which people tend to have one as the dominant. In creative people the right hemisphere dominates, but part of the left hemisphere is also needed for analysis and planning of originated ideas (Runco M. A., 2006). Creativity comes from genetic predisposition, as a person who is more sensitive to colours and lights will have an advantage in painting, or who has a perfect pitch will do well music, and other people just interested in knowing about other themes in terms of acquiring new knowledge, which brings innovation. Considering that creativity also is influenced by the environment in which a person develops. For example, a person who born in a poor society, with a lack of knowledge, lack of resources it would be difficult to be creative or to develop novelty ideas (Csikszentmihalyi, 1997). In conclusion, it can be said that two

types of personality make people behave in a more creative way than others. Firstly, it is the creative behaviour with which people are born and secondly, it is the knowledge society acquire by relating to the external environment (Runco M. A., 2006).

According to evidence in definitions and concepts studied by researchers, it can be affirmed that people have the potential to be creative and this creativity can sometimes be altered from the acquisition of new knowledge or experiences because creativity can be stimulated, as it was said before (Hernandez Barajas, Garzon, Serrano Cardenas, & Bravo Ibarra, 2015). After studies on creativity, it was concluded that the elaboration of thoughts comes from psychic creation and is part of human nature. Characteristics can be found in creative people who differ from the rest of the people as a high degree of intellectual capacity, value their independence and autonomy, have great aspirations, think and associate ideas in an unusual way, are productive and do things and have verbal fluency. They express their ideas well, have a wide range of interests and behave honestly (Esquivias Serrano, 2004). Most people have creative behavioural skills that define them as creative people such as flexibility, originality, fluency, sensitivity to problems, elaboration, evaluation, logical thinking, intuition, concentration, resistance to closure, openness to new experiences and transformation. It was discovered that many skills are components of creative thinking and problem-solving. It should also be noted that creative people have personality traits such as tolerance for ambiguity, freedom, flexibility, risk-taking, positive attitude, which come from the nature of people's behaviour as well as can be taught or developed through diverse and focused creative activities. The majority of components of creative thinking need a knowledge basis, which makes them acquire more effectively and fluently those creative skills to solve problems or think creatively in real-life situations. Another important trained skill for effective creative thinking and solving problems is the metacognition, which refers to the planning, monitoring and evaluating outcomes (Feldhusen & Eng Goh, 1995). What makes people think creatively is mostly the novel and unique solutions that they have seen involved in society. Observing how problems could be solved in an unusual but feasible way. Hence, openness is one of the great characteristics of the personality with which it is possible to determine if a person is creative. Promoting the ability to reason, to be able to create solutions to problems without intimidating people from doing this, it is a way of nurturing creativity. Not only it is something that people have by nature in their personality, but it is also part of how culture and society tend to foster it. Researchers have found that there are several elements that tend to foster creativity and are training, resources, expectations, hopes and opportunities, motivation. For example, when a person is recognized or rewarded for their creative idea, they tend to continue thinking in this way, being able to generate higher expectations, as long as they can have the necessary resources to perform and with resources referred to both people and objects or money (Csikszentmihalyi, 1997).

Creativity can only be considered when people have a continuous focus on the problem to be solved. Mihaly Csikszentmihalyi (1997) proposed that curiosity is what makes a person to behave as creative since each of humans is born with two sets of different characteristics, the conservative tendency, which generates saving energy, self-preservation, and expansive tendency which is one that makes people risky to enjoy the novelty and explore. Both are important for the person, but the expansive tendency is that not most people can develop (Csikszentmihalyi, 1997). However, there are some theories based on nature and nurture creativity which explain that both sides are

important. Creativity is defined as the ability of people to create something unique, original, whether with products or situations where a problem should be solved, and these creative ideas must be accepted in the environment in which they decide to implement them by society. It can be said that this creative capacity depends in part on the nature of people but can be largely nurtured in others. For example, scientists say that their creative capacity is the accumulation of knowledge and experience and that it is not part of their personality. While artists are the contrary side. For them, creativity is something a gift with what is born, As they have born with this gift, it is easier for them to improve it through knowledge and experiences lived (Vernon, 1989). In people who are at the same social level and in the same country, there is no great distinction of creativity nurtured. For this reason, it is important to know about other cultures, to have experiences in different places where people live and to leave the comfort zone. Nurtured creativity can generate changes in nature creativity or vice versa. For this, it is important to always have both developed to see improvements in the creative ability of people (Sameroff, 2010).

In an organization, managers contribute with the training of the creative behaviour of people to make them think differently and to overcome boundaries. Some activities are to encourage cross-application experiences, carrying on activities to encourage people to think across different experiences, to use the problem-solving strategies and motivate them to reach the main goal of the company (Jaussi, Randel, & Dionne, 2007). The training programs referred to cognitive styles will be effective inside enterprises if potential and current employees know and prefer the situation of change (Woodman, Sawyer, & Griffin, Toward a theory of organizational creativity, 1993). Individuals have some creative-relevant skills from their nature which aim at identifying problems, generating new ideas and using the right standards to evaluate and refine ideas. The presence and generation of a creative environment develop that people who are involved in this same environment tend to have creative behaviour and help in the development of unique solutions. Communication between people also makes creativity, and that communication is something that is taught, something nurtured in order to build a creative environment. (Shalley, Zhou, & Oldham, 2004).

Environment and climate are other external factors that make a person think differently, in the sense that there is the possibility of generating an environment which meets the characteristics mentioned above, that are able to foster creativity as motivation, rewards, training to not only think within the established limits but to think out of the box and to foresee a sociable, friendly, incentive climate, where there is not a lack of curiosity and people do not be judged about their ideas (Feldhusen & Eng Goh, 1995).

A study was carried out to make a research about design thinking. It consisted of making managers of an organization exposed their employees to unfamiliar situations, unusual and outside their comfort zone, outside of what they knew and had been doing throughout his life within the organization. This study showed within the company who were the ones with creative traits. That is, who suited better the changes or those who looked for ways to solve what was happening. Then three stages could be described along with the study. First, the stage of being able to know that something was changing and being reasonable about what it is. Then the uncertainty stage, where new solutions that may become possible solutions begin to be raised and, the last one, the commitment stage where employees observed the achievements by having implemented the changes

thought in the previous stages. But through this study, it was observed that some people stayed in the first stage, without being able to adapt themselves to the changes, while others found it difficult to adapt, but following their mates with more creative skills, they were able to follow them and get to see positive results (Plattner, Meinel, & Leifer, 2015). In conclusion, if a person has creative personality skills by nature, it will be easier for this person to adapt to changes, but if a person has not developed creative skills, it does not mean that this person cannot find the way to adapt to changes as the person knows that creativity can be also nurtured.

5. The two-step process of creativity

According to Guilford, one of the pioneers of creativity research, creativity can be assessed by a two-step process that remained as part of cognition, which includes convergent and divergent thinking. People who have the ability to bring novel ideas are able to use those two thoughts. In other words, individuals who generate new and unique solutions, because of their creative behaviour, is because of divergent thinking that goes hand by hand with convergent thinking. Creative outcomes come from cognitive skills linked with attitudes generated by the use of those skills. However, these two thoughts are necessary in order to make successful the potential creativity as they are part of the relationship that an individual, the domain and field must have to generate creative solutions. The first thinking is referred to convergent thinking, being able to develop well-defined situations and to solve problems rationally with only one correct answer. Then there is the divergent thinking, which is able to make a person thinks from one extreme to the other one without hesitating when it should be developed an idea, to cover the whole problem in general and with its consequences, always looking for solutions thinking outside the box. These ideas provided from the second type of thinking can be good or bad, in terms of being accepted or not by society. In this case, in order to choose the most accurate one, it is needed the convergent thinking (Csikszentmihalyi, 1997). This last thinking leads to a single correct solution determined by the given facts. The other one is where ideas shoot in different directions. The production of ideas involves research and assessment referred to creativity where in this process can be identified problem-solving and problem finding. The convergent thinking can be ordinarily called problem-solving and divergent thinking problem finding (Feldhusen & Eng Goh, 1995). In conclusion, both thoughts lead to the generation of unique ideas, considering that convergent thinking generates orthodoxy in ideas, and divergent thinking generates variability in ideas. The two-step process would involve novelty generation followed by the exploration of the novelty from workability, acceptability or similar criteria to determine if it is effective (Cropley A. , 2006).

As it is shown in figure 4-5-1, the generation of novel ideas has different phases in which the convergent and divergent thinking go hand by hand, differentiating the first phase as the generation and the exploration of novelty. Then, in the second phase, called result, creativity arises when it is performed variability and exploration and acceptance. It can be produced variability and exploration and rejection, wherein this case, it is likely to have stifled creativity or having that the novelty is ineffective. However, it is important when it is had the acceptance, that there are no mistakes in variability which leads to novelty ineffective. The third phase is the risk, which for creativity is presented as overconfidence, which often does not reveal or think outside the box, or not be curious. Another important risk to take into account is the missed opportunities because of

focusing too much on one part of the problem and not having a clear vision of everything in general, or by the theory of paradox of ideas. This theory explains that sometimes it can be presented or thought about many ideas at the same time, which generates that the curve with which the amount of people generating ideas is measured over the value of each one. The value of ideas goes up until a limited point, and then this value starts to descend because it is shown that when people think and generate a lot of ideas, they lose focus on the value and the ideas cannot be developed in the best way, as it can be done with just a few ideas which ones are able to bring creative solutions, with the possibility to improve them in order to get one best solution, the most accurate for the problem, and not to have a lot of ideas that cannot bring any value to it (Cropley A. , 2006).
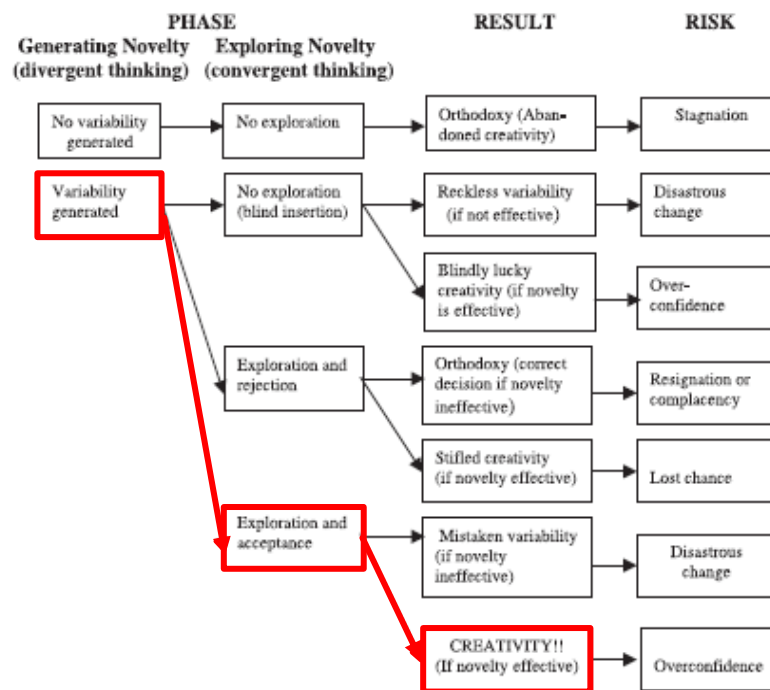
Figure 6 Consequence of differing combination of divergent and convergent thinking (Cropley A. , 2006)

It is useful to go deeper into these two concepts to better understand the effect of convergent and divergent thinking on the creative potential of people, where it was inquired that some traits of personality, mood, and natural skills are the main actors involved into them. As it was said above, both convergent and divergent thinking are necessary to develop novel ideas, but the divergent thinking has more emphasis on creativity because is the kind of thinking which makes a person think outside the box, take risks and to think not just one idea, but a lot. Hence, the ideation step is affected by divergent thinking where imagination and problems finding appear, but to get reliable solutions the judgment and rationalization, which depend on convergent thinking, must arise (Mumford, 2012). It will be explained below both convergent and divergent thinking separately, and how they together impact creativity.

1. Convergent thinking

Convergent thinking is an important aspect of creativity because it is the step focuses on the evaluation of ideas, which is present throughout all stages of a creative problem-solving behaviour process (Feldhusen & Eng Goh, 1995). It involves critical processes in terms of involving criticism of the results of divergent thinking, although it is useful because of the possibility to explore, evaluate or criticize the variability of ideas and identifying its effective factors (Cropley A. , 2006). Convergent thinking works logically, coherently and rationally without losing any details. Once it is known the solution to a problem, it is ordered in a logical way to give coherence to this solution (AECA, 2014). Convergent thinking is necessary since it manifests if the ideas generated are valid, if they solve problems in a unique way and if they can be carried out efficiently. This type of thinking is what rationality in the brought ideas seeks more than anything else (Goldschmidt, 2016). Convergent thinking includes speed, accuracy, logic and knowledge, determining what is familiar and what not and considering the accumulated information in a person and using it in the most efficient way. In order to reach the convergent thinking, it must have a well-defined problem and thus be able to arrive at a single clear answer that in most times is the best one, without leaving room for ambiguity. One important factor is the knowledge because is which can provide criteria of effectiveness and novelty in ideas (Cropley A. , 2006).

People are who have the ability to perform creative potential because they are able to generate new ideas and evaluate them, getting as result ideas that can reach innovation, because people generate ideas without hesitating, without needing the acceptation of the society to make affordable their ideas. However, creative people must generate a few ideas and focus on which one is the best option to reach the goal and make society accept it. For this reason, the criticism and evaluative skills are essential in convergent thinking because without them it is not possible to find gaps or problems and solve them (Mumford, 2012). In conclusion., convergent thinking is the thinking which brings information and knowledge to problem-solving, thinking rationally about reaching the main goal through the development of a correct chosen idea (Goldschmidt, 2016).

2. Divergent thinking

The most widely used assessments for creative potential require divergent thinking with which people explore a variety of directions and possibilities in terms of originality, fluency, and flexibility, to generate a huge amount of answers (Runco, Paek, Alsuwaidi, Abdulla, & Al-Jasim, 2016). Divergent thinking includes the generation of multiple answers to a problem, answers that are novel, surprising and unusual, considering the acquired knowledge and accumulated information in a person. Through this thinking, combinations of the acquired information, experiences, and knowledge that achieve the production of novel solutions can be developed (Cropley A. , 2006). The divergent thinking involves occurrences, fantasies, and intuitions, insists curiosity, experimentation, artistic sense, metacognition and taking risks. It enhances the skill of open-minded in order to try new experiences to observe and imagine solutions to problems differently than common situations (AECA, 2014). People who have developed this thinking are able to think through diverging directions which make the variability of ideas and lead to creativity, but with defocused attention (Goldschmidt, 2016). The essential thing to keep in mind is that a person not only gets creative accomplishment

for society but also for organizations. As divergent thinking is based on bringing new ideas through knowledge and being able to link different directions of the thinking of people, it can be said that it is the thinking that includes the generation of ideas and not the implementation (Mumford, 2012). To better understand this concept, it can be mentioned a clear example of divergent thinking that is brainstorming, which has the aim to generate many ideas of a problem or situation where more than one is correct (Colzato, Ozturk, & Hommel, 2012).

In conclusion, the process of divergent thinking seeks to see the novelty and new opportunities, seek to change perspectives, taking risks and producing a large number of ideas which solve a problem in general, and it is the process with which its results are unusual solutions, new ways of dealing with problems, feeling of excitement and the capability to associate ideas from remote fields (Cropley A. , 2006). In addition, divergent thinking has been studied based on training effects on this thinking. That is to say, divergent thinking is part of a great variety of creativity-training programs, and it brings with great success the improvement of trainees' creativity-thinking abilities. In special tests on this behaviour, it can be seen how divergent thinking improves when it is trained and when it does not, in terms of creativity, since it makes the latter develop better when it is trained. What could be observed after several studies, is that this improvement in divergent thinking is due to the increased competences in a wide variety of different skills and not only in relevant creativity skills (Baer, 1993).

3. Convergent and divergent thinking as a whole how impact creativity

Creativity is not just a matter of divergent thinking to generate ideas, but it requires the convergent thinking to evaluate ideas, in the sense that, creative process influences the divergent and convergent thinking, where the interest in studying both was originated from the study of creativity, wherein the divergent thinking was the one which got the attention for creativity process (Goldschmidt, 2016). Both thoughts involve the application of a superordinate ability to acquire, process and store information. The process is specified in the sequence of identifying and defining a problem, generating and selecting ideas and carrying them out. The transition from one stage to another is due to the evolution of creative thinking, that is, the divergent, logical, which refers to the convergent (AECA, 2014). To better explain the production of ideas through the convergent and divergent as a whole, it can be said that convergent thinking is a prerequisite for obtaining effective divergent thinking. Some models explain how the two thoughts work together. First, the summation model which aims to show that convergent and divergent thinking add something to each other or to compensate defects to each other. Second, the threshold model in which the threshold approaches from below in convergent thinking making divergent thinking increase, but when the threshold passes the level of convergent thinking has no further effect on divergent thinking. Third, the channel model where convergent thinking provides the channel through the information reaches the divergent thinking deciding which kind of information should be processed. Finally, the capacity model where the convergent thinking aims at determining the amount of information that reaches cognitive systems, making available this information to the divergent thinking.

As stated above, the two thoughts together generate and evaluate novel ideas to achieve the proposed objectives. Since both thoughts have an impact on creativity, it will be better to assess how they impact each phase of creativity. The first phase which includes information and preparation, where the problem is identified and objectives are learnt and defined, obtaining new knowledge or emphasizing knowledge already acquired, has as main thinking the convergent one. The second phase consists of incubation, where associations between ideas are made to determine what should be the possible solutions or situations that achieve the proposed goals, resulting in this phase the combination of cognitive elements. In this stage, divergent thinking is used. The third phase is the illumination where divergent thinking takes place, where new ideas arise to solve problems. Then, in the phase of verification, both thoughts are present. It is the phase where the effectiveness of ideas is verified and only the relevant ones are those that persist. Finally, both thoughts are included in the validation and communication phase, where it will be feedback about the other phases and judge of relevance and effectiveness along with all phases and where the result is the achievement of the novel idea to solve problems (Cropley A. , 2006). Creative people should be able to alternate both convergent and divergent thinking, according to the demand of particular creativity phases to produce effective novelty.

In conclusion, convergent and divergent thinking are seen as occurring in cyclic phases among the creativity process. Where divergent thinking is based on defocused attention since many ideas for a solution originate, but then convergent thinking that is related to focused attention, states that only one of those ideas is the most appropriate. And for this reason, the mixture between both thoughts impacts on the creative behaviour of people (Goldschmidt, 2016).

6. Factors that impact on creativity

A comprehensive description of creativity must include the factors that lead individuals to undertake deliberately creative actions (Ford, 1996). From the organizational point of view, creativity is a complex interaction between the work situation in which they operate and the individual itself. According to Woodman et al. (1993) and Anderson et al. (2014), in an organization, creativity can be presented in four levels. At the individual level, the creativity results of biographical variables, cognitive styles, and ability as divergent thinking, personality, relevant knowledge, motivation, social influences, and contextual influences. At the team level, creativity is the consequence of the interaction between group members with creative behaviour, group characteristics, team processes, and contextual influence. At the level of organization, innovation is managed by individual and group creativity. And the multi-level involves the other three levels and the transformational leadership's impact on creativity and innovation. As well as those authors proposed the four levels, J. P. Guilford was the one who claimed in the fiftieth that there should be a greater emphasis on the phenomenon of creativity. The research processes on this subject have focused on four main phases: cognitive, distinctive characteristics, the development of creativity in people and the social environment (Simonton, 2000). These categories were also studied by Amabile, who proposed a model by going into more detail on them.

Creativity manifests itself within individuals through complex processes. As creativity engages individuals, it should be analysed the factors that are involved in them, like

cognitive skills, abilities, personality factors and motivation, strategies or metacognitive skills which are more external from an individual, but they contribute to generate creative behaviour. Other factors as context, pressure, environment impact psychologically through motivation and disposition of creators (Feldhusen & Eng Goh, 1995). The application and recognition of several factors related to concerns and problems are involved in the creative process (Jaussi, Randel, & Dionne, 2007).

However, creativity is part of a very important category of innovation. So, the models that define and specify the factors that affect creativity, also consider how these factors are those that have an impact on innovation since creativity and innovation are directly related. To better understand this relationship, emphasis can be placed on the componential theory of organizational creativity and innovation by Amabile (1997). The model is depicted in Figure 4-6-1, where the main elements that are included in this theory are related to the creativity of the individual with the organizational work environment, which includes the social environment as well. In the figure, it can be seen two parts with three circles each. On the one hand, at the top, the elements contained in the circles are essential components for innovation, belonging to the work environment. On the other hand, the other three lower circles depict the components of the individual's creativity. The main idea is that the elements of the work environment, directly impact on individuals' creativity, in addition to creativity from individuals is a primary source for achieving innovation in organizations (Amabile, Motivating creativity in Organizations: on doing what you love and loving what you do, 1997).

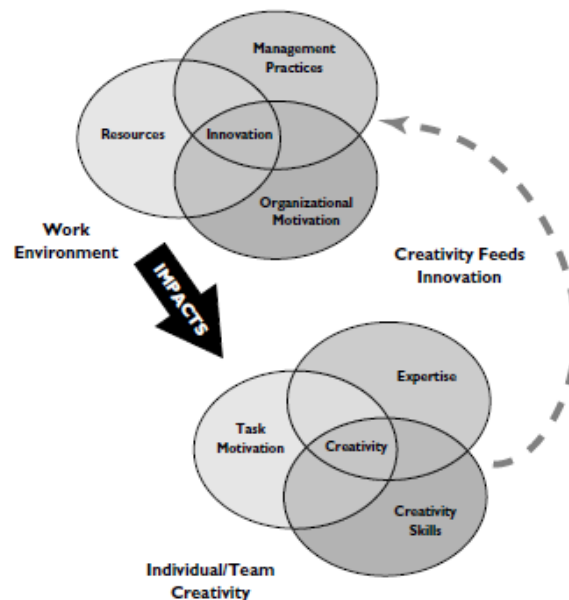Figure 7 Componential theory of organizational creativity and innovation (Amabile T. M., Entrepreneurial Creativity through Motivational Synergy, 1997)

Although all the elements of the work environment impact on the creativity of individuals, the factor most influenced by these elements external to the individual is the task motivation, since motivation has a certain dependence with what is external to the individual.

1. Factors that impact on creative behaviour

To generate a new model that involves creativity and innovation, Teresa M. Amabile made a study where employees from different areas were asked to tell a work situation that they considered creative and another one no creative. In the search for information about the major influences on creativity and innovation, it was realized that the kind of things the interviewees talked about fell into four major categories that are qualities of the environment that promote creativity, qualities of the environment that inhibit creativity, qualities of problem solvers that promote creativity and qualities of problem solvers that inhibit creativity. Qualities of an environment are referred to as any factor outside of the problem solvers that influence creativity. The concept of quality of problem-solver is related to any factor of ability or personality within problem solvers that influence on creativity either positively or negatively (Amabile, A model of creativity and innovation in organizations, 1988). Amabile (1988) called qualities of problem solvers to this group of characteristics that people commented on. The question was why problem solvers and creativity are related. The cognitive theories of creativity often focus on the problem-solving process. Problem is related to a goal and an obstacle in the way in which an individual wants to or needs to reach something, but first, it must deal with the obstacle. The thing is how a problem is defined. If the problem is defined as an obstacle between one's self and a goal, then many creators can be called problem solvers. They may be solving the problem of finding the best original and new way to express an idea or refine a technique. Where there is a real problem there is some novel behaviour on the part of the problem solver, hence there is some degree of creativity. Problems are not always solved with creativity, or creativity performance is not always a solution to a problem, but the work on problem-solving contributes to the understanding of some creative performance. The creator is who sees the problem and needs to solve it, for this reason, creators can be called problem-solvers (Runco M. A., 2006).

Sternberg (1991) argued that Amabile (1988) proposed a componential model describing creativity as the result of motivation, domain-relevant skills, and creativity-relevant skills, emphasizing the resources of creativity (Sternberg & Lubart, 1991). Also, Conti (1996) supported the componential model of creativity that Amabile created. Along the research written by T. M. Amabile, it was carried out a study where the data was taken from 90 young adults enrolled in an introductory psychology course. The study was divided into 3 phases. In the first one, each participant wrote three short stories in response to three different pictures. In the second phase, participants engaged in each of the three art activities in different random orders. And in the last one, participants were asked to write a short story involving two of the characters they had previously read about in a learning passage. Through the analysis of the results, a consistent pattern emerges that fits well with the predictions made by the componential model of creativity. Creativity measures taken within the same context and in the same domain were highly and significantly intercorrelated. Measures taken in different contexts, but from the same domain, showed moderate and mostly significant correlations. Measures taken from different domains in different contexts show low but positive correlations. Thus, there is compelling evidence of general creativity skills across different tasks within a domain, and some suggestive evidence of general creativity skills across quite different domains (Conti, Coon, & Amabile, 1996).

Within the qualities of problem solver to promote creativity, it will be revealed that ten transcripts help on this promotion:

- Various personality traits as persistence, curiosity, energy and intellectual honesty.
- Self-motivation, in the way of being self-driven, enthusiastic, attracted by the challenge of the problem, having a sense of working in something important and belief in or commitment to the idea.
- Special cognitive abilities in relation to a special talent of problem solvers in this field. The problem-solving abilities and tactics for creative thinking they have.
- Risk-orientation based on unconventional, attracted to challenge, oriented toward taking risks and doing things differently.
- Expertise in the area as talent, experience and acquired knowledge in a particular field.
- Qualities of the group as synergy arising from intellectual, personal and social qualities of individuals making up the project team.
- Diverse experience based on broad general knowledge and experience in a wide range of domains.
- Social skills as well as social and political skills, good rapport with others, being a good listener and good team player and being broadminded or open to others' ideas.
- Brilliance based on a high level of general intelligence.
- Naivete as being in a new field, not bound by old ways of doing things.

On the other hand, some factors inhibit creativity:

- Unmotivated involves the lack of motivation for the work, being a pessimist and not being challenged by the problem.
- Unskilled involves a lack of ability and experience in some areas.
- Inflexible based on being set in one's own ways, opinionated, unwilling to do things differently and too constrained by one's education or training.
- Externally motivated based on being motivated primarily by money, recognition or other factors arise from the work, being competitive and jealous of the success of others.
- Socially unskilled involves the lack of social or political skills.

The componential model of creativity was designed to account for the importance of talents, education, cognitive skills, interest patterns, and personality dispositions in order to influence creative behaviour. The model involves three main components for individual creativity:

- Domain-relevant skills: it includes factual knowledge, technical skills and special talent in the domain in question. The component can be viewed as the set of cognitive pathways for solving a given problem or doing a given task. Dominant-relevant skills appear to depend on innate cognitive, perceptual and motor abilities, as well as on formal and informal education in the domain endeavour. The involved factors are expertise in a specific area, brilliance, and special cognitive abilities, and about the negative ones, it involves the unskilled abilities. Amabile (2012) defined the factors that are put into play in this component. It is related to the expertise in the relevant domain. This category includes knowledge,

expertise, technical skills, intelligence and talent in the particular domain where the problem-solver is working. It comprises raw materials with which an individual is able to draw throughout the creation of a creative process (Amabile, Componential theory of creativity, 2012).

- Creativity-relevant skills: domain-relevant skills are not enough to produce creative work. It is needed other personal skills in people in order to carry them out. These personal skills are classified into creativity-relevant skills. The positive personal qualities from the study that are involved in this category are the various personality traits, risk orientation, qualities of the group, diverse experiences, social skills, naivete and certain of the special cognitive abilities. The negative ones are inflexibility and lack of social skills. It also includes the cognitive-perceptual style which appears to be characterized by a facility in understanding complexities and the ability to break mental set during problem-solving. The creativity-relevant skills depend on personality characteristics related to independence, self-discipline, ability to delay gratification, perseverance in the face of frustration and absence of conformity in thinking or dependence on social approval. Also, it depends on training thoughts which they may be explicitly taught by experiences. To wrap up, Amabile (2012) argued that it comprises the cognitive and personality processes conducive to novel thinking, independence, risk-taking and taking new perspectives on problems, considering also the generation of ideas through skills and work style of individuals. The cognitive style is referred to how an individual thinks, perceives and remembers information to apply it to new processes or opportunities. While the personality process includes the self-discipline and tolerance for ambiguity.

- Intrinsic task motivation: the personal qualities put into play in this category enhancing creativity are the self-motivation and various personality traits. About the negative impact on creativity, the unmotivated and being externally motivated concerns are related in this category. Task motivation makes the difference between what an individual can do and what one will do. It determines the extent to which domain-relevant skills and creativity-relevant skills will be fully and appropriately engaged in the service of creative performance. Amabile (2012) argued that the necessary motivation to engage in the activity out of interest, enjoyment or a personal sense of challenge. Passion is the main key to intrinsic motivation. It is referred to the satisfaction of own challenge without any kind of rewards just for interest or enjoyment in carrying out a new idea.

These three individual components build the blocks for the componential model of creativity. Each of the components is crucial to produce some level of creativity. The higher the level of each of the three components, the higher the overall level of creativity in an individual should be.

Once explaining the individual components of the componential model of creativity, it should be explained the social environment which includes most of the extrinsic motivation factors involved in individual lives. Returning to the study above, it will be mentioned the qualities of the environment that have an impact on creativity. These qualities are external from the individual itself (Amabile, A model of creativity and innovation in organizations, 1988).

- Freedom is necessary in order to act freely, a sense of control over one's own work and ideas. The most important component is the operational autonomy related to daily freedom in work or the decision about how to achieve a certain goal. Freedom is the most prominent environmental promoter of creativity.
- Good project management in terms of having a good manager within a company who shows as a good role model, enthusiastic, has good communication skills, protects the project team from outside distractions and interferences, matches tasks to skills of workers and interests and sets a clear direction.
- Enough resources access to necessary resources, including facilities, equipment, information, funds, and people.
- Encouragement based on management enthusiastic for new ideas.
- Various organizational characteristics are a mechanism for considering new ideas, a corporate climate marked by cooperation and collaboration across levels and divisions, an atmosphere where innovation is prized, and failure is not fatal.
- Recognition is appropriate feedback, recognition, and reward for creative work.
- Enough time is what people need to have time to think creatively about a problem and to explore different perspectives rather than having to impose an already-determined approach.
- Challenge as a sense of challenge arising from the intriguing nature of the problem itself or its importance to the organization.
- Pressure based on a general desire to accomplish a goal or the sense of urgency generated from the competition outside the organization.

Moreover, other factors can inhibit creativity:

- Various organizational characteristics are inappropriate reward systems in the organization, lack of cooperation and collaboration or little regard for innovation.
- Constraint involves the lack of freedom and lack of sense of control on own work.
- Organizational disinterest involves the lack of organizational support, interest or faith in the project.
- Poor project management is when a manager unable to set clear directions and with poor technical and communication skills.
- Evaluation based on inappropriate or inequitable evaluation and feedback systems, unrealistic expectations or environment focused on criticism.
- Insufficient resources involve the lack of appropriate facilities, equipment, materials, funds or people.
- Time pressure involves insufficient time to think creatively or having an unrealistic time frame.
- Overemphasis on the status quo based on the reluctance of managers or co-workers to change their way of doing things, unwillingness to take risks.
- Competition in interpersonal or intergroup activity within the organization. Fostering a self-defensive attitude.

Concluding with the list of qualities of individuals and environment that can influence positively as well as negatively on creativity, individual creativity can be powerfully influenced by elements of the organization.

Following the componential model of creativity, the different factors that have an impact on creativity will be explained more specifically below in order to better understand how they influence in creative behaviour of people.

1. *Domain-specific skills*

This first component involves knowledge, intelligence, expertise and, talent and technical skills which are drivers that impact cognitive skills referred to as an individual creative factor. Below, each one will be explained, taking into account how they impact on creative behaviour.

Knowledge

Some individuals can recognize opportunities to solve problems in an easier way than others, this happens because these people are prone to acquire and accumulate new knowledge from people, environment, education, books or just lived experiences. Some studies have argued that increased knowledge through a specific field can lead to important advantages for individuals in terms of developing new tasks or taking novel decisions in an automatic way (Shepherd & Patzelt, 2018). Creative individuals express their creativity by bringing the knowledge and procedures to solve one situation and switching that knowledge from one field to another. But there is a controversial problem related to the lack of knowledge. Lack of knowledge makes a person think more openly, without having limitations on what they already know. But also, truly creative work is almost always done by people who are in the know, because they have more knowledge about different fields which makes generate new ideas relating to the acquisition of diverse concepts. It can be said that knowledge presents an inverted-U function whereas a person reaches a higher level of education, the knowledge related to creativity grows, but until a point, whereas the level of education increases that level of creativity concerning knowledge decreases because people focus too much on what they know to be no longer original in their ideas or open-minded (Sternberg & Lubart, 1991). Some studies were carried out to have evidential data about if this inverted-U curve of knowledge behaves always in this way, and in a high percentage the situation was accomplished (Simonton, Formal education, eminence and dogmatism: the curvilinear relationship, 1983). Empirical evidence has shown the negative correlation between creativity and knowledge once the breakpoint at the level of knowledge is reached by a person, that is, most people have not been able to be distinguished by presenting creative contributions in a domain unless have been able to acquire the necessary level of knowledge and relevant skills to demonstrate their creativity. This capability is difficult to reach since the theory of the U-inverted curve of knowledge related with creativity is verified, where after a certain time acquired knowledge, this makes people unable to think and reason outside the box because they focus on knowledge already acquired and do not have the facility to generate new ideas, different from what they already know (Cropley A. , 2006). Although there are studies that reaffirm this theory, it does not mean that people without any knowledge are creative. To some extent, knowledge is necessary for creativity as it allows doors to be opened to new challenges and new situations from which, without having acquired that knowledge, they would not have been discovered.

The prior knowledge of people, which is the knowledge that people have on a particular topic, makes people pay more attention to the most important aspects of available

information and to process it more efficiently, thus facilitating the recognition of opportunities. The prior knowledge is very important for the creative field, Amabile (1997) argued that "[...] *relevant knowledge can be viewed as the set of cognitive pathways that may be followed for solving a given problem or doing a given task*". Other studies also have argued the prior knowledge aims to increase the number of innovative ideas because this knowledge can give rise to creativity, allowing linkages and thoughts that may have never been considered before. Individuals tend to compare new information with their prior knowledge in order to understand it and make the difference, thus expanding the limits of knowledge. In other words, the comparison between these two kinds of knowledge makes individuals start thinking about new insights and not just the current ones. The greater the prior knowledge people have, the higher the level of innovativeness of them. Concluding with this concept, people with these characteristics tend to see non-obvious opportunities. Due to their greater knowledge and understanding of particular markets and industries compares to professionals in these fields, they are able to recognize market applications that other ones never could have imagined (Shepherd & Patzelt, 2018). In addition, it is not possible to generate novel ideas in a field that is not known, as some knowledge is needed to guide its application and creative reach. Creative thinking is contemplated as the result of the manipulation of ideas, coming from general or specific knowledge. Ideas are extended to other areas, modified or combined in such a way as to be useful (Fernandez Fernandez & Peralta Lopez, 2011).

Moreover, there is a relation between a different kind of knowledge and innovation performance. It means, the knowledge acquisition and accumulation have a positive impact on innovation capacity, in other words, the higher the frequency of managing knowledge, the greater the innovation of individuals. The same occurs with technology innovation. As innovation is a benefit for companies in terms of optimization and growth, this knowledge management can ensure good use of knowledge to improve innovation. Sharing knowledge is the only one which has a little or almost nothing impacts on innovation (Hsieh, Hsieh, & Wang, 2011).

From a psychological perspective, several stimuli can be gotten by eyes and ears, from the external environment to individuals. This information is called sensation and can be collected from the outside and which humans are able to perceive and to record. The sensation works together with the perception, which is the interpretation of the stimuli that are worked from the brain. There are two processes that work together. The bottom-up processing which is based on capturing information through some sense which travels to the brain. And then, the top-down processing where the brain uses its knowledge, expectations, beliefs to be able to give an interpretation to the stimulus obtained. But the issue is that if the brain does not have that information to be able to interpret the stimulus, people cannot process it and it will not be understood what it refers to. For this reason, it is very important to have a broad knowledge of what is going on around individuals, to go to experiences that can lead to open minds, i.e. to know and be able to perceive the situations that are presented in the external environment (Griggs, 2012).

Intelligence

Intelligence consists of part of a set of mental processes used for the input, transformation, and output of information. Intelligence even today is an aspect that is

still not very clear how to face it. Many researchers have arrived at conclusions through studies, but nothing is so precise or as valid as to rely on just one. There are different opinions, which through achieved studies are valid but even some contradict each other. Furthermore, intelligence is a factor that is in a continuous investigation. Stanovich was a cognitive researcher who argued that intelligence is meaningful, but it is not the only factor that matters for good thinking. There is another element which is as important as intelligence and it is the rationality, the ability to think and act rationally, and as it was argued, rationality is directly related to convergent thinking.

However, there are evidential theories on which to rely to define intelligence. The theory of intelligence developed by Sternberg aims to discuss three types of intelligence. Analytical intelligence is one that is measured by intelligence tests and that gives a result of IQ of people (Intelligence Quotient). Practical intelligence can be measured by common sense. Creative intelligence is based on the ability to solve new problems and deal with unusual situations. These last two types of intelligence do not have great applicability in the academic world, as does the analytical (Griggs, 2012). Intelligence is composed of three types of information processing elements. First, meta-components that serve to plan, monitor and evaluate strategies to solve problems. Second, performance components that are used to solve problems. And finally, knowledge acquisition components used to learn to solve problems. These three elements are involving in creativity in order to produce novel ideas and situations or to take common situations into a novel one in order to adapt it (Sternberg & Lubart, 1991). Nonetheless, Mihaly Csikszentmihalyi (1997) argued that a high level of intelligence is detrimental to creativity because people with a high score in IQ tend to lose curiosity because they are pretty secure about their mental superiority, they feel like they no need to look for novelty things, they do not have doubts or the need to improve their knowledge (Csikszentmihalyi, 1997). During these years, other researches were made, and it was found that there is a correlation. The higher the intelligence capacity, the higher the creative performance of people (Vartanian, Bristol, & Kaufman, 2013).

There are certain variations with respect to the concepts between creativity and intelligence. Beyond that, it has been shown that they are related, some researchers still doubt about this correlation. There are different kinds of intelligence, giving rise to multiple intelligence which makes humans cognitively where each one has a characteristic profile of it. Just as intelligence is multiple, creativity can also be considered multiple. People are able to know and learn in different ways that can be combined when certain tasks are developed. Therefore, intelligence is made up of innate and learned components that facilitate the understanding of the environment (AECA, 2014). To prove the correlation between creativity and intelligence, a study with a group of students was made. The students had taken a test of creative potential and then another test of intellectual potential. The results have shown that there is not a strong correlation, but they depended on each other, in other words, there is a threshold of intelligence that is necessary for creative performance. The relation is shown in a scatterplot in figure 4-6-2, in which it can be seen that people can have a high level of intelligence but a low level of creativity, but no one has a high level of creativity and low level of intelligence and there is where the correlation takes place. The theory is based on tested ability, the data is from tests of creativity and intelligence (Runco M. A., 2006).
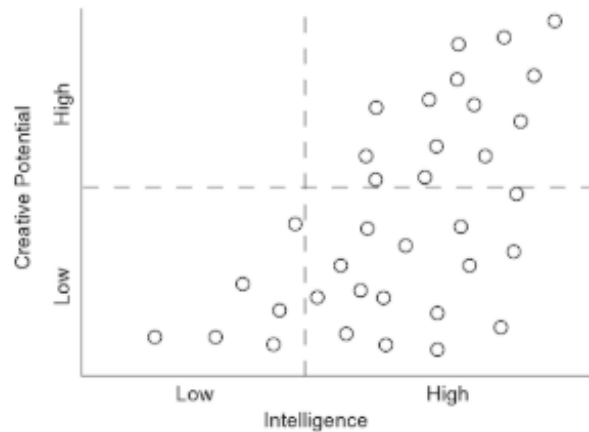
Figure 8 Correlation between intelligence and creativity (Runco M. A., 2006)

Expertise

The expertise can be explained in terms of knowledge. Experts develop huge knowledge bases, much of its domain-specific knowledge, but the important thing is that they have a lot of interconnections among knowledge. The knowledge of experts is better organized than a novice and they tend to outperform novices within their domains but not outside of them. Experts often make assumptions because they know so much, for this reason, they make decisions quickly and take more risks. But the weakness about to know so much is that can prevent original and creative thinking.

Individuals have the ability to analyse new information and to allow a better understanding and insight to turn from what they already knew and what they know, thinking out of the box, bringing new ideas and changing their point of view of things and situations. The protraction of insight determines that it may depend on information and experience. The learnt experience of people can affect positively to creativity in terms in which it is a way to think broader and put together different concepts learnt through the realized experiences, but also it can have a negative impact as a mental block to one's thinking that keeps one from finding new and original ideas. Considering this situation, sometimes it is better to be a novice in a certain field in order to think out of the box and catch new ideas (Runco M. A., 2006). The main advantage that experts have over novices is that they have learnt and often automatized a large number of task-related procedures (Sternberg & Lubart, 1991). In conclusion, it is important to have a great deal of knowledge on specific topics, but it can be seen that the expertise is also related to knowledge, which would also have a breakpoint where experts can no longer think creatively because they are already so enclosed by the limits of what they know, that a person who does not have the same knowledge, called a novice, can solve easier problems faster and proposing to take risks, while the expert would seek to answers to each situation without taking risks.

Talent and technical skills

Talent is given by the skills that people have. In this case, talent is referred to the creative skills of people which can make improve creative abilities and behaviours. Talent is related to experiences in the way in which for people who do not have the experience to fulfil their creative potential or do not exercise their creative talents is more difficult to

generate new ideas or opportunities. The talent is the combination of nature potential - biologically genes- and nurture potential -experiences- (Runco M. A., 2006).

Talent has often been used interchangeably with the term genius. A genius can be someone with high intelligence or high creativity for example. There are assigned four properties to talent. First, the talent can be transmitted by genetic structures, hence it is at least partly innate. Second, its full effect may no evident at an early stage, but there will be some advance indications, allowing trained people to identify the presence of talent before exceptional levels of mature performance have been demonstrated. Third, these early indications of talent provide a basis for predicting who is likely to excel. Fourth, talents are relatively domain-specific. The impression of studies is that both genetic and environment contribute to variation in talents (Vartanian, Bristol, & Kaufman, 2013). Creative thinking is an element of talent in people. Through talent it is possible to assess, observe and document the factors involved in creative thinking, people are born with this talent and if they nurture it then that it will have a greater potential, so when training a characteristic of creativity gifted, it will be even more powerful than any other which has not been a dowry to the person (Treffinger, Young, Selby, & Shepardson, 2002).

Regarding technical skills, it can be emphasized learning. Learning capacity generates perception, understanding, thinking, and behaviours in different ways. There are two types of psychologies that study learning, behavioural and cognitive.

Behavioural psychologists: it focuses on the learning of classical conditioning and operant conditioning.

- Classic conditioning: it is associated with events that occur around us (environment) such as smells that can lead us to think that it is what happens. Pavlov's theory was one of the great discoveries that developed this type of conditioning. When one is able to perceive signals and from these signals then able to know that an unconditioned stimulus or action will occur. So, what is proposed is that through a conditioned situation an unconditioned occurs.
- Operant conditioning: it is associated with our behaviour and the consequence that this can make in the environment. It depends on how we adapt to the situations, those situations that do not leave us satisfied make us change our behaviour, while those that leave us satisfied are those that make us act again in that way in the future.

Cognitive psychologists: it is based on a complex type of learning that involves the memory of the human being, how to collect and store information, and then use it when is necessary. Cognitive learning is divided into latent and observational learning.

- Latent learning: the learning is not demonstrated until an incentive.
- Observational learning: learning and imitation of actions of other people.

In conclusion, talent and technical skills are necessary for creativity. As well as people must have an equilibrium between what is natural and acquired, taking into account that what is natural can be further developed through technical skills where a reference was made to learning, and where creativity can be a talent that could be improved by learning (Griggs, 2012).

2. Creative-relevant skills

The more creative people are, the more they reveal an openness about their feelings and emotions, sensitive intellect and understanding self-awareness and wide-ranging interests. Creative people tend to have a clear preference for uncommon situations. The personality and cognitive style are expected to affect the creativity of individuals by influencing the extent to which they apply various strategies that may facilitate creative idea generation. For example, individuals with certain personality characteristics should be especially effective at recognizing problems or at combining new information, which may enable them to produce more creative ideas (Shalley, Zhou, & Oldham, 2004).

Personality traits

Personality can be defined as the performance of individual behaviour in relation to the control of the emotional and psychological feelings of individuals (Hsieh, Hsieh, & Wang, 2011). According to Richard A. Griggs (2012), personality is defined as a *person's internally based characteristics, ways of acting and thinking called personality traits*. Some personality traits support creative behaviour as autonomy, self-confidence, intuition, attraction to complexity, independence of judgment, ability to solve problems or conflicts, broad interests, high energy, persistence, and curiosity. People with these personality traits aim to think creatively and generate new ideas to contribute with innovation within organizations (Woodman, Sawyer, & Griffin, Toward a theory of organizational creativity, 1993). Each trait goes from one end where there is a characteristic of the behaviour towards another end where the opposite of this characteristic is placed. These trait dimensions are the building blocks of personality in people, where each one has different traits that lead to it. But what does they come to be different? There are several theories that reflect the study of personality. But there are four major groups to study: these theories study different components and characteristics that make each person's personality:

- Psychoanalytic: it is the personality development that is given by experiences from childhood and unconscious forces. Freud, in this case, presented a theory which concludes that the personality is divided into three levels of awareness, the conscious mind which makes reference to what people aware of, the preconscious mind that is all information that is contained in the brain and a person without being conscious can access, and finally, unconscious mind that is the part of the mind which people cannot access and cannot become aware of. The latter is important and contains impulses of life and death and it is the first to act on people's feelings and actions. Besides, it is presented in this theory that there are three parts in the structure of the personality in which there is the id that contains instinctive impulses, then the ego that is responsible for managing the personality of people and the superego that contains the sense of morality, getting from the external environment. These levels and parts of people's minds work together to seek the solution of problems and to show satisfaction in people.
- The humanistic approach to personality: it is based on the personal growth motive. This humanistic part of psychology is based on personal growth and it is what makes a person unique, concentrating positivity in the performance of actions, increasing the level of motivation necessary to reach this satisfaction. To better understand this approach, it can be explained the theory developed by

Maslow, the father of the humanistic movement. Maslow sought healthy and creative people for his study. He proposed how people should reach their one's full potential and built a tool more than anything that involves motivating people to reach their full potential through a hierarchical pyramid of needs. The pyramid base is based on the psychological needs, those that are essential for living and basic, however, as the needs progress they become more human and less basic. The second step is safety, feeling out of danger, or at least moving away from scared situations or are not within people's comfort zone. The next step is love and belonging, the need for people to feel loved, accepted, to belong to a group of society. Then, there is the self-esteem which involves confidence in oneself, being able to develop a positive image of individuals and to gain appreciation from others with achievements reached. Finally, there is self-actualization, the level where the person reaches his full potential. People who reach this level tend to be independent, autonomous, creative. Although this theory is still studied, many psychologists focus on the study of self-actualization (Griggs, 2012). Maslow's theory explains a key driver related to creativity which is the tendency to change. The pyramid is directly related to creativity in the sense that the top of the pyramid can be linked to people who are distinguished from others by having a special talent for creativity, i.e. relates directly to the concept of creativity. The five steps can be grouped into three main categories: self-fulfilment needs for the top, psychological needs for the third and fourth steps and physiological needs for first and second steps. The category which involves the top of the pyramid is considered transcendental creativity because it is referred to the realization of talent or potential that a person has. But then we move on to needs focusing on other people, giving rise to the second level, which involves the psychological needs, that is social creativity in which creativity solves problems of esteem and desire. And at the bottom level, which tends to cover physiological needs, there is functional creativity (Cropley A. , 2006).

- Social cognitive: it is based on the importance of the thinking process and interaction with other people. It explains the development of personality through the social inclusion of people, and how they learn from the environment, including social and cognitive factors, although these external factors are influential, researchers consider that the person is who builds it own personality. This approach can be better explained following Bandura's self-system. Self-system is the set of cognitive processes by which a person observes, evaluates and regulates her or his behaviour. Many times, people learn actions from what they see around, many times concluding to their own positive conclusions or not. Bandura's theory also proposes how people judge their behaviours compared to their own standards. This is based on self-efficacy which is a judgment of one's effectiveness in dealing with particular situations. People with high self-efficacy tend to be positive and self-confident, they are able to be more successful and work to achieve their goals (Tierney & Farmer, 2002).

- Trait: it emphasizes the role of basic personality dimensions. Different types of personality are measured through tests that can cluster people into the diverse kind of personality dimensions that exist. Theories that are based on traits approach of personality tend to search through statistics and analysis of certain factors which and how many are the necessary traits to describe the personality of a person. Traits researchers discovered through a lot of studies that there are

only five traits needed to describe personality, which makes it much easier to cluster people. It does not mean that all people are equal and those in the same group always behave in the same way, but that they tend to behave under certain situations in a fairly similar way. Even so, people can have a greater or lesser percentage of these five traits so that is what also defines their personality. These five characteristics were defined by factor analysis and arisen from a more complete theory than the general theory that Eysenck defined, who only defined three types of aspects which he believed were sufficient. Even so, in order to demonstrate the performance of those tests showing the clustering of people into the five traits, including a greater explanation about each one, the focus will be on two main tests. These ones are validated, i.e. they have been used a lot of times to know that the results are valid for all people. For this reason, these two tests are the most used.

First, the Eysenck three-factor theory will be described. As stated above, Eysenck conducted studies following an analysis factor, which deduced that the characteristics are divided into three dimensions: extraversion-introversion, neuroticism-emotional stability, and psychoticism-impulse control. He proposed that these three traits are determined by heredity. Extroverted people are gregarious, they have many friends, they are sociable people. Introverted people are those who do not like being in society, shy. Extroverted people generally have developed another part of the mind that is what makes them feel good, satisfying learning and sharing with other people. The neuroticism dimension makes people anxious, emotionally unstable and depressed, while emotional stability makes people more patient, calm, with positivism. The psychoticism dimension is concerned with aggressiveness, antisocial behaviour, lacking in empathy, impulsive, while impulse control is the opposite. Once analysed the theory of three traits, the researcher realized this theory was incomplete. In order to make a more accurate theory related to the personality of people, the Big Five or the Five Factor Model of personality was developed. These five dimensions are openness, conscientiousness, extraversion, agreeableness, and neuroticism. The test will be better explained in the chapter of tools, where the definition of each dimension will be also given in the following chapter.

In addition, researchers argued that some people are born with creative skills more developed than others, and taking into account this it can be explained the difference between intelligence and creativity:

- Intelligence is not quite related to creative behaviour, but even so, it is believed that if different types of intelligence have to be taken into account for a person to develop in a creative way.
- Personality based on openness, risk-taking, and flexibility are the skills that symbolize creative people.

The definition of each one of these four approaches developed the importance of knowing the personality of a person in order to know how their behaviour is related to creativity. Nonetheless, the trait approach and social cognitive are those more related to creativity, and with which ones can be reached a greater understanding of creative personality (Griggs, 2012). Although, communication is one of the most important characteristics of the personality of an individual. The ability to solve problems, to communicate new

ideas, to listen and learn about others in order to gain knowledge and thus being more prepared to affront difficult situations are part of the personality, for this reason, it should be analysed in the best way. Individuals that present initiative, independence of judgment, flexibility, openness to experience, persistence, self-confidence, tolerance to ambiguity, disposition to take risks and to learn from mistakes have greater chances of taking advantage of opportunities to express and develop creative ideas (Mumford, 2012). One personality attribute associated with creativity is the tolerance of ambiguity. Sometimes, there is a period in which an individual is trying to figure out a problem. In this period, the individual feels anxiety and nervousness because the problem is not solving itself with a creative idea. So, they need to be able to tolerate this ambiguous situation and to solve creatively the problem. Another personality attribute associated with creativity is a willingness to overcome obstacles and persevere because some people live experiences that make them think creatively than people who grow up under circumstances where everything goes right. Then, there is the willingness to grow through openness to new experiences overcome it the society or other circumstances approve the new idea, threatening the status quo. They tend to take risks and to go beyond limits, experiencing the unknown (Sternberg & Lubart, 1991).

Cognitive style

The cognitive style involves flexibility, fluency, and originality of ideas, in addition to analytical reasoning. It is mostly related to the solution to problems and the generation of new and novel ideas. The perspective is on how people express themselves using their own creative capacity (Mumford, 2012). Cognition is the cognitive process that starts from experiences, recognition, perception, and reaction of an unusual situation by searching in memory of individuals considering similar situations. The creative behaviour of humans is based on cognition. The cognitive process is quite related to the mental process in terms of psychology, involving factors as attention, perception, information processing as also is linked with intelligence, problem-solving, thinking, languages (Runco M. A., 2006). Going deeper into this process, there are found four main areas:

- Insightful problem-solving: throughout studies and researches was found the manner in which ideas arise from the incubation period.
- Creative cognition: cognition is related to the generation of novel and new ideas. The key element of creativity.
- Expertise acquisition: the creative ideas that people produce are based on the knowledge acquired and the full use of the skills that the person has. A person not only has a good idea without first living experiences and learnings from which they may have acquired information that may become a novel idea.
- Computer simulation: it is based on the way in which computer skills can be used to solve difficult problems but in a creative way, being able to verify if the information is reliable and valid or not.

Creativity is a cognitive ability which requires knowledge, thinking and intelligence factors that are linked to cognition. First of all, understanding what is known is something innate but knowledge is acquired over time and provides the basis to apply intelligence to allow a better way to solve problems. Knowledge is a key driver for people and it is defined as an intangible asset, considering that the potential of its capacity is

limited since it can be created, reproduced and shared due to the synergies it presents, provided that knowledge is transferred or shared. The second aspect of cognitive abilities is thinking. It is a consequence of cognitive and reflexive processes based on both observation and experience and the mental process that helps the production of ideas. There are two kinds of thinking, one is a source of innovation and has a logical character (convergent thinking), and the other is a source of the invention related to creativity (divergent thinking). Finally, thinking gives rise to intelligence, which is the ability to choose between options (AECA, 2014). Idea production has as a main driver the cognitive abilities that are directly related to creativity. Cognitive abilities can be identified through different factors which are fluency, flexibility, originality, and elaboration (Woodman, Sawyer, & Griffin, Toward a theory of organizational creativity, 1993).

Besides, cognitive style is related to metacognition. This last concept refers to individual control to monitor their actions and involves the intentional actions taken by humans to enhance one's own creativity. Metacognition is the basis for any tactical and strategic creative efforts. The strategic effort is the determination of basic long-term goals involving the adoption of actions and allocation of resources necessary to carry out the goals. On the other hand, the tactic efforts are specific processes for dealing with a particular situation (Runco M. A., 2006). The early theory of cognition relates the creativity with cognitive style and the proof of this relation was carried out by Kirton's Adaption-Innovation theory which has a natural orientation or a preferred means of creative problem-solving. On one hand, there are the adaptors who seek to develop situations within given procedures without verifying their validity. On the other hand, there are innovators who are more willing to take risks of violating the agreed-upon way of doing things in order to develop problem solutions that are qualitatively different from previous solutions. The theory emphasizes that creativity behaviour is more outstanding in innovators than in adaptors (Shalley, Zhou, & Oldham, 2004). From a more cognitive perspective, there are also techniques that aim at improving creativity-related skills by providing specific problem-solving strategies or by activating existing knowledge. These ones are a way to improve nurtured creativity in people (Vartanian, Bristol, & Kaufman, 2013).

Moreover, cognitive psychology studies the levels of information processing and aims to specify the main components with which some people think in a more advanced way than others. The situation is not related to the amount of knowledge but the ability to apply it differently, because of the focus on novel tasks (Vernon, 1989). Nonetheless, as it was said above, cognition is quite related to thinking, for this reason, it will be defined deeper by this factor. Thinking is about solving problems with information recorded and be able to make decisions. It is considered as part of the cognitive process. The problem could be presented clearly with all the states specified, well-defined, or not so clear, called ill-defined. Problem-solving can be divided into two steps:

- Interpretation of a problem: a problem can be interpreted in diverse ways by people, but always seeking the best solution. Not all people have the ability to think out of the box and develop or build novel interpretations of a problem. These people try to solve problems following the instructions so closely that they cannot imagine other ways to solve problems. But some people have the ability to think beyond the instructions, following rules, but solving problems showing

novel ways to interpret problems. These kinds of people are called creative thinkers.

- The solution of the problem: sometimes people seek to solve problems in the same way that past solutions were solved, hoping they have the same level of success, something that does not always happen since not all situations behave in the same way. For this, solutions should be thought creatively. Problem-solving strategies can be given through algorithms, which are based on a step-by-step process, which must be performed correctly in order to obtain the correct answer. Or heuristic methods, which there is no procedure to follow, is based on experience or knowledge, with the problem that it may not give us a correct answer, it is only based on facts, not on analysis.

In conclusion, the cognitive style is the motor of creativity behaviour on people. It is the process to generate novel and new ideas through the utilization of knowledge, thinking, flexibility, fluency in order to produce distinguished solutions through diverse and novel ways to interpret a problem (Griggs, 2012).

3. *Intrinsic task motivation*

The motivation resource deals with the driving forces behind the creative performance. Motivation consists of everything that is involved in the achievement of objectives, as well as internal or external factors, being situations, people or people themselves who lead to motivation. It can be interpreted as the needed feeling to be able to perform an action with which after performing this, people involved in motivated situations feel satisfied and fulfilled. There are two types of motivation. Amabile (1988) argued people who engage in activities because of their own interest or personal sense of satisfaction and fulfilment are intrinsically motivated, whereas people who engage in activities to achieve some external goal are extrinsically motivated. For instance, money is considered an extrinsic motivation for financial invests, whereas the achievement of one's potential is intrinsic motivation. The intrinsic motivation for individuals is an important driver for creativity. It is considered a key factor that has a greater impact on creativity (Jaussi, Randel, & Dionne, 2007). Below there going to be explained those two types of motivation:

- Extrinsic motivation: the motivation of people is referred to as external reinforcements which one is obtained by the performance of certain behaviour (Griggs, 2012). Extrinsic motivation is based on the extent to which a person is encouraged for external outcomes to pursue goals (Shepherd & Patzelt, 2018). Sometimes rewards and evaluation systems can impact negatively intrinsic motivation as they make the following technical and rule-bound aspects of task creativity performance. Sometimes, monetary rewards given for performing a certain task can increase creativity in individuals. In other words, when a person is motivated to do a task and perform it creatively and, at the same time, this person agrees that this development will be rewarded, then creativity can increase. But if a person who performs a task that is not to liking to this person, the only motivation that can be given is monetary rewards, and it is not assured that this task will be performed creatively (Woodman, Sawyer, & Griffin, Toward a theory of organizational creativity, 1993).

- Intrinsic motivation: the motivation of people is based on the achievement of their own goals, where the feeling of accomplishment is the most important factor (Griggs, 2012). The important motivation for creativity is task-focused, the focus is on reaching the desired goals (Sternberg & Lubart, 1991). There is empirical evidence that demonstrates creative performance is directly linked with a high level of motivation, especially of intrinsic nature in creative work (Mumford, 2012). Intrinsic motivation refers to the extent to which an individual is excited about a situation and seeks to engage in it. Scholars argued that individuals are likely to be most creative when they undergo high levels of intrinsic motivation since such motivation increases their tendency to be more curious, cognitively flexible, risk-taking and persistent in overcoming barriers. These factors should facilitate the development of creative ideas (Shalley, Zhou, & Oldham, 2004). Creative motivation is necessary for innovation which can be enhanced by rewards as motivation is close to personality traits impacting creativity, in other words, the creative personal identity is directly related to self-motivation (Jaussi, Randel, & Dionne, 2007). Hence, proposed goals help in the organization of intentional behaviour and the performance of creative actions doing by individuals following an inner motivation. Creativity does not influence the person if the person is not able to pursue own motivation to achieve own goals in a creative way. Motivation is related to the manner in which people work, in terms of interesting, enjoyable and unthreatening (Ford, 1996). It is related to four factors. First, the self-enhancement recognition which aims at gaining successfully social status and recognition by society. Then, there is the openness to change referred to find learning stimulating and enjoy using their intellectual capabilities to create innovative products. People with this characteristic are likely to receive greater satisfaction by exploring new ideas. Thirdly, the self-transcendence value is aimed to move individuals beyond self-centered interests toward bettering other people's lives to beneficiate them. Finally, the conservation value which tends to prioritize stability and persistence in new projects (Shepherd & Patzelt, 2018). Passion is the most important driver in intrinsic motivation, it increases the level of energy to perform tasks that are truly desired. Putting the best of oneself into play to reach that goal.

Once these concepts are differentiated, it can be stated that the intrinsic motivation is one that is more related to creativity, since extrinsic motivation sometimes tends to decrease creativity in people, since they focus more on rewards and evaluations and not in what they really want to pursue and achieve in their lives to feel satisfied and more energetic, also to be able to continue developing creative ideas, just because they want to do it and not needing external factors that encourage this. However, if complete success has been achieved, there will be no motivation to undertake exactly the same task again because it has been completed. When people succeed in the achievement of a goal, intrinsic motivation increases. On the other hand, if complete failure has occurred, intrinsic motivation decreases. The intrinsic motivation principle of creativity argues people will be most creative when they feel motivated primarily by the interest, enjoyment, satisfaction, and challenge of the work itself. In other words, people who are primarily intrinsically motivated will be more likely to generate truly creative ideas than people who are primarily extrinsically motivated. If a person begins with low intrinsic motivation in work, the extrinsic motivation should provide at least some motivation to carry the workout, but when a person begins with high interest in work, this person will

challenge his or her own in order to reach the own goal. This person is more prompt to keep own intrinsic motivation under all but the extreme extrinsic circumstances (Amabile, A model of creativity and innovation in organizations, 1988). The well-being of people is important to determine because it is directly related to how a person can develop own behaviour in terms of self-acceptance and self-confidence, extroversion, autonomy, personal growth and purpose in life. People are more likely to innovate when they reach a positive level of motivation in their projects. Some researchers have argued that as extrinsic as intrinsic motivation can increase not only the ability of people to generate new opportunities but also those opportunities with a high level of innovation (Shepherd & Patzelt, 2018). When individuals are motivated to make real their new ideas in order to obtain rewards but not in a monetary sense, but in the way in which they feel that they are contributing to the society a better product, services or process which can change people lives and make them feel comfortable and happy. The feeling of being innovative when they are motivated to lead reaching their well-being. It is directly related to the level of stressed and frustration of people as the greater the motivation and well-being people have, the lower the level of stress they will present (Chau, Zhu, Shen, & Huang, 2018). For instance, there is a kind of motivation in which people want to develop new ideas when they feel the need to help people with disabilities. This kind of motivation is called prosocial motivation and is related to the cognitive process where a person seeks to make a difference in a charitable and helpful way to other people. There are people who for some reason have suffered a change of identity, in their way of thinking, of believing, of acting. This could happen because of some trauma suffered or because of situations in which they leave their comfort zone. In these situations, they have been developing new abilities or ways of thinking to be able to confront this challenge, which leads to having an innovative personality.

According to social psychology, people interact with another to achieve some goal or satisfy some inner motivation, they want to reach goals that can be associated to rewards and how a person's mental processes connect to changes in the social situation when people are in contact with outside situations (Neuberg & Cialdini, 2006). Studies show the importance of the intrinsic motivation over extrinsic one, because of the comfort and new functionality that innovators try to find in the development of an innovative product or services or process in order to make use of them, and not just for earning money. One strong factor of motivation is passion which is related to the self-determination theory. This theory argues that people encounter three types of needs when they have to face decision-making situations. These three types are the need for competences, the need for relatedness and the need for autonomy, which ones can be controlled or autonomous. The controlled motivation concerns the pressure to act while autonomous is related to the voluntary participation of individuals to make decisions.

4. Social environment

The analysis of the social environment is referred to how an individual perceives the creative environment that surrounds it, considering the creative personality skills of a person and the relation between this person and the creative environment (Jaussi, Randel, & Dionne, 2007). Creativity emerges from the interaction between the domain, field, and individual, where the social environment has a greater impact on the field and domain. The environment influences the creativity of people through factors such as autonomy, effective leadership, adequate resources, a favourable environment, and an

adequate rewards system. Those characteristics that negatively affect creativity are the lack of freedom, lack of time and resources, bureaucracy and the existence of competition. Therefore, the presented creativity in a place does not depend only on individual creativity but on how well disposed of the fields and areas are for the recognition and diffusion of novel ideas (AECA, 2014). The creation of an accurate environment is needed for innovators in order to help them to come up with new ideas, take risks and think in a positive way, making them feel happier, more motivated and putting all their effort to make things well (Wellner, 2015). The social environment is referred to as the surrounding environment of individuals or work environment. Amabile (2012) and Shalley et. al. (2004) agreed in the theory that research in organizational settings has revealed several work environment factors that can block creativity such as political problems, emphasis on status quo, low risk-taking and conservative top management and an excessive time pressure which will have an impact on stress on people. But other external ones can improve the creativity as diversifying work teams and collaborative, idea-focused and freedom in carrying out the work, managers who communicate encouragingly the vision and cultures to achieve the goals of the company and norms of actively sharing ideas through the organization, sense of positive challenge in the work (Amabile, Componential theory of creativity, 2012). Creativity is influenced by the environment which helps to the continuous research of novelty ideas, considering the intrinsic motivation because of the originality, singularity, flexibility, optimism, and determination about the context in which it is developed (AECA, 2014).

To enhance creativity, people should not focus on past routines or experiences, and they should not think about automatic behaviours. The interest for the new is the main force to generate creative ideas, thus the social environment has a greater impact because it needs to change constantly in order to be in continuing update and not being always the same. People are not the only ones who have to deal with changes, but the environment too in order to encourage creativity in people (Runco M. A., 2006). The change is produced by the diversity in solving problems, not producing always in the same way. The change in environment causes a change in the minds of people, for this reason, it is an essential factor for creativity. Creative personal identity represents a stable identity construct which shows an impact through situations and different environments at work because individuals are engaged in behaviours that reaffirm the creative identity. It can be said that individuals tend to seek out opportunities to be creative at work because creativity is part of them, they demonstrate a sense of well-being at work because of their satisfaction of career identity that is referred to the personal identity related to one's career (Jaussi, Randel, & Dionne, 2007). In order to be creative, the environment should encourage the person to be able to think novel ideas and make easier the way in which the person can be curious. It is important to have good connections, a place with positive energy (Csikszentmihalyi, 1997). The environment is important as well as teamwork to overcome the fear of failure, which could be related with shame, lack of self-confidence, fear of future or to lose social influence because the fear can make people start doubting about their knowledge and abilities to successfully undertake tasks (Shepherd & Patzelt, 2018). Therefore, creativity is not only within an individual but also that it has to do with the environment in which the individual is placed. That is why it was argued that it is difficult to be able to make tools that can measure 100% creativity since many researchers have tried to investigate what characteristics and qualities spaces should have to foster creativity in people, but they are never the same and are complicated studies to perform, but what has been noted is that the motivation that can be generated

in society is a characteristic that fosters this potential, as well as the number of resources and works under pressure (Simonton, 2000).

The environment includes school, homes, cultural influences and the state of knowledge. All of these factors impact creativity, as creativity in these environments is nurtured. Creativity is subjectively evaluated, considering that the generation of creative ideas differs from one environment to another one. It can be explained three situations which are relevant for creativity. The first one is that the environment helps to the production of new ideas, for instance, studies made with children resulted in high creativity when the room where they developed tasks was full of colour and objects. Secondly, creative ideas are nourished in an environment which encourages creativity. And the last one, the environmental context helps with the evaluation of novel ideas. Schools and homes are considered environment context to generate ideas, in both places the creativity can be nurtured in children or adults because of the stimulation of creativity that the environmental context generates. Most of the nurture creativity characteristics in people are related to the social and environmental context (Vernon, 1989).

2. Other factors

These factors are not involved in the Amabile's model (1988), but making the research through other bibliographic sources, it was observed that these factors also influence on creativity and, therefore, in innovation.

<u>Culture</u>

The innovative culture begins with children with the incentive and learning to create novel ideas that bring them pleasant consequences to society. So, it is all about inspiring people to think out of the box (Csikszentmihalyi, 1997). Over the years it has been noted that there are differences in people's personalities and behaviours who come from diverse countries, but at the same time, they can be clustered according to similar characteristics. One of the cases is the gender difference, where the woman is shown to present neuroticism, extraversion, agreeableness, and conscientiousness while men present openness to experience. This phenomenon does not occur always, it depends also in the culture of each country, where maybe women do not have room to express themselves or in countries not developed yet where men are prone to feel more pressure, they tend to take more risks and be socially dominant while women tend to be cautious. Nowadays, the difference is not noticed as much by how society has evolved, leaving room for women and equality (Costa, Terracciano, & McCrae, 2001). Besides, the national culture has an impact on innovation. For instance, South Africa aims at having more people involve in achieving new solutions and ideas to solve current problems, they do not look at the change as a threat because they need it to survive. Nonetheless, Chinese people will look for stability, they think that if ideas are going well among years, they would remain over time, instead of changing them. It is not always like this, because innovation is related to creativity and creativity can be nurtured by knowledge, the knowledge is at a high level in developed countries (Janssen, Van de Vliert, & West, 2004). The same situation occurs with resources because creativity needs resources to be reached, but resources are more achievable in rich countries. Therefore, there exist opposite situation, where individuals can be more creative in no developed countries because they need to be creative to survive, but as it was said among the report, creativity

is the interaction with the domain, field, and individuals, and if the field and domain are not creative so the creativity cannot reach high levels.

To better understand how innovation in people behaves and how their culture is related to, the five dimensions of Hofstede should be explained. The theory involves how different values impact on behaviour of people. The first dimension is the power distance index which measures the acceptance degree of unpowered people in relation to richer ones. In cultures where there is a little distance to power, this power aims at being more equitable and intends to grow in fields as education, economy and so on. Government bases on the power distance to carry out innovation in his or her country. Secondly, the individualism vs collectivism measures the level at which individuals are integrated into society and the feeling of belonging to the group. When the level of this parameter is high means that people aim at being more individual and to seek their satisfaction and comfort. Countries as the United States, Australia or England are in this category. Thirdly, masculinity vs femininity where female values are more likely to be similar between different cultures than male ones. In cultures with a high level of masculinity, society tends to be more competitive and assertive. Fourthly, there is the dimension of long-term vs short-term orientation. The long-term orientation aims to societies with a propensity to save and persevere as China, Japan, and Korea. On the opposite side, the short-term orientation incentives to spend money and the status of members of society is really important if people can take advantage of their power. They are more traditionalist and concerned about social obligations as Spain, the United State, and England. Finally, the most important dimension of this study is uncertainty-avoidance. It is the extent to which a culture deals with society's acceptance of uncertainty and ambiguity, in other words, the uncomfortable or comfortable feeling of people in front of unstructured situations which are totally different from the usual ones. When this parameter is high, countries will not take risks and avoid unstructured situations. These kinds of countries are more emotional and want their stability and security. Russia, Japan, and Greece are less close to innovating. In contrast, other countries tend to be more reflective, tolerant and relativistic. The unstructured situations are accepted by them and take decisions in a more flexible and relaxed way, so they aim at innovating more (Hofstede, 2001). A survey-based study was made to obtain empirical evidence of the relation between national culture and national preferences for innovation strategies where leaders of organizations were interviewed. The leaders are who produce innovative ideas and make the rest of the people in charge follow them in the achievement of goals through these ideas. To analyse the cultural relationship that impacts innovation, the three dimensions that are most related to innovation, developed by Hofstede (2001), will be studied. These three are power distance, individualism, and uncertainty-avoidance. The hypothesis about the individualism and collectivism dimension is to analyse how nations will behave in these aspects of the dimension. Countries which aim at being more collectivist, prefer cross-functional support for innovation effort. Moreover, countries with high power distance of a society tend to seek leaders who are working closely with those in authority to approve innovative activities in an easier and faster way, thus supporting innovation effect. The last hypothesis about the third dimension is that the higher the uncertainty avoidance of society, the more people will prefer to ensure champions work within an organization's rules and standards operating procedures to develop the innovation. In conclusion, the results could confirm the hypothesis about power distance and that uncertainty avoidance is also related to autonomy from organizational norms and procedures. The collectivism hypothesis also was confirmed

(Shane, Vcnkataraman, & MacMillan, Cultural differences in Innovation Championing Strategies, 1995). There is also a relation between Hofstede's factors and Big Five model in terms of correlation among them. For instance, a country which can be defined as individualist correlates with its average extraversion, whereas in countries with a higher power distance the score of conscientiousness is higher. Then, in countries with a high openness in terms of experience and problem-solving tend to have more democratic institutions (Barcelo, 2017).

Frequently, innovative ideas are conveyed by a team of people who present different cultures, knowledge, skills in order to succeed in their innovation. When the diversification in a team is high, the team is more likely to achieve innovation effectively because they will know how to utilize the potential of their diversity, keeping good communication between them (Hackman, 2002). Likewise, countries, where the level of collectivism is high, tend to be more motivated to innovate because of the contribution of many people who help to make them choose the right direction. The rates in innovation change because of the different cultures in countries. The innovation depends on how people are prepared to encourage innovation which leads to change, driven by economic and societal conditions and not just by increasing the money spent on R&D or infrastructure. Another issue that affects the innovation rate is the per capita income because it increases when nations become wealthier. The reason is that wealthy nations have a greater demand for new goods (Shane, 1993).

Entrepreneurial behaviour

Entrepreneurial behaviour presents a competitive advantage in offering knowledge and opportunities and using them to get novel products in order to reach this competitiveness in the market. The entrepreneur can be defined as a creative person, innovative, flexible, dynamic, facing risks and putting all own effort on work, always adapting to new environments, seeking for new achievements out of the routine with an intermittent search of changes and own satisfaction. To analyse entrepreneurs, it is necessary to know the characteristics in their personality as are their self-confidence, independence, responsibility, tenancy, perseverance, a vision of the future, personal and professional growth, among others. As can be seen, these characteristics are quite similar to the innovator ones because they have similar competences, the only important difference is that entrepreneurs tend to isolate themselves while innovators can innovate and work individually or collectively (AECA, 2014).

Entrepreneurs are likely to see new opportunities where other people do not, through their knowledge and ability to perceive the unsatisfied needs of people, tending to solve problems or develop ideas that are not usual. It can be made the comparison between entrepreneurs and inventors where the first ones are likely to carry out with new and creative ideas to satisfy people's needs just with existing objects but giving them a new meaning, while inventors create a product for the first time. This is the main difference between them and what makes entrepreneurs be part of the field of innovators, as well as innovators differ from inventors. Entrepreneurs have two crucial characteristics which are the distinctiveness which would be referred to the innovative behaviour in which a person seeks to have a performance that differs from the rest and get a more leadership attitude and demonstrate as unique, and the second is the belongingness which can develop a negative aspect in the well-being of people because it tends to make them always wanting to act as others want in order to be able to belong to a certain group. This

situation can lead to stress, which negatively affects the motivation in people to undertake new changes or generate opportunities. Some researchers have argued that there is a conflict between distinctiveness and belongingness because the first one is referred to the differentiation from other and the second to the inclusion into a larger social collective. The distinctiveness is the tool to get optimal well-being because of the feeling of satisfaction and comfort when a person makes the difference between others, but a higher level of it is not always good because sometimes a person could start to feel lonely and lose self-confidence which leads to stress. This situation can be represented as a U-inverted shaped curve as it is depicted in figure 4-6-3.
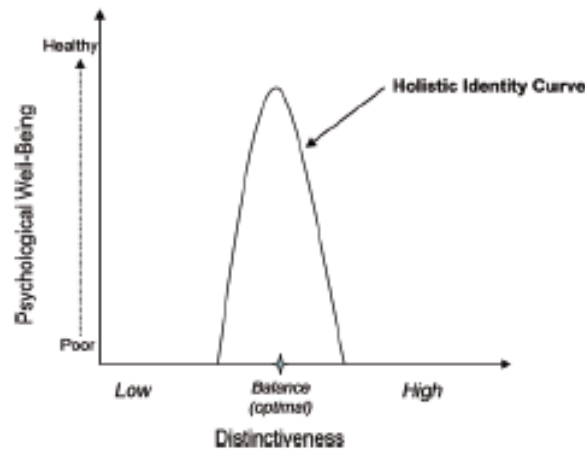

Figure 9 Entrepreneurial identity of an individual (Shepherd & Patzelt, 2018)

At the optimal point, there is a balance between distinctiveness and belongingness which leads to the optimal well-being in a person, reaching higher levels of motivation and work progress.

In conclusion, entrepreneurs have similar characteristics to innovators but they differ more than anything in that they do not need to be part of organizations that encourage them to perform tasks, but they themselves, as they have a very high intrinsic motivation are able to achieve their own goals creatively. They are able to see businesses where other people without these entrepreneurial characteristics cannot see. So, if a person is an entrepreneur, they are more likely to develop creativity at a very high level compared to others (Shepherd & Patzelt, 2018).

7. Models to measure creative behaviour

Once the factors that impact creativity were explained, as well as the componential model of creativity by Amabile (1988). It should be noticed that there are other models that support the Amabile one. The report will focus on two important models. The first one is the model developed by Treffinger et. al. (2002), who argued that creativity can be measured by the factors of cognitive skills, personality traits, and motivation, showing in which way he made a study in order to make the model reliable. The second model was developed by Anderson et. al. (2014) who argued that within an organization there are four main levels to considerer in order to carry out with creativity inside it, these levels involve each other, in the sense that the model begins with the explanation of an individual aspect and he moves further in order to understand how the individual and

the external environment should be related to reaching creativity within the organization.

Treffinger (1988,1991) built a model to recognize creative potentials. He proposed that creative productivity arises from the dynamic interactions among four components: characteristics, operations, context, and outcomes. Based on these factors, three important attributes can be noted. First, creativity refers to an attribute of a product presented by an actor, the concept of a creative product can be thought of as the examination and judgments that people make, including communicated ideas and processes judged independently from outcomes they produce. Second, creativity is a judgment made by members of the field about the novelty and value of the new product. Third, creativity assessments are domain-specific, they may change over time as a domain evolves by retaining creative actions. Following these insights, creativity could be defined as a domain-specific, subjective judgment of the novelty and value of an outcome of a particular action. In order to go deeper into the understanding of how to measure creativity, it will analyse a framework in which will be explained the main characteristics to have into account in order to understand the application and results of creativity measurement tools. Operations involve the strategies and techniques people employ to generate and analyse ideas, solve problems, make decisions and manage their thinking. The context is referred to the culture, climate, situational dynamics as communication and collaboration, and the physical environment. The outcome is related to products and ideas that result from people's efforts. Individuals, fields, and domains of an organization help with the definition of creativity in terms of that actions and outcomes should represent the target of assessment, the field represents the domain which should deliver these assessments and the domain should provide the basis for assessment of creativity. Creativity characteristics vary within different people, they can be nurtured or be nature, but always with the possibility to improve them. People's characteristics are clustered into four categories:

- Generating ideas involve cognitive characteristics of people as divergent thinking, metaphorical thinking, considering fluency, flexibility, and originality. The generation of ideas is about the development of the ability to transform a common thing into a novel one (Runco M. A., 2006).
- Digging deeper into ideas is based on convergent thinking and critical thinking. Analysis, reorganization or redefinition, evaluation, desire to solve problems and understanding complex situations are some characteristics of this category.
- Openness and courage to explore ideas is related to personality traits in terms of interest, experiences, attitudes, and self-confidence of people. The involved characteristics are problem sensitivity, aesthetic sensitivity, curiosity, sense of humour, playfulness, fantasy and imagination, risk-taking, tolerance for ambiguity, tenacity, openness to experience, emotional sensitivity, adaptability, intuition, and willingness to grow.
- Listening to one's inner voice includes traits that involved the understanding of oneself, intrinsic motivation, including awareness of creativeness, persistence, and perseverance, self-direction, internal locus of control, introspective, freedom from stereotyping, concentration, energy and work ethic.

The theoretical part of the creative behaviour of the model developed by Treffinger et. al. (2002) is going to be explained as it can help to develop a solution for the missing

methodology for companies. The model combines four data sources and four levels of the present performance. Firstly, the data sources explain the way to gather information in creativity, abilities, strengths, skills or potential of people.

According to Griggs (2012), there are three groups of tools of data collection generally speaking, where Treffinger et. al. (2002) emphasized the descriptive tools and divided them into four types of data sources. Nonetheless, descriptive tools, correlational tools, and experiment tools are the three main levels. The descriptive is the most used because people are analysed in their own environment in their comfort zone. They developed themselves as usually they do, so there is nothing manipulated and if they are able to generate ideas, it will be because they have creative behaviour and they usually behave like that, without forcing any situation. There are two main methods to use this kind of tool. If it is needed to divide into groups quite similar personality characteristics of people or to understand the personality concerning their natural thinking behaviour, then the most accurate descriptive tool to use would be the survey research. Within a survey, a large number of data can be grouped into few characteristics, for instance, it will be obtained that certain people of an age range tend to be more creative or be more prone to changes that people with larger age range. Otherwise, if it is necessary to know how a person develops in a certain area, even so without forcing their behaviour but only observing in their natural place how this person behaves, then the type of tools will be other because it is needed more detailed information. In this case, the observation method would be used within the descriptive tools, tending to visualize in a more natural environment and see how the person behaves. Both tools can be used at different stages, either first to group people that are of interest and then observe them and get conclusions, if that person can adapt to or not the emerging changes referred to innovation. The second group is the correlational or predictive tools. It aims at measuring two or more variables in order to know whether they are related. In this correlation, some variables can demonstrate whether they are positively or negatively related, or directly unrelated. They are used mostly to know possible causes of why a certain variable occurs. What should be clarified is that the correlation is seldom perfect, there are almost always certain exceptions that make the difference to emphasize that the correlation is not perfect. So, the prediction is not something of a 100% secure, but more than anything to have a hypothesis of what can happen. Using other types of tools that can lead to realizing what is the real cause of that situation that needs to be analysed. The experiment tool is the third and last group of tools. It is the most difficult tool to use and it is only efficient in cases where the person is required to demonstrate creativity in already adapted places and it is not their natural environment. It is a tool that is used for a period of time and which requires adaptation time. It is based on the manipulation of one or more independent variables in a controlled setting to determine their impact on one or more measured dependent variables. The data sources are the following:

- The behaviour of performance data: the data collection is through the behaviour of people in the current environment where they should apply problem-solving creatively.
- Self-report data: it is based on questionnaires that people can carry out by themselves. People answer questions freely expressing themselves by feelings, beliefs, attitudes and without being interfered with by nothing. But it has some disadvantages such as that people may show a problem much worse than it is, that they are not entirely transparent or honest.

- Rating scales: it involves instruments that provide specific descriptions of qualities or behaviours that describe creativity characteristics and ask people to rate the creativity of others.
- Tests and surveys: they refer to the person's answers to a structured set of tasks or questions, administered under controlled or standardized conditions, through which the person demonstrates his or her ability to think or respond to creativity.

There are four ways of classifying the level of development and expression of creativity manifest in the behaviour of a person or performance at the present time under certain circumstances. People change and grow, depending on the ability to acquire and accumulate knowledge in order to have a wide vision of future ideas.

The levels of present performance are the following:

- Not yet evident: the person's present level of performance does not reveal behaviours that are consistent with the selected definition of creativity. It does not mean that people in this category are not creative, just they do not have these creative characteristics developed yet. The level is about performance and it is related only with characteristics of creativity defined for the assessment.
- Emerging: there is evidence of creativity characteristics in the person's present performance. Creativity is beginning to emerge in ways that are consistent with the definition of creativity being assessed, although the creative behaviour may be limited in quality, inconsistent or tentative.
- Expressing: this level is presented when data indicate some signs of creative characteristics on people. These characteristics can be observed in a person's behaviour.
- Excelling: there is a constant presence of creativity characteristics and those characteristics are accompanied by creative accomplishments in one or more qualitative and original areas of performance or talent.

The model was applied to children from a school in order to know how it behaves in real cases. At the table 4-7-1 is depicted the model with the relation between levels of present performance and data sources. As well as, it is going to be explained the relation between the levels of present performance and the characteristics, operations, context, and outcomes in order to visualize the related model. As the model is focused on students, the teachers' role involves deliberate planning of opportunities for students to become more aware of their personal characteristics, interests and creative strengths in the level of 'Not yet evident', as they should behave as coaches. Also, they will provide direct instruction designed to help students discover, develop and improve their competence in relation to the four categories of characteristics. They may require some extrinsic motivation focused on their efforts to learn about and develop their personal creative abilities. The level of emerging includes some skills that should be put on practice. In the phase of expressing, students show and apply creative skills and are growing in confidence in their creative abilities, intrinsic motivation is placed. They are ready to face up real problems and situations. Teachers' role is to support development by helping students to carry out their own ideas and to identify realistic and meaningful situations in which their creative skills and abilities should be applied. The need for intrinsic motivation increases. Finally, the level of excelling demonstrates a highly significant level of creative thinking. Students must focus on extending their competence, confidence, and commitment to stimulate to reach new levels of creativity. Teachers' role is to

delegate many of the process decisions and actions to the student. They move to areas of sustained personal interest or passion for learning, for this reason, intrinsic motivation is at its highest level (Treffinger, Young, Selby, & Shepardson, 2002).

Data source	Not yet evident	Emerging	Expressing	Excelling
Behaviour of performance data	In students' projects is not seen fluency, flexibility and originality yet. Students may be hesitant to engage in creativity	Students' work includes some evidence of fluency, flexibility, originality when prompted by teacher or work in team. But still have lack of confidence in themselves.	Students' work includes some evidence of fluency, flexibility, originality in individual projects. They participate in individual creativity activities and make consistent creative contributions.	Students' work includes evidence of spontaneous fluency, flexibility, originality with documentation of real-world problems. They initiate creative activities or challenges.
Self-report data	Self-description indicates neither creative characteristic, nor attitudes or interests in creativity.	Self-description indicates few creative characteristics, but they still are uncertain about involvement in creative activities.	Self-description indicates several creative characteristics. They show motivation and interest in creative activities.	Self-description indicates high level of creative characteristics, very enthusiastic to pursue creative challenges.
Rating scales	Student rating on specific creative thinking criteria does not reflect evidence of creative thinking.	Ratings of students' creative thinking skills demonstrate some indicators of creative thinking but limited.	Ratings of students' creative thinking skills demonstrate indicators of creative thinking in a better average.	Ratings of students' creative thinking skills demonstrate indicators of creative thinking above average to excellent.
Tests	Students' do not show fluency, flexibility, originality and elaboration at projects. Scores are low.	Students' show average skills in fluency, flexibility, originality and elaboration at projects. Scores are near the mean of an appropriate comparison group.	Students' show greater average skills in fluency, flexibility, originality and elaboration at projects. Scores are above the mean of an appropriate comparison group.	Students' show strongly average skills in fluency, flexibility, originality and elaboration at projects. Scores are pretty above the mean of an appropriate comparison group.

Table 1 Adapted model of the relation of data sources and levels of present performance (Treffinger, Young, Selby, & Shepardson, 2002)

Anderson et. al. (2014) developed a model in which was explained the relation between four main levels that are related to creativity. The levels are individual level, team level, organizational level, and multilevel innovation. The model is quite similar to the model of Amabile and Treffinger et al. together, where it shows the performance of individuals by themselves, or working in a team or organization and what are the main characteristics in each level to consider in order to understand the creative behaviour. It was argued in this paper that innovation and creativity in the workplace have become increasingly important determinants of organizational performance, success, and

longer-term survival. As organizations seek to harness the ideas and suggestions of their employees, it is axiomatic that the process of idea generation and implementation has become a source of distinct competitive advantage. Yet, creativity and innovation are complex, multilevel, and emergent phenomena that pan out over time and that requires skilful leadership in order to maximize the benefits of new and improved ways of working. Creativity is a complex interaction between the individual and its work situation at different levels of an organization. At the individual level, creativity is the result of antecedent conditions, cognitive style, and ability as divergent thinking, personality, relevant knowledge, motivation, social influences, and contextual influences as physical environment. At the team level, creativity is a consequence of individual creative behaviour, the interaction between the team members, characteristics, team processes, and contextual influences. At the organizational level, innovation is a function of both individual and team creativity (Anderson, Potocnik, & Zhou, 2014).

8. Creativity measurement tools

Creativity assessment is not an easy process. It might identify different categories for test development in order to see a broad view of the different factors that impact on creativity. These categories involve cognitive, rational and semantic characteristics, personality and environment, mental health, among others. Creativity can be assessed according to the personality, cognitive abilities, motivation of people, but also according to the level of creativity in newly generated products. This assessment needs judges in order to justify if the generated product is considered creative or not. The selection of tools should help researchers in selecting instruments to measure creativity correlation and components (Feldhusen & Eng Goh, 1995). Creativity has high relevance in the implementation of innovation, for this reason, researchers have had the purpose of identifying strategies to understand the creative behaviour of people. Thus, different tools emerged for a better understanding of creativity. Through these tools, important factors that influence creativity based on different concepts developed in established theories are analysed (Hernandez Barajas, Garzon, Serrano Cardenas, & Bravo Ibarra, 2015). According to the tools to measure creativity, it can be said that are based on ratings. The approaches used to measure creativity allow an evaluation of judger reliability of creativity ratings. If the ratings achieve acceptable levels of reliability, the creative scores will be computed as an average of creativity ratings for each interviewee (Shalley, Zhou, & Oldham, 2004). The creative capacity is a difficult characteristic to measure in people, for this reason, researchers have observed that the most accurate way is through certain drivers that explain it better, such as the fluidity that explains the number of ideas generated by a person, the flexibility related with generating ideas that can change the meaning of things, originality that demonstrates uncommon ideas, and elaboration of ideas that can be organized, elaborated and understood. In conclusion, it is stated that creative capacity is described as a series of indicators associated with the relevance of the idea, its effectiveness, novelty, satisfaction, and generalization of the idea. The development of tools to evaluate creativity considers these factors (Hernandez Barajas, Garzon, Serrano Cardenas, & Bravo Ibarra, 2015). Regarding the definition of the process of creativity, it was argued that creative behaviour is composed by personality traits, related with nature characteristics of the behaviour in relation with creativity; cognitive abilities, which involves divergent thinking and convergent thinking; and social environment which includes all the external issues that affect the individual creativity (Hernandez Barajas,

Garzon, Serrano Cardenas, & Bravo Ibarra, 2015). Furthermore, it was considered a high level of reliability and validity of all tools in relation to creativity.

The creativity measurement tools are not equal to each other and they do not tend to measure the same factor or driver which impacts on creativity. The method they implement to measure creativity is different depending on which driver they are measuring. Therefore, it should be taken into account the different types of tools in order to determine the in which way they are different and how they can measure the creative behaviour of people. Below, it is going to be explained the different tools, considering the driver they are measuring and after this, the classification of them in order to better understand the relation that they have with the creative behaviour of people.

1. Selection of Tools

The selection of tools carried out in this report was based on determining which tools were used by the authors of the papers already read in order to demonstrate reliability and validity about the models and conclusions they have determined and, thus demonstrating that the results obtained are feasible through studies managed by them to different groups of people. As it has been analysed throughout the chapters, great consideration is given to convergent and divergent thinking when talking about creativity. As so it has been demonstrated through the models of Amabile (1988), Treffinger et. al. (2002) and Anderson et. al. (2014) that emphasis should be placed on looking for tools that can measure personality traits, cognitive style, motivation, intelligence and studies of how individuals develop themselves in their surrounding environment. For this reason, the tools to be analysed will be those that, in addition to having a high percentage of validity and reliability, are also consistent with the measurement of these factors. However, only some tools will be analysed, those that are considered important since they have been the most used throughout the analysis made along with this research. Due to lack of time, no more tools can be analysed since the search for these tools is not an easy task, since there are several new tools or that have only been used a few times and the results are not reliable, leaving room for future researches. To make it clear, the selected tools measure creativity based on the personality of people, intelligence related to creativity, both type of thoughts, convergent thinking and divergent thinking, and finally the creative behaviour of individuals within the social environment. Therefore, the selection was developed from the models and explanations mentioned throughout this report and taking into account that these factors are the most related factors with creative behaviour in order to measure creativity in people.

To measure creativity, it should be taken into account the analysis of verbal and visual motor tests. Therefore, it must be measured to better understand it, in a multidimensional way and not only partially. For this reason, the tools that tend to be used the most are those that require proof in several ways and not just one, since better results are obtained on the creative behaviour of people. Besides, it will be considered the descriptive tools mentioned by Griggs (2012) because they are the most accurate for these cases (Garcia Mendoza, Sanchez Escobedo, & Valdes Cuervo, 2009). The extensive interest in tests of creativity has resulted in several validity studies concerned with the most accurate way to measure it because validity is the main factor to make tests survive.

In order to measure the validation of tests, the structure of scores from the provided instrument should be analysed carefully (Kim, Cramond, & Bandalos, 2006).

<u>Personality traits measurement tools</u>

There are two types of personality tests, the personality inventories tests and projective tests. They differ in the number of characteristics that are being evaluated in people and the way in which they are analysed. It will be focused more on the tests of personality inventories since they are the most used and those that have less margin of error, in addition to the results are computerized to be able to analyse more accurately. In contrast, projective tests are based more on the perception of the person being interviewed. That is, for the same person interviewed, two different interviewers can give different results on this same interviewed individual.

- Projective tests: they are a series of ambiguous stimuli, in which the test taker must responses about his perception of these stimuli. For instance, the test is about to develop a history of what a test taker is seeing or describe a stimulus. An example is the Thematic Apperception Test, which consists of 31 cards with black and white background figures with which stories can be created. These types of tests cannot be scored or classified in the same way, although perhaps the people who measure the answers to these tests have more or less the same basis. One of the most important tests to identify personality is Rorschach Inkblot, which constitutes a series of black figures with white background, and others in red with a white background. The test taker has to answer what he sees, and he will do it based on lived experiences, conflicts that he has with himself, that is, with characteristics that reflect that person's personality.
- Personality inventories tests: It is possible to measure the personality characteristics of people through questions or statements that tend to know if the person who is making the test (test maker) applies to the questioned or not. The answers tend to be short, with true or false or yes or no. One clear example of this is the MMPI (Minnesota Multiphasic Personality Inventory). The results of tests are scored by a computer, which generates the profile of the taker tests in 10 different clinical scales, determining if there is any kind of disorder. Results are also obtained if the person is lying, so as not to show what he feels. This makes these tests extremely reliable and predictive with this result. The most important ones are The Big Five Model and Personality style inventory.

Big Five Model

The model of the big five traits of personality has been explained in Chapter 6, where personality traits were discussed. Even so, the way of executing this model will be explained, being able to understand that the result obtained is the measure in percentage of the amount of each of the five characteristics that the people who carry out this test contain. It is a question-answer test in which an option must be chosen and where the results are computerized in order to detect the true characteristics of people with as little error as possible. Based on that, we will also analyse what characteristics are those that creative people must have in greater quantity since it is the result that is required to obtain. This tool provides an index of the creative potential of a person. Individuals with a high score on the measure of it tend to demonstrate tolerance for ambiguity, persistence, and self-confidence, which are personality traits related to creativity. The

five characteristics of personality are directly related to creativity, emphasizing that the most important trait connected with an individual's creativity is the openness to experience. Individuals who are curious, broad minded and untraditional tend to be high on openness to experience (Shalley, Zhou, & Oldham, 2004). The model is a classification of personality traits based on common language descriptors, suggesting five dimensions used to describe the human personality and psyche. These five dimensions are the following:

- Openness to experience: it is based on the level of intellectual curiosity, creativity and take-risking. The main goal is to reach self-actualization. People who are open to experiences want to live new experiences and do not fear of changes.
- Conscientiousness: it is related to convergent thinking. People with this characteristic tend to do things perfectly, in an optimal way, to organize and persist in reaching their goals.
- Extraversion: it is based on the level of enjoyment and pleasure generated by social relationships. They like to learn and explore experiences related to being with other individuals.
- Agreeableness: it is related to empathy, where measured the level in which a person can put himself in the place of another one in order to understand the inner feeling and concerns of a person.
- Neuroticism: it is related to stress, nervousness, and insecurity. It shows the emotional instability of people.

In table 4-8-1 the characteristics of each dimension are explained in the way in which they are at a high-level end of dimension or low-level end of the dimension.

Dimension	High level of dimension	Low level of dimension
Openness	Independent, imaginative, broad interest, receptive to new ideas.	Conforming, practical, narrow interests, closed to new ideas.
Conscientiousness	Well-organized, dependable, careful and disciplined.	Disorganized, undependable, careless and impulsive.
Extraversion	Sociable, talkative, friendly and adventurous.	Reclusive, quiet, cautious and aloof.
Agreeableness	Sympathetic, polite, good-natured and soft-hearted.	Tough-minded, rude, irritable and ruthless.
Neuroticism	Emotional, insecure, nervous and self-pitying.	Calm, secure, relaxed and self-satisfied.

Table 2 Adapted table of the dimension of The Big Five (Griggs, 2012)

Once the five dimensions have been explained, the analysis of these ones and the innovative behaviour of people can make room. First of all, it was pointed out in a study that people with outgoing personalities and openness have a significant impact on performance, because their absorption of information affects and improves innovation. Then, people who have a strong sense of responsibility and are achievement-oriented tend to have a high score on conscientiousness, which tends to mark a negative impact on innovation. People with high scores on agreeableness and extroversion tend to be more willing to share their knowledge to promote individual and organizational innovation (Hsieh, Hsieh, & Wang, 2011). It was made a study based on a questionnaire in order to determine the relation between personality and innovation performance. The study had really good reliability and validity with personality traits. It was carried out in

Taiwan in the biotechnology industry. The results correspond to Lee and Lin's study, showing that people with conscientiousness tend to be diligent and present and individual performance. Furthermore, the results of Taiwan company showed that conscientiousness, agreeableness and extroversion have a significant effect on innovation technology. The more obvious these personality traits are, the better the technology innovation. It was analysed the innovation capacity in which the more obvious the conscientiousness, openness to experience, extroversion, and emotional stability are, the greater the innovation capacity (Lee & Lin, 2008).

Personal style inventory

The journal of engineering and technology management published an article in which a study was accomplished in order to understand the characteristics of the personality of professionals, in this case, divided into engineers and non-engineers, to know if they fit with the requested characteristics. The Personal Style Inventory was the implemented tool which evaluates the main personal style through some questions. The analysed characteristics in this study in order to have reliable results were:

- Assertiveness: people who say what they think, conveying confidence and support on ideas.
- Conscientiousness: reliability to work optimally, complying with rules and cultures.
- Customer service orientation: to prior comfort on customers.
- Emotional stability: emotional resilience to support stressful situations.
- Extraversion: the quality of being talkative, gregarious.
- Intrinsic motivation: inner satisfaction to reach personal goals.
- Openness: adaptation of change, new learning, and innovation.
- Optimism: belief that good things can happen.
- Teamwork and flexibility
- Tough-mindedness: assessing information and making decisions based on logic and facts.

Two different aspects were evaluated in this study. First, the characteristics that influenced more engineers than no-engineers. Second, the positive relation that has some characteristics with career satisfaction (Williamson, Lounsbury, & Han, 2013). According to a study carried out by Baek-Kyoo and Taejo, career satisfaction on employees is higher when they have good communication in teams, self-determination, competency in their work. Career satisfaction is the degree of satisfaction that individuals have with their career accomplishments, achieving goals with the support of the work environment and resources (Baek-Kyoo & Taejo, 2013). According to the first aspect, engineers scored lower than non-engineers in conscientiousness. This means that engineers tend to be more flexible, creative and able to think out of the box because there are not depending on the rules and norms of the company, they just want to solve problematic situations in the best way. The intrinsic motivation was one of the characteristics with greater scores in engineers than non-engineers and it is related to self-determination and self-management in activities through the company. Another characteristic with a higher score was the tough-mindedness because it is aligned with engineer's studies. The extraversion is low in engineers in the way in which they focus on their work with high concentration and quite without being distracted by social interaction. As extraversion, the assertiveness is lower too because enterprises do not

search for engineers in leadership or selling jobs, but nowadays this situation is changing as engineers will be related to innovation which entails having new ideas and make people follow the correct direction to achieve that idea. The teamwork does not have different scores between engineers and non-engineers, it is a skill that depends on each person. The visionary style was scored lower. Engineers are not familiarized with the idea of creativity when they want to learn more about this and to make a long-term strategic decision, they seek to work with designers and people experts on that field in order to have a better knowledge about creativity and thus increasing their visionary style. The stress on engineers is really high which leads to having a lower score in emotional stability than non-engineers, but it does not mean that they cannot manage this stress. Optimism was scored similar to emotional stability and they are related because of the stress suffered by them. Customer service orientation as Image management was scored lower because engineers do not have developed these skills yet. Over the years, companies realized that customers are the main factor to success and to attract them employees should show a good personal image, self-confidence and express security and comfort. Openness scored higher as engineers are in constant development about their knowledge and improving their skills to be prepared for possible changes. Finally, the flexibility depends on people and the job that they are performed in a company, so the results were not reliable. On the other hand, the second aspect to analyse is related to the career satisfaction. It can be said that most of the characteristics are positively related to career satisfaction as intrinsic motivation, tough-mindedness, extraversion, assertiveness, emotional stability, optimism which was one of the most highly correlated, customer service orientation and flexibility. Then, conscientiousness and visionary style were not correlated with career satisfaction while image management had a negative relation with career satisfaction, Finally, teamwork and openness were modestly related to it.

In conclusion, the information above is of great support for the process of selection of individuals in which can be known that characteristics of a person's personality, also knowing the way they face their job analysing the career satisfaction which can even facilitate the adoption of new knowledge. It should be noted that the analysis is also carried out by observing people's attitudes, not just their personality's characteristics. In addition, it was demonstrated that engineers tend to be more introverted, intrinsically motivated, flexible and creative and tough-mindedness analytical, but if they are more satisfied with their career tend to be more assertive, customer-oriented, emotionally stable and resilient, extraverted, open to new experience, optimistic, with analytical thoughts, teamwork-oriented and less concerned about image management (Williamson, Lounsbury, & Han, 2013).

The MBTI (Myres-Briggs Type Indicator) is the most common type of indicator used to measure the personal style inventory. It aims at identifying the personality style preferences along four dimensions: extroversion or introversion, sensing or intuiting, thinking or feeling and perceiving or judging. With the analysis of these dimensions in people is easy to know how they act or develop and think in life situations. The implemented tool is a questionnaire in which people should answer according to their personality style preferences. All people will have different preferences so there is not a wrong answer, just a result that can show to people their personality style. The questions are about the way in which a person makes a decision if it is in an individual way or analytical or intuitive way, the energy that a person has and which tools they tend to use to conclude problems. If there are emotions present in the decision chosen or just logical

things without considering the abstract part. Furthermore, the way in which a person relates to others and if a person's thoughts are based on facts or ideas. Once the test is finished, the score must be counted for each question, these are divided into four different groups which indicate the style preferences, but at the same time each group is divided into two and just one of those two will be predominant. The MBTI model is interpreted as behavioural rather than a cognitive measure of intuition, its scale assesses the individual's perception of possibilities, patterns, symbols and abstractions (Runco M. A., 2006). The four pairs of dimensions are present in all people. Hereunder, the extremes of these groups will be explained:

- Introversion and extraversion: the first characteristic is related to the independence of constraints when they make a decision. They tend to be quiet and socially reserved, to work alone and to be careful before acting but they lose opportunities to act because do not have good communication with others and are secretive.
  Extroverted people are more related to the external environment, culture, and people inside the company. They are outgoing, open and like to work in teams but are impatient with long tasks, impulsive and almost always make decisions congruent with demands.
- Intuition and sensing: intuitive people think and discuss in a spontaneous way with a high tendency to solve problems easier than no intuitive people, no matter if these people can make errors of fact. They prefer possibilities and gestalts, also they are imaginative and aim to work out new ideas. But sometimes they have ideas out of real and lose sight of the here-and-now. Where Runco (2014) supported the definition of intuition saying that it is almost the most important characteristic of a creator.
  The second characteristic is related to people who prefer to think in a concrete, real, factual, structured way. They tend to be careful and attend to detail making few errors of facts but missing a conception of the overall. They do not see possibilities and prefer not to imagine the future.
- Feeling and thinking: the feelers are more worried about feelings. They are able to understand people's needs and values, interested in conciliation but they are not guided by logic or objective. They aim at basing justice on feelings.
  Thinker people are more interested in logic, analysis, and verifiable conclusions They do not take into account the values of others, they act without considering the feeling of others. They tend to be objective, organized and stand firm.
- Perceiving and judging: perceiver people are open, flexible, adaptive, compromised, always welcoming new perspectives and information. They wish to roll with life rather than change it. Sometimes they are so involved in too many tasks that do not reach the objective of them and become frustrated. Sometimes they are indecisive and do not plan things or tasks, do not have an order.
  The judger is decisive, firm and sure, setting goals and sticking to them. If they cannot solve or achieve the objective of goals, they give up with that and start with a new project. They tend to plan and have control over things and make quick decisions but are inflexible, unadaptable and stubborn.

In conclusion, as it was said before it is almost impossible a person has the characteristics of the extreme dimensions. People tend at being closer to one extreme than the other, but extremes are not good. To continue this study, the analysis made on the four

dimensions can help to understand the profile that a person seeks in another one (Hogan & Chamagne, 1980). It can be observed that extroverted, intuitive, feelers or thinker and perceiver people are more likely to have similar characteristics than innovator or creators as they adapt to change, seek new ideas or solve problems in an unusual way, are flexibles and imaginative, and also they think out of the box. A company should consider groups that include the characteristics of dimensions in order to hire innovative and creative people.

This method is simplified into two main groups which are the SJ and NT. Each person who has an S and J in his or her profile belongs to SJ group and the same for NT type according to Gunter Dueck. In his books appears that more enterprise leaders are related to the SJ group. Below, the concepts of SJ and NT will be developed.

- SJ type: SJs are characterized by being very organized, conservative, orderly, reliable and responsible, deductive and analytic in their thinking. They seek efficiency and are risk-averse, they do not search for change.
- NT type: NTs are characterized by being the keepers of the key to knowledge. They tend to know how to manage creativity and understand how things work. They are concept-oriented, professional and impersonal. NTs tend to form networks. They prefer good communication and work all together. The knowledge for them is everything because it makes them think out of the box to get new ideas and opportunities. They look for change.

The NT personality type is better at addressing the matter of what people are supposed to do, i.e. they will be in charge of the early warning system and exploration phases. SJ type is better at approaching tasks whose preferred results and already defined (Huber, Kaufmann, & Steinmann, 2017).

Divergent Thinking test

Numerous tools exist to the assessment of creativity, including divergent thinking tests, interest and attitude inventories, personality measures and biographical inventories. Divergent thinking tests assess the quantity and quality of creative ideas produced by the test maker. This approach to creativity assessment is based on the premise that the process of divergent thinking is a critical element of creative performance. There is substantial evidence indicating that scores from these tests are sufficiently reliable and valid predictors of creativity for use in research and group assessment because temporal factors can cause variation in a person's creative production, caution has been expressed regarding the usefulness of these scores for identifying the creative potential of any particular individual (Clapham, 2004). In studies of creativity, divergent thinking tests in which people are asked to generate multiple responses to novel, ill-defined problems have been scored in terms of three attributes: fluency referred to the total number of responses given by any one person; flexibility, which represents the number of categories of themes suggested by the ideas; and originality, which is defined in terms of uniqueness. They have shown to evidence adequate construct and predictive validity. There are a large number of tests which measure divergent thinking. These are used to identify individuals with creative potential and to test the impact of programs designed to enhance creative performance. With the assessment of tests, it was sought several abilities in the family of divergent production including creative thinking, planning,

fluency, flexibility, figural-symbolic production, figural-symbolic-semantic production, transformation abilities as well as creative abilities within particular age groups. One very popular divergent thinking test is Consequences, where is asked possible outcomes of changes that could occur in the world. It was found that it has a notable relationship with the measure of creative problem-solving. People may rate the responses for quality and originality. Another test of verbal divergent thinking measure is the Instances in which people should name all things they can think of that move on wheels as possible, round things, things that make noise. The Alternate Use test is another one in which people may list the different ways they could use a chair for example. Another is the pattern-meanings test, which was one of the visual/figural tests, which consists of answering, looking at cards with drawings, what things they think the cards could have. (Mumford, 2012). The most used tests to measure divergent thinking are TTCT-F and TTCT-V, because of their high level of reliability, although in all papers where the creativity was measured, the authors argued that this tool is the most accurate and whit which one the results are truly valid and correct. Studies have argued that the Torrance Test Creativity Thinking is one of the best predictors of creative achievement because it involves many phases that each one is similar to another divergent thinking, in other words, these tests are the joining of much single divergent thinking test (Runco M. A., 2006). The TTCT has much to endorse its use. It has become highly recommended in the educational field and is even used in the corporate world, furthermore, it is the most widely used test of creativity and has been used in more research than other any creativity test, where the scores are standardized (Kim, Cramond, & Bandalos, 2006).

Torrance Test Creativity Thinking

The Torrance Test Creativity thinking is the most useful divergent thinking measurement tool (Mumford, 2012), in which results are obtained from the four most important factors to understand the creative capacity of people (Hernandez Barajas, Garzon, Serrano Cardenas, & Bravo Ibarra, 2015). The TTCT was published by E. Paul Torrance and his associates in 1966, but then it has been reformed four times, being the last one in 1998. The test has two forms to be applied, the visual and verbal types. Innovation requires a set of conditions that are measured by TTCT model, as the nature creativity skills of people or the application of creative skills in some situations (Kim, 2017). The TTCT involves five subscales which are flexibility, originality, fluency, abstractness, and elaboration. The TTCT-F is the first form and corresponds to drawn results while TTCT-V is the second one and can be written or orally. The first method consists of activities referred to picture construction, picture completion and repeated figures of line or circles. The written or verbal model starts with a picture and the test taker responds to it in writing. The subscale fluency is measured by the number of relevant ideas to the picture, originality by the unusualness of ideas and flexibility by the variety of different types of ideas. Hence, creative attitudes are measured with the figure method. The creative attitudes can be defined by four main attitudes in which each one identifies different creative attitudes that can be related. Kim identified these four attitudes groups and called them the 4S attitudes, in which in all the 4S together are twenty-seven attitudes.

- Sun attitudes: optimistic, big-picture, curious, spontaneous, playful and energetic attitudes.

- Storm attitudes: independent, self-disciplined, diligent, self-efficacious, resilient, risk-taking, persistent and uncertainty-accepting attitudes.
- Soil attitudes: open-minded, bicultural, mentored, complexity-seeking and resourceful attitudes.
- Space attitudes: emotional, compassionate, self-reflective, autonomous, daydreaming, nonconforming, gender-bias-free and defiant attitudes.

No creative individual does not possess twenty-seven attitudes, but the greatest innovators do, and these attitudes predict innovation better than any other trait in the field of creative thinking skills. Through TTCT-F these attitudes can be measured and grouped into five categories.

- Open-minded attitude: it is one of the most consistent attitudes found among creative individuals. Individuals are able to think with a different perspective than others, leaving room for new and broad experiences.
- Emotional attitude: it includes recognition, understanding and expressing individuals' feelings. Emotions affect creativity and are present in all creative endeavours.
- Playful attitude: individuals with this attitude are humorous and focus on their passion and goal while using flexible thinking to make a work funnier and feel more motivated.
- Daydreaming attitude: it is based on seeking unique ideas and takes advantage of daydreams to achieve innovation. Some ideas can be seemed unrealistic, but they do not lose their goal-oriented thoughts.
- Nonconforming attitude: it aims to help individuals find their uniqueness beyond existing norms. They do not tend to think in a conventional way, they know how to manage change and think out of the box, developing new concepts, approaches or products.

Considering both TTCT-V and TTCT-F, creative thinking skills are related to the ION model -Inbox, Outbox, and Newbox- which ones are required to achieve innovation.

- Inbox: thinking is narrow and deep, helping to develop expertise. It requires a persistent and systematic process obtaining the necessary knowledge and skills for expertise development, which is the pillar of creative knowledge.
- Outbox: thinking is quick and broad, helping to develop unique ideas. It includes fluent, flexible and original imagination skills. The fluent imagination consists in the generation of unique ideas. Then, the original imagination consists of generating unusual ideas, for this reason, it is a good predictor of innovation. Finally, the flexible imagination which includes the different perspectives in which ideas can be generated.
- Newbox: this thinking combines elements of inbox and outbox to create something new. It aims at connecting and synthesizing ideas resulting from critical thinking, then transforming the synthesized ideas into a new creation which can be recognized as an innovation. The TTCT-F measures newbox connection skills of synthesis, transformation, and promotion.
  - Synthesis: it enables the combination of ideas and information in a coherent whole to reach innovation, considering that it is an extension of existing knowledge and skills. The TTCT-F method measures synthesis by

boundary-crossing whose concept is to think unconventionally, seeing connections between different and irrelevant fields and it is measured by extending or creaking boundaries. Another measure is the patter-finding which consists of using symbols to represent ideas or images. Finally, there is a dot-connecting measure referred to see ideas and information as a whole.

- Transformation: innovation transformation of ideas into useful creations. The TTCT-F measures elaboration which helps to refine details, explain, expand and complete the transformation stage. The refinement phase is based on unexpected variations which aim to improve the uniqueness of the creation.

- Promotion: The TTCT-F method measures to which extent the crafting and sharing compelling and interesting stories is necessary for promotions. In storytelling are present emotions and enabled creative mental imagination, something that is a factual list people could not feel them. Articulating features and benefits of creation make the audience can understand, accept and desire the creation.

Both TTCT-F and TTCT-V are related in terms of measuring creativity, but there are some differences as the TTCT-F is a more comprehensive, reliable and valid measure of creative potential than TTCT-V. Also, the first one provides test-takers with profiles of their creative thinking skills and creative attitudes compared to their peers (Kim, 2017). Below, in table 4-8-2 and table 4-8-3, it is depicted the model of TTCT-F and TTCT-V, where are defined the methodology, purpose and creative factors that are applied in each phase of the test. Through the tables, it can be seen how the four main attributes, which are fluency, flexibility, originality, and elaboration (Runco M. A., 2006).

Test	Methodology	Purpose	Creative Factors
First activity: Picture construction	Construction of picture with a pear shape or jelly-bean shape as stimulus. The shape must be an integral part of the composition.	This activity aims at finding the purpose of something that has no definitive purpose and to elaborate it.	Originality. Abstractness of titles. Elaboration. Checklist creative strengths.
Second activity: Picture completion	Completeness of 10 pictures in order to make and name an object or picture.	The activity aims at putting into play the need to structure, integrate and present an object, scene or situation.	Fluency. Originality. Abstractness of titles. Elaboration. Resistance to premature closure. Checklist of creative strengths.
Third activity: Lines and circles	Construction of object or pictures using lines or circles given in three pages, adding titles and names at the bottom of each picture.	It aims at creating different pictures but with the same stimulus, disrupting structure to create something new again and again.	Fluency. Originality. Elaboration. Checklist of creative strengths.

Table 3 Adapted model of TTCT-F (The Alberta teachers' association, 2014)

Test	Methodology	Purpose	Creative Factors
First activity: Ask and guess	Formulation of questions based on drawings on a page.	This activity reveals a person's ability to sense what a person is unable to discern by looking at picture and to ask questions to fill in gaps in knowledge. It is evaluated the curiosity.	Fluency. Flexibility. Originality.
Second and third activities: Guessing causes and consequences.	Guessing about causes and consequences of happenings related to a drawing.	These activities are designed to reveal a person's ability to formulate cause and effect.	Fluency. Originality.
Fourth activity: Product improvement activity.	Thinking of different ways to change a toy to make funnier to play with.	It taps the person's ability to develop and play with items.	Fluency. Flexibility. Originality.
Fifth activity: Unusual uses activities.	Devising of many uses as possible for objects as cardboard.	This activity tests a person's ability to think originally.	Fluency. Flexibility. Originality.
Sixth activity: Just suppose activity.	Prediction of possible outcomes and consequences of an improbable situation.	It aims at making person play with ideas and consequences, measuring the level of imagination.	Fluency. Flexibility. Originality.

Table 4 Adapted model of TTCT-V (The Alberta teachers' association, 2014)

According to Plucker et. al. (2010), the TTCT is by far the most commonly used test of divergent thinking. As it is shown in the first table, there are three subtests in the TTCT-F. The picture construction requires participants to make a drawing out of basic shape, whereas the picture completion asks for finishing and naming the drawing, and the lines and circles aim at changing the form of a provided set of lines or circles. As in the second table is depicted, there are five subsets in TTCT-V, where it is asking and guessing causes and consequences provide a picture to be used as stimulus in order to do as many questions the person imagine, guess the causes of the image and consequences as a result of that image. The product improvement is about the interaction with an object, where the issue is to find different improvements on it. The unusual uses test consists of listing different uses to everyday objects and the unusual questions to ask as many questions the person is able to do about an object. The last one is the just suppose activity, where participants should imagine what would happen if an improbable situation took place. Once the measurement of results of these subtests was scored, the test-taker analysed the level of creativity involving all the results in a whole one (Plucker & Makel, 2010), (Clapham, 2004). The only thing to consider is that it is difficult to have the same results in the TTCT-F, because of the different ways the test taker has to interpret the solutions of the subtests. Nonetheless, as it is standardized, the gotten results and consequences will be similar in any situation, but the same can vary just a little percentage.

Convergent thinking test

Convergent thinking involves reasoning, logic, evaluation, and intelligence. Intelligence tests have been considered as a measure of this kind of thinking. Convergent thinking seeks to measure the analytical capacity of people, those who are able to find a single correct solution. There are different types of tools that can lead to measuring this

thinking, among them are intelligence tests. This kind of thinking test looks for ways to measure the ability to acquire knowledge and use it in problematic situations, as it also measures the speed with which they can reach correct conclusions and the logical thinking obtained through activities to which they intend to develop a solution. The most used test of convergent thinking is the Remote Associates tests which will be explained below. Whereas other tests are useful too, and it worth to name them. The Wonderlic Personnel Test, which is a short test with 50 items, assessing an individual's ability to learn, avoid costly miss hires, decrease training time, reduce involuntary turnover and increase overall productivity. It measures general mental ability. One of the important tools to measure the evaluative phase of ideas is the Alternative uses in which is required that an individual generate the way one uses a common object. It is easier to connect this kind of thinking with innovation, especially involving some minor change or adaptation in an existing product. Another test is the correlate completion II which provides two-word pairs which have a common pattern, and then the matching word for the third pair is asked (Mumford, 2012). However, in this section of convergent thinking will be explained the method to make intelligence test and the RAT which is the most used tool of measuring convergent thinking.

Intelligence tests

Francis Galton believed that intelligence was genetic and that in order to measure intelligence he had to measure various aspects of the human brain and his nervous system. What Galton confirmed is that intelligent people tended to be stronger, react quickly to different stimuli and a sharper sense of perceiving certain situations. But their tests did not give correct results, so they were unsuccessful. But he pioneered testing the genetic evaluation through statistics, which were not used before. Based on this, Alfred Binet after numerous studies published a test which allowed measuring intelligence in children, which had an inclination on the nurture side. Time later, Lewis Terman made one of them, and larger discoveries taking into account Galton's theory, considering intelligence as part of nature and looking for tests that could check the level of intelligence following the Binet model. Through this study, Terman unveiled a new variable with which intelligence can be measured, called intelligence quotient, which measures the relationship between the mental age and the chronological age of people. The tests can be verbal or nonverbal, being that with figures you can perform a type of intelligence tests, but always with just one correct answer (Griggs, 2012).

Remote Associates Test

Thinking creatively is a skill that not many people can achieve. In order to evaluate this convergent thinking, the Remote Associates test by Mednick (1962) is commonly used, which has been reformed to Compound Remote Associate task by Bowden and Jung-Beeman in 2003. The test consists of three unrelated words where each word can form a word or phrase composed of a fourth sought-for word. When people have acquired knowledge and solve problems using it, then they make use of neural and cognitive processes. This observation suggests that this test takes advantage of more than a different component of creativity, where the best solution appears in conscious awareness. In the test that is performed once the word relationship is completed with a fourth, the participant must clarify whether the answer was deduced analytically or if only that word came to mind (Zmigrod, Colzato, & Hommel, 2015). The RAT test consists of forming associated elements, based on this theory, the creative thinking process

consists in the formation of associative elements into new combinations which either meet specified requirements or are in some way useful (Akbari Chermahini & Hommel, 2010). The more mutually remote the elements of the new combination, the more creative the process solution. It seeks to find a link associated with a group of words, it must be associated with each word, which measures the level of creative thinking when linking the words with one in general that is linked to each one. In other words, find out what is the word that generates the other three can be related. The more the number of relationships on an element that the person can make, the greater the probability of generating creative situations. The data obtained through studies confirm the validity of this test and its correlation with creativity. People who score high in RAT as engineers were much more productive on research proposals and more successful in winning contracts for their proposals (Mendelsohn, 1976). The test RAT requires finding an association between diverse or seemingly unrelated concepts, having correct responses for each task, and involves convergent and evaluative skills to measure. The main is to measure the analytical and evaluative skills of people in situations. The test is built by 30 items, each having 3 words, where the test- makers are asked to find a four-word that links all three, for example, railroad – girl – class: 'working'. Even though the word is not formed analytically, the same is considered a high level of creativity, since without thinking, the person by the knowledge acquired and accumulated, can grasp without thinking what the Instantly relationship between words (Mumford, 2012). Mednick was the developer of this tool, who in his book argued "*the solution process consists of freely associating to the three stimulus words until convergence on a single association occurs. Thus, subjects with a flat gradient should produce those remote associates required for convergence more frequently and more rapidly. The negative findings regarding associational fluency and uniqueness make this description untenable, as do interviews with subjects about their solution strategies. Typically, subjects report that their approach is like that for conventional problems: they actively search for an answer through a process of hypothesis formation and evaluation. That is, a stimulus word is selected as a starting point, an association to that word is retrieved from memory and then checked against the remaining stimulus words for its adequacy as a solution. After the failure of an initial attempt, and initial attempts should usually fail since culturally primary associations are never correct answers, a new association is tried or the subject may switch to a different stimulus word to derive a hypothesis until a solution is obtained or the subject, stymied, moves on to a new item.*"

A succeed performance will depend on the availability of elements, the accessibility to those elements, which means the ability to retrieve words that fit the requirements of the problem is the best indexed by the word fluency. The development of a systematic solution strategy, the fluency of generation of hypothesis, and flexibility to switch among diverse hypotheses. Any ability or tendency which serves to bring otherwise neutrally remote ideas into contiguity will facilitate a creative solution. The RAT can be used as a problem-solving task because of its potential for shedding light on thinking and cognition. It is considered a driving test to establish the link between original problems and personal skills, and this link depends on procedures designed to measure the relevant capabilities, abilities, and strategies (Mendelsohn, 1976). One last thing is that according to Runco (2006), people who have high verbal abilities will score better than those people who not (Runco M. A., 2006).

Social creative environment test

To better understand the relationship between creativity and the social environment, some researchers identified certain variables that make this relationship possible such as inter and intragroup interaction, leadership, organizational structure, competition. Many tools that have been developed to measure these variables, more than anything leadership, are rather well defined to measure creativity individually. Even so, the validation of most leadership tests is given by studies carried out mostly on students or teachers, not so much within an organization. Today, there are a large number of tests that measure people's leadership abilities, but in this chapter what we want to analyse more than anything is creativity in the work environment. So, the relationship of leadership tools with creativity will be left for future research, since the relationship between creativity and leadership exists. The main tool which has high levels of reliability is KEYS, developed by Amabile et. al. (1996) and tool which is going to be explained below. Whereas, there is another tool in order to measure how people see the work environment which they have to deal day by day. The tool is the realistic problem generation and consists of writing all kinds of problems that people see in the work environment that do not help to foster creativity, and then test-makers should think about how they can solve those problems. The validity of this tool is not high, but it is opened to future researches (Mumford, 2012).

KEYS tool

Amabile et. al. (1996) developed an instrument called KEYS, assessing the climate for creativity or Work environment inventory. This tool was designed to assess perception of all work environment dimensions which are related to creativity in organizations. It aims at examining the psychological context of creativity, the work environment that can influence creative work in organization. KEYS is a unique tool that measures the organizational environment for creativity. KEYS is focused on the individual's perception and the influence of this perception on creative work. Through the test, it is measured the psychological meaning that test-makers attach to events in organization and teamwork. The perception is really important in the analysis because people, in order to be creative and develop creative work, should feel and be encouraged by the environment itself. For this reason, the objectifiable aspects of the work environment need to be direct. In conclusion, the test KEYS focuses on the work environment perception of project team members and the relationship between the perception and the creativity of the project outcomes. The conceptual model of KEYS is depicted in figure 8. It includes the different scales that the tool involves. The scales related positively with creativity are called stimulant scales, and those ones which affect negatively creativity are called obstacle scales. Amabile et. al argued that the categories were developed from two primary sources, previous research and from studies which consist of 120 R&D scientists and technicians were asked to describe a high-creativity event in their work environment as well as low-creativity. Within each category, psychological mechanisms are described where the majority are derived from intrinsic motivation. The categories will be explained below. KEYS was built to provide reliable and valid assessments of aspects of work environment creativity at organizations. It is intended to serve as a tool for research and theory development.

- Encouragement of creativity: it fosters the generation and development of new ideas. It involves three main scales. Firstly, the organizational encouragement

which influences creativity positively. It seeks the encouragement of risk-taking and idea generation, having good support on an evaluation of ideas which can enhance the intrinsic motivation if the ideas are good enough, in addition to the collaborative idea flow across an organization and participative management and decision making. The second is supervisory encouragement which is pointed to the role of project managers in the areas of goal clarity, the open interaction between supervisors and employees and support on the team's work and idea. It also influences creativity positively. The last one is work group encouragement, which aims at involving diversity on teams, openness, constructive challenging of ideas and shared commitment to the project, affecting creativity positively.

- Autonomy and freedom: creativity increases when individuals and teams have high autonomy and a sense of ownership in their work and own ideas. They tend to think more creatively when they pursue their own ideas and are free to accomplish them. It is a stimulus scale.

- Resources: resource allocation is directly related to project's creativity. If inside the organization there are not enough resources to carry out with creative and new projects, the motivation of people will decrease, and it will trigger bad consequences to projects. The availability of resources will foster the development of creative projects, it is a stimulus scale.

- Pressure: some researchers have found that time pressure could affect creativity positively, but until a breakpoint where the pressure turns undesirably high. Because of this, there are two forms of pressure. The first one is workload pressure which negatively influences creativity in the sense that the person does not do the job because he or she wants to but because of higher demand. The second one is a challenge and it affects positively creativity because of the perception of being challenged by a time project.

- Organizational impediments to creativity: the category involves internal strife, conservatism, rigid and formal management structures that impede creativity because people feel under control by the organization. It is an obstacle scale.

The tool is based on items that score the different scales of the categories, through a kind of interview with people inside the organization. There are seventy-eight items, sixty-six items describe the work environment, six items measure the creativity and six items the productivity of work being carried out in units of an organization. All items are written as simple descriptive statements of work. And in order to avoid response bias, some items are drafted positively and others negatively. The points of the scale correspond to a rating of how often true the statement is of a respondent's current work environment. On table 4-8-4, it is depicted the KEYS tool, focusing on scales and showing the description of the scale and the way in which are analysed through the tool considering possible answers of people who work inside the organization (Amabile, Conti, Coon, Lazenby, & Herron, 1996).

Scale name and n° of items	Description	Sample item
Organizational encouragement – 15 items	Encouraging creativity through fair, constructive judgment of ideas, rewards, among others, sharing the vision of the organization.	Problem-solving inside organization.
Supervisory encouragement – 11 items	Supervisor sets goals, supports the team, shows confidence in the work group.	Work model.
Work group supports – 8 items	Diversely skilled teamwork, to be open to new ideas, being challenged.	Free and open communication within teamwork.
Sufficient resources – 6 items	Access to appropriate resources.	Getting needed resources.
Challenging work – 5 items	Working hard on challenging tasks.	Feeling challenged.
Freedom – 4 items	Freedom in deciding which work to do or how to do it.	Freedom in decision of carrying out own projects.
Organizational impediments – 12 items	Impediment to develop creativity, competition inside organization avoidance of risks among others.	Political problems in organization.
Workload pressure – 5 items	Unrealistic expectation for productivity and distractions from creative work.	Too much work in too little time.
Creativity – 6 items	Creative organization or unit where a great deal of creativity is called for and people believe in their creative work.	The area of the organization is innovative.
Productivity – 6 items	An efficient, effective and productive organization unit.	The area of organization is effective.

Table 5 Adapted model of KEYS tool (Amabile, Conti, Coon, Lazenby, & Herron, 1996)

In conclusion, KEYS is a tool that allows measuring the level of creativity that an organization drives considering the work environment, where the mentioned categories including the scales are very important and important to determine which are the factors that positively or negatively affect this job environment. The result of having high creativity in an organization is being able to innovate and thus be able to subsist to the permanent changes that take place over time (Amabile, Conti, Coon, Lazenby, & Herron, 1996).

2. Classification of tools: open-ended and close-ended

Creativity depends on the ability to solve problems in a novel and unique way. The solution to any problem is based on reaching a proposed goal, overcoming all kinds of obstacles. The solution to problems made by those obstacles can be differentiated by the two-step process, where on one hand there is the convergent thinking involving the evaluation of ideas, and on the other hand, the divergent thinking involving the generation of ideas. However, the different tools that are related to creativity and more directly related to both divergent and convergent thinking can be placed in two types of methods, the open-ended tools, which corresponds to the first thinking, and the close-ended test, which corresponds to the second thinking. In other words, all tests of divergent thinking are open-ended because it is allowed to produce a high number of

ideas by test-maker. Instead of convergent thinking tests which usually require one conventional response (Mumford, 2012).

Some researchers focused on finding and testing other ways to develop a creativity test since the way it was being done was a non-creative way, where both creative and non-creative skills were observed, and they did not have only a focus on creativity. So they began to carry out studies of how they could consider performing tests of divergent thinking, which are those tests in which a large number of ideas must be exposed, presenting a free way of doing it, without putting limits on the questions, since that the generation of ideas is done putting into play the openminded capacity of people. The test was carried out in a school for middle-aged children, who were asked to write as many ideas as possible about a solution to a problem that could be generated. Clarifying that it was not a test with which a grade was obtained, that none could go wrong. In other words, these researchers focused on changing the normal work environment for an extremely different one, without limitations, with freedom, with necessary resources. The result that was obtained was amazing, all the children wrote many ideas, most of them very creative and the participation and communication between them improved. Therefore, through these studies, it was possible to determine that the best way to measure the divergent thinking of people is through studies where people can express themselves freely, following a single slogan but without responding with limitations. This type of test is called open-ended, and it means that the answers are not unique, nor does a multiple-choice exercise be needed to evaluate it, but rather seeks to know how people react to the command, sensing the ability to respond. , whether it is necessary to draw, or speak or create stories, play with objects, give new shapes to things, it is a test where everything is allowed and where the test-taker is the one in charge of knowing how to measure the level of creativity that test-makers handle. An example stated in an open-ended test is, for example, making a list of things that can move on wheels, listing square things and heavy things. In this case of questions, the answer can be multiple, and these multiple solutions are correct. By carrying out several similar studies and taking into account that the social environment is creative or that it promotes creativity, it is possible to obtain validity and reliability in that these types of tests measure divergent thinking more precisely (Runco M. A., 2006). What makes the application of open-ended tests difficult is the difficulty with which the scores must be measured. There can be no fixed scoring criteria. There is no standardized scoring methodology, since obtaining multiple answers and all of them can be different but correct, a model that can be standardized does not. Sometimes training is needed to be able to give concrete results. This training is based on determining certain words, movements, ways of thinking or writing that the people who take the test have in order to know the level of creativity they use. Even so, although the answers are difficult to measure since the tools that measure divergent thinking have in common the indicators to be measured, there are main guidelines to keep in mind. For example, measuring originality should focus on the person's ability to develop rare responses, or fluency is measured by counting the number of given answers (Mumford, 2012). Another study carried out to determine the ability to solve these tests in terms of obtaining results of divergent thinking related to creativity, was to propose students to propose innovative ideas to attract tourists, giving as information two types of solutions in which they could be base, developing disadvantages or displaying advantages. Twenty minutes were given in this study to solve it. Once finished, it could be seen that those ideas that were generated from the disadvantages, that is, critical criticism were the most creative ideas. So through this type of tool, it can be seen how the environment helps

determine new ideas by visualizing changes in it, taking into account the wishes and requirements of people, what they are looking for so that a place or an activity is more pleasant. Hence, it was confirmed that explicit information can be communicated by task instructions to increase originality scores on divergent thinking tests (Runco & Sakamoto, 1999).

In spite of knowing that creativity can be measured better with open-ended tests, convergent thinking, which is also needed for creative skills too, is measured in another kind of test. This type is called close-ended tests because they have just one correct answer. The questions are presented in such a way that just one option could be correct, restricting the development of answers that are not present on the current questions of the test. Convergent thinking is related to intelligence and reasoning in order to be able to evaluate ideas, therefore the capability to answer correctly to one choice is really important because it shows how much an individual can adjust itself to assess a situation with the limitations that can be found in real life. It is able to measure the potential that people have to evaluate situations, no matter if they are under pressure or they have strict limitations, people should know how to act and these kind of tests are the perfect way to measure that (Runco M. A., 2006). Close-ended tests are the most traditional, in which the results can be measured through computers, that is, computerized, and depending on the type of option chosen. It is the result that will be taken into account in order to obtain at what level it corresponds to make a test. This type of test is used more in order to measure people's skills, that is, for those skills in which people can be clustered in different categories of them. A clear example is personality tests, where the person only should choose one option, and based on that single option in the different questions, people can be part of a certain category. Therefore, the obtaining of results is much easier and the conclusion that is reached also, since it is predetermined what kind of answer corresponds to each category. Still, they are not only based on options to choose from, but it may also be that you only have to write one word, which would be the correct one. Therefore, close-ended tests are based on obtaining a single correct answer, either based on multiple-choice, or on writing the answer.

9. The framework to assess creative person identity

As was stated in this report, it has been shown that creativity is directly related to innovation, and in order to foster it, it is necessary to understand the main factors that influence creativity. Most of them are related to people, in terms of attitudes and behaviours. Therefore, the described information allows obtaining a greater vision about which are the main factors that must be taken into account when creativity in people needs to be measured. Creativity is one of the main stages of innovation and is directly related to people, but also with the environment in which they operate. The factors to take into account to determine the level of creativity are personality skills, cognitive skills, and social environment, basing these data on the previously seen models of Amabile et. al. (1996), Treffinger et. al. (2002) and Anderson et. al. (2014) who emphasizes that the cognitive skills are more measurable when creativity should be developed, as the social environment involves a set of attributes which ones enhance creativity. In turn, it has been shown that in order to obtain results on creativity, different tools are used, concluding to results that demonstrate high or low levels of creativity. Considering this, a framework can be built with which the different factors related to creativity can be displayed in a more intuitive way, and how these can be measured

through the developed tools. The building of the framework was focused on the division that Amabile (1988) made in the componential model of creativity, where she found that two main groups were obtained in people, the individual aspect and the social environment, supported by the other models already described. Therefore, one model of a built framework will focus on this division as they are important drivers that impact on creativity. On the other model of this framework, the methodology goes more in detail. It aims at showing just the individual aspect as it is a broader field. The main drivers that were analysed in this second model were those involved in creativity-relevant skills that were described by the model of Amabile (1988). The main reason is that this component focuses on personality traits and cognitive style, two factors that have a greater impact on creativity. The other components were not considered because they are indirectly related to these components, as well as they are in continuous research, hence the development of a framework with data not defined yet would be awkward. Moreover, the drivers involved in these components can be measured through the cognitive skills and personality traits indirectly. For instance, intelligence, knowledge can be related to convergent thinking which is part of cognitive skills, and motivation can be related to personality. Nonetheless, the framework was developed considering the cognitive skills in the main framework and personality traits were presented in tools. The reason is that personality traits are difficult to cluster in just one axis, as these traits depend on each person, where one person has many traits which can be the same trait that another but at a higher or lower level. Through the research was found the possibility to cluster personality traits into five categories, but it is an issue that is in continuous research as the personality of people is a difficult factor to measure. As the main direction of this report is to bring an organized performance of the influential drivers that impact on creativity in order to placed creativity measurement tools, the building of a model based on personality traits will be awkward. Nonetheless, many of the personality traits are indirectly related to cognitive skills as many of them that measure creativity can be related to the main drivers that affect this factor.

This is how through all this analysis has gotten the point of building two models of a framework based on two factors of creativity measurements. It worth noting that those models have been built with already investigated information, pointing in a more orderly way the meaningful used factors which measure creativity. The first model involves more general aspects, as individual and social environment, following the models described. The second one goes more in detail. It involves the two-step process, convergent and divergent thinking, measuring cognitive skills as it was seen that these two thoughts are pretty important in order to measure creativity accurately. Nonetheless, as on these frameworks will be placed the presented tools, it will be considered the classification of those ones in order to have a greater understanding and visualization about the diverse ways of measurement creativity. It is not a matter of finding which is the best tool, but of finding which aspects are important when considering which tool to use to determine creative identity in people. In conclusion, the framework will be able to cluster the diverse types of tool which measure creative people identity. According to Woodman et al. (1990), Feldhusen et al. (1995), Shalley et al. (2004) and Mumford (2014), people's creative behaviour is involved mostly by personality, cognitive aspects, and the social environment. The framework will not be focused on interests and personality tests because they are not direct indicators of creativity, although they are useful in explaining correlates creative behaviour. The best indicators are related to thinking, motivation, intelligence, and the environment (Feldhusen & Eng Goh, 1995).

The detailed model of the framework will be developed first. First of all, it is going to describe the axis which has in one extreme the convergent thinking and in the other the divergent thinking. This does not mean that they are opposite, but they are complementary. In order to be able to produce ideas, an individual must have both convergent thinking and divergent thinking, since it is not only to generate ideas but also to be able to analyse them rationally to be sure that they are coherent with the own goals or the objectives of the organization. Common people are more likely to have greater ability in one thinking than in the other. Therefore, when people should be analysed in order to get who have creative skills, both types of thoughts must be taken into account. Nonetheless, sometimes the focus will be just in one kind of thinking, it depends on what test-takers are looking for, and in this case, it will be considered one extreme of the framework which presents a high level of divergent but not so high level of convergent thinking, or vice versa. It should be borne in mind that they can be complementary, in terms of making teamwork to initiate to produce ideas and to lead to innovation within the company, it should be considered that these people could be enhanced their skills when working in the same teamwork, exchanging knowledge from both convergent and divergent thinking. The framework will be able to better place creative people, in order to have a greater vision of the different analysed aspects and what kind of skills to seek. Figure 4-9-1 shows this first axis where there is only one extreme convergent thinking and the other extreme only divergent thinking. In turn, the combination of both thoughts is represented in the middle. The main idea of this framework is to be able to show which tools are those that measure only one thinking or both, and thus knowing what type of tool to choose when looking for people with required creative characteristics.

CONVERGENT THINKING   MIXED CONVERGENT AND DIVERGENT THINKING   DIVERGENT THINKING
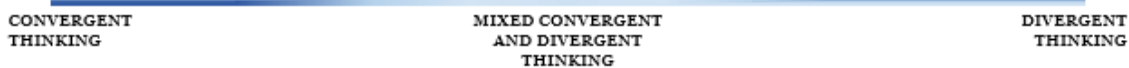
Figure 10 Axis of convergent and divergent thinking

The tools to be taken as an example are those described within chapter 9. Figure 10-2 shows the placed tools on the framework. Tools that are capable of measuring creativity through convergent thinking, such as intelligence tests and RAT, are only used for this type of thinking, so they are at this extreme. They facilitate the resolution of rational problems that have a unique answer. Regarding divergent thinking, those tests tend to generate responses that are classified according to fluency, flexibility, and originality, and the main tool which represents divergent thinking is the TTCT. This tool actually measures divergent thinking to a great extent, but since it is a tool that contains several stages, some of them measure the ability to evaluate ideas and not only the generation of them, so it will be placed closer to the center of the axis, where the mix of the two thoughts is depicted. On the other hand, the KEYS tool should be placed, which is based on measuring divergent thinking more than anything because the attributes involved in the social environment are related to fluency, flexibility, originality, and all those factors involved in divergent thinking. Regarding personality tests, as The Big Five and MBTI, are not totally linked to these kinds of thoughts, they focus more on personality and not on cognitive aspects. Researchers have developed studies where only one of the personality of people skills is directly related to divergent thinking, and it is the openness

to experience. In other words, it should be considered that personality contributes to the creative behaviour of people, but it cannot measure directly creativity. According to The Big Five test, in which the personality characteristics measured are conscientiousness, extraversion, agreeableness, neuroticism, and openness to experience, studies conducted to observe the reliability and validity of personality test with cognitive skills, was observed that only openness to experience proved to be highly reliable with divergent thinking. The most accurate trait is the openness to experience because it relates to the potential for original ideation and divergent thinking. Openness will allow the individual to consider diverse and varied ideas (McCrae, 1987). Therefore, the MBTI does not have room in this framework because it does not measure openness to experience, but other factors involved in personality. In addition, to complete the framework, all those tools are placed according to the classification of tools. It was said in chapter 9 that there are two types of tools, open-ended tests which correspond to divergent thinking, and close-ended which are related to convergent thinking. But the personality test The Big Five should be analysed differently. It measures creativity through a close-ended test because it is the better way to computerize results thus cluster people through their identity according to the results and conclusions concluded by the tool. As the skill of openness to experience is the only skill which is positively correlated with divergent thinking, it is possible to be measured not with open-ended tests but close-ended, as it is an involved skill in personality. The situation is depicted in figure 4-9-2.
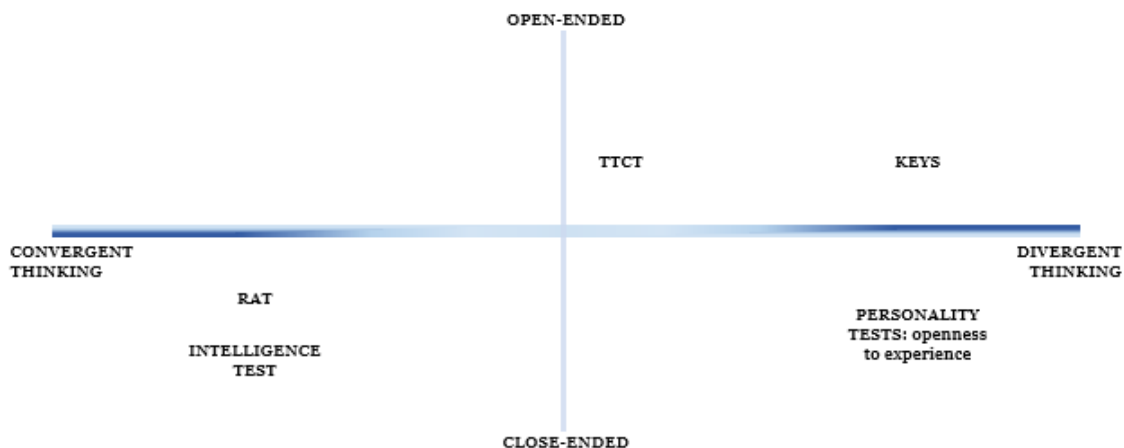

Figure 11 Placed tools on the axis of convergent and divergent thinking

Once the cognitive skills have been analysed, besides the personality skills, there are still other aspects in which creativity is measured, as well as how divergent and convergent thinking was analysed, the field of the social environment at one extreme of the axis will be analysed, and the individual at another one. As in cognitive skills, where both thoughts were not mutually exclusive, but both are needed to get high levels of creativity. The social environment and the individual aspect will behave in the same way. As it is depicted in Figure 4-9-3, it can be graphically observed that in this axis there is the mix between both aspect on the middle, and in each extreme just one aspect. It will be good to clarify that both are needed to generate new and novel ideas. Personality and cognitive skills are more reflected in the individual aspect, while in the social environment are included the characteristics of encouragement of creativity including management of the

organization, support on works and supervisory encouragement, pressure on work, freedom, and autonomy, resources, among others, which foster creativity following the model by Amabile et. al. (1988) and Amabile et. al. (1996), taking into account the ability to perceive the creative social environment by individuals.

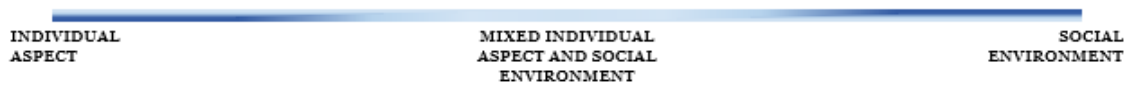| INDIVIDUAL ASPECT | MIXED INDIVIDUAL ASPECT AND SOCIAL ENVIRONMENT | SOCIAL ENVIRONMENT |

Figure 12 Axis of individual aspect and social environment

Considering the named tools and which ones are taken as an example, they are part of personality skills, cognitive skills, and social environment. This does not mean that just the tool of the social environment is important because personality and cognitive skills are part of the individual aspect, so it will be correct to emphasize the relation between them. If it is deepened into these two aspects, it can be said that in the individual aspect, according to the model of Amabile (1988), cognitive skills, personality skills, motivation, and domain-specific are in, therefore the tools of RAT, TTCT, The Big Five as well as MBTI and intelligence tests are part of this aspect. While the KEYS tool is placed on the social environment at the middle of the axis where a mix between individual aspect and social environment is developed since as the tool measures creativity in an external environment, it has a lot to do with the perception of people on this creative environment, so it tends to measure creativity considering both aspects together and not just one, as it is depicted on figure 4-9-4. The social environment tends to be more related to divergent thinking because it includes leadership on managers where they encourage employees to generate ideas, follow their feelings, take risks, be open to new experiences, also because it is related to rewards in terms of the motivation of employees. The convergent thinking is more difficult to related with the social environment because it involves the reasoning, analysis, and evaluation of ideas where the social environment does not bring too much value or contributions to the creative behaviour on people in the phase of evaluation, nonetheless this part of the framework must need future research in order to better understand the influences that may be social environment may have in convergent thinking (Shalley, Zhou, & Oldham, 2004). Taking into account the classification of the tools, it is possible to group them between open-ended and close-ended, continuing with the classification of these according to the axis of the social environment and individual aspect.

OPEN-ENDED

TTCT   KEYS

INDIVIDUAL   SOCIAL
ASPECT   ENVIRONMENT

        PERSONALITY
           TESTS

           RAT

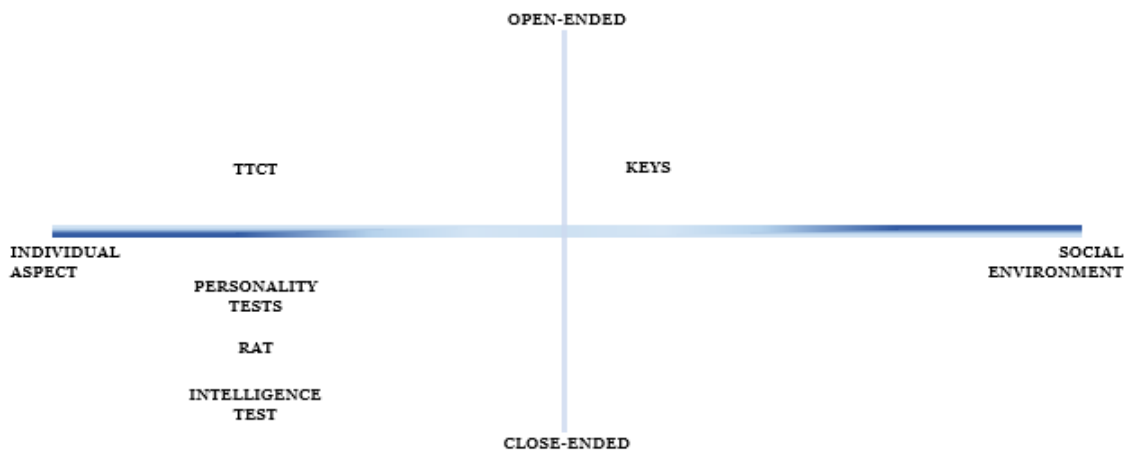   INTELLIGENCE
           TEST

CLOSE-ENDED

Figure 13 Placed tools on the axis of individual aspect and social environment

The models of a framework have been built based on already developed models. The information obtained on these already built models has been used in such a way that these models could be built, giving a better visualization to the various aspects that influence creativity and being able to determine and place the necessary tools to measure creativity, establishing which of the aspects is the most appropriately measured. Furthermore, the implementation of the framework seeks to find people who have creative skills and who in turn have innovative ideas. Considering that for organizations the innovation significantly helps their continuous growth, since, through it, they are able to adapt to recurring changes. Finding creative people is not an easy task as it has been seen, but it must have a series of factors and drivers to measure, which are measured through tools. These tools mostly measure only one driver at most two, so it must be taken into account what are the measured aspects and thus know what type of creativity the person will find and where to focus.

5. Conclusion

The report has performed the importance of innovation and the relation between innovation and creativity, being able to discover the diverse factors involved in creativity and, therefore, which have an impact on innovation. The main objective of this report is to be able to obtain a framework in order to have a clear reading about which tools should be taken to measure a specific factor of creativity. Moving further with the research, it was possible to build the framework considering the existent models which group the factors that affect creativity, and the related tools that were investigated in order to spot the relationship between those and the drivers of creativity that are brought into play.

The aim of the developed framework is to act as a guide for a better comprehension about the relationship between the tools that measure the level of creativity and the factor that impact on creativity, in turn, which drivers that impact on this factor are analysed with the utilization of that tool, in order to be able to know which one should be used according to the necessity. The implementation of the framework will help to a better understanding of which creative factors people perform well when it should be considered the participation of them in the development of innovation.

Once the factors that stand out most in the measurement of creativity were identified, it was analysed and observed how these factors are managed to obtain results that represent to what extent creativity is disclosed. Therefore, the existence of tools capable of giving results on the measurement of creativity in people was concluded, considering their level of reliability and validity, that is, the ability of these tools to obtain correct results and the most suitable possible. For the selection of tools, those that are most frequented and those most used throughout the papers in which this report was based were taken into account. The analysis and research of other tools are available for future researches which ones should be located in the described frameworks, where they were placed according to their classification of tools depending on the way in which results are obtained, open-ended and close-ended, as well as the clustering according to the creative skills. The location of the tools in the models helps to obtain and identify which tools are most used to measure a factor that impacts creativity. It is not based on the extent to which the analysed tool has the ability to measure creativity or not, because all the selected tools do it, but not all measure the same driver of creativity. Each one focuses on measuring one factor more than the other, therefore the application of the framework should be aligned with what it is sought in order to make a model with which each aspect of the creative person can be analysed to further understanding on the creative capacity in humans and to be able to differentiate most influential factors on creativity to measure the creative capacity in each individual. It is a division of involved factors of creativity in order to obtain in which way in they can be analysed to obtain accurate results.

The utilization of this framework can give a possible solution to the gap companies are suffering, in the way in which it could be easier to identify which tool is the most accurate one in order to determine the capable person to perform creativity in a specific field of the company. For instance, a company found people that develop well in creativity but the same the development of innovation is not the expected one inside the company. It could be possible that those people have a high level of creativity but all of them in the same influential driver of creativity, and as it could be seen along with the research, in order to reach greater creativity it is needed more than one driver impacted on creativity to reach a huge level of innovation. Thus, the framework can help in this situation as is placed a different kind of tools throughout the axes of the drivers in order to know which tool measures better one driver than the other, finding people with a high level of creativity but within different drivers of it, reaching an equilibrium between these different kinds of creative behaviour of people.

In conclusion, the developed models of the framework mapped in a coordinate system where the main axes involve specific drivers which impact on creative factors and the classification of tools which measure the level of creativity, being able to develop the relationship between those factors and the related creativity measurement tools, demonstrating a more orderly way of observing the factors that most influence creativity and what tools are the most appropriate for this measurement to develop future analyses, thus simplifying the analysis of innovation, which is necessary to survive. , as well as for companies, entrepreneurs or individuals.

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