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قال الله تعالى: "وما اوتيتم من العلم الا قليلا" سورة الاسراء -85-

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List of abbreviation:

BEEPS: Business Environment and Enterprise Performance Survey

HR: Human Resource,

HRM: Human Resource Management,

MENA: middle east and north of Africa

OECD: Organization for Economic Co-operation and Development

OFF-JT: off the job training

OJT: on the job training

PISA: Program for International Student Assessment,

R&D: research and development

GENERAL INTRODUCTION

General Introduction:

"Innovation in management principles and processes can create long-lasting advantage and produce dramatic shifts in competitive position. Over the past 100 years, management innovation, more than any other kind of innovation, has allowed companies to cross new performance thresholds."

—GARY HAMEL, 2006

"If you don't have a competitive advantage, don't compete."
JACK WELCH

"The *most valuable of all capital is that invested in human beings*" Alfred Marshall,1890

'Human, not financial, capital must be the starting point and ongoing foundation of a successful strategy.'
Christopher A. Bartlett and Sumantra Ghoshal
MIT Sloan Management Review
Winter 2002

By taking a look in the world, there are different changes in the world, changes touch different fields such as technology, economics, industry, political, education, religion, security of the nations, appearance of developed state and the disappearance of others …etc. These movements are following the different changes in the states. From the educational side, the educational system from primary level, middle and secondary to the university level play an important role in the human capital creation.

Before, we did not hear about any African country as strong economy. However today, there are some indicators mention that there are important economies appears in Africa such as Rwanda, Gambia, Malawi and Mozambique in addition to Uganda. These countries faced different changes in their systems until there called innovation learners (Bourouaha and Maliki 2018). This is due to their high jumps in the global innovation index. This means that these countries understand that the most important steps to cutch-up the developed countries is to follow their steps and innovate. There are widely recognized that innovation is the main bias of the competitiveness and sustainability of companies and nations.

The Theoretical developments and empirical studies continue to abound around this central theme that is innovation following its necessity nowadays. The researchers are then essentially focused on the different conditions of development of innovation capacities, whether within the companies (as part of the work on innovation management) or at the level of the nations (within the innovative framework of public policies).

Different companies are increasingly evolving in environments where technological breakthroughs and innovation are critical to gaining competitive advantage.

For all countries, the innovation has become a major concern. Therefore, the valorization of resources in innovation projects is necessary because it contributes to build and maintain competitive advantages.

Innovation, in this sense, is no longer the exception, it becomes the rule, and it is a permanent part of the life of organizations. To be clear from the outset that the concept of innovation has a polysemic meaning. Innovation, in this context, is not to be confused with invention, it is defined as a collective and interactive process of creating or improving products, processes, organization, marketing or logistic methods. The idea that innovation is a social phenomenon is becoming a commonplace. Different researches are increasingly focused on the design of innovation extended to the macroeconomic study of technical change.

From another side, technology has become the main weapon of competitiveness of nations. The technological policies and industrial policies tend to converge, hence the importance of the infrastructure who's their purpose is to define the framework of action of innovation dynamics.

From now, the competitiveness of companies and nations depends on their innovative ability and mastering the knowledge production processes. According to this competitiveness, the gap between the richest and the poorest countries is widening. One of the most important problems facing developing countries is therefore the reduction of technological dependence and the setting of the strategies and the policies of the innovation processes learning. The recent trend of competitiveness through innovation and changes in the organization of the world economy have transformed the objective conditions facing these countries (changes in the competitive paradigm, competitiveness through innovation, changes in the rules of international trade). The lack of mastery of imported technologies and the delay in the development of innovative capacities are explained, in the case of developing countries, by the very attitude of these countries in terms of technological development. Being perceived as an exogenous phenomenon, technological change was strongly linked to investment. In the sense that technology is perceived as a stock of capital, where the central problem is to choose the right technique: an intense technology in labor (intensive labor) or an intense technology in capital (intensive capital).

These states of affairs can be explained both by the lack of knowledge of the important role played by these factors in the learning processes of technologies and innovation dynamics, and by the lack of control over the conditions for implementing organizational frameworks of these countries.

Different studies are understanding that the phenomena of differences in growth and divergences in development trajectories involve abandoning several components of the standard paradigm and challenging the dichotomy established between the macro and micro levels economy. They stressed the need to take into account the institutional framework and organizational dynamics of innovation.

Today, the ability of a country to adapt to permanent technical progress and to reorient production in areas with dynamic comparative advantages based on skills in qualification and innovation. Innovation should enable developing countries to create market niches through the introduction of products new high added value.

At the risk of further lockdown, developing countries need to boost and protect their capacity of innovation taking into account their specificities. In other words, the prospects of insertion of the developed countries in the globalized economy and therefore their potential for development are largely dependent on their ability to innovate, which in turn is conditioned by the managerial and organizational capacities.

Indeed, after more than thirty years of experience in industry, education, training and research, the integration of the Algerian economy into international trade remains problematic. This is partly explained by its limitations in terms of its ability to generate a real innovation dynamic that would allow it to have competitive export advantages. The situation is all the more complex as competitiveness is increasingly based on the ability to control information and knowledge. Investment in physical assets is no longer sufficient; skills building and investment in intangible assets are the driving forces behind the innovation dynamic of companies and nations.

In Algeria (because it is one of the MENA countries), and like several developing countries, the primary sector (hydrocarbons in Algeria) remains the only export bias. The old technical system developed, derived from the import substitution models, which is in essence highly protectionist, has proved its limits. Until now, companies have operated without proper control of the technological factor and without innovation activities. For example, Algeria is today confronted with a situation of technological obsolescence of the productive systems. The challenge of development policies is the renewal of the technology park. This renewal is thwarted, on the one hand, by the absence of international technology transfer, and on the other hand by the weakness of local learning and innovation capacities. Non-hydrocarbon production suffers from an insufficiency both quantitatively and qualitatively (reliability, standardization, technological content, etc.).

The technological backwardness and the low level of technological control can be apprehended through direct indicators such as: the low productivity of the factors, the low diversification of the products, the low rate of use of installed capacities, the relatively products (manufactured products).

To remedy this situation, the firms of the MENA region are confronted with the need to master innovation, which would allow them both to have competitive export advantages (product innovation) as well as to improve productivity levels (innovation process). Let's specify immediately that dynamics of improvement and dynamic of creation are not exclusive. In the long run, both are necessary.

In the second side of technology that it represents the physical capital, the human capital is considered also as an important engine of the production process in the organization or the state.

By “human capital” we mean the knowledge and skills people possess that enable them to create value in the global economic system. How nations develop their human capital can be a more important determinant of their long-term success than virtually any other factor.

As it is mentioned before, developing the technology of the firms allows it to compete, survive and innovate. Also, the development of human capital can be also an important key for the organization to compete and innovate. Following the knowledge and skills acquired, the employees could generate new ideas. Following the education, the employees could use high tech machines that will produce new product for the firms.

This thesis has some main objectives. The first is to look for the links between human capital and economic growth. Second objective is to explore the necessity of the training for human capital development and innovation. Third objective is to select the different variables that could affect the innovation. Therefore, the thesis is organized as follows, it starts with theoretical part and followed by empirical part.

The theoretical part includes all of three first chapters. The first Chapter discusses issues surrounding the definitions and measurement of human capital in the first steps, followed by some important theories of human capital and economic growth, with the aim of mentioning the effect of human capital on the economic growth. After, exploring some factors that have an effect on the human capital in general such as education, migration, looking for job and gender. In the end, a conclusion to finish with the first chapter.

However, second chapter explores issues on the training and how it affects the education and sector of work. This chapter is beginning with definitions followed by the training approaches, methods, types and benefits. After, it is necessary to mention the factors that affect the training, because these factors such as age of the employee or trainee and cost of training have their effect during the training. After that, the thesis touches the relationship between the human capital and training. Next, and following the similarity between education and training, it is necessary to mention the links between them because there are two policies for the knowledge transfer. Also, the next point discusses about the training and sector of work with examples following its necessity in all sectors of work. Following the problematic of the thesis that it the training and innovation, the last section before the conclusion focused on the creativity training, that is how cold be the training policy used for the creativity, solving problems and even innovation. In the end of this chapter, a conclusion presents the essential of the chapter.

In the second side of the training, the aim of the thesis is to look for the effect of training on innovation. Therefore, the third chapter is for the innovation. After the introduction of the chapter, the first section demonstrates the links between both innovation and creativity following the narrow gape between both of them. Following the unlimited innovative field, the section after presents the theoretical side of innovation as multidisciplinary field of research, followed by the section of some theories of the creativity, to enlarge the definition of innovation. After, the section demonstrates the different characteristics of innovation such as types, level and kinds of innovation in the aim of building theoretical basis of the empirical parts. In the next section, the study explains a bit about the relationship between training and innovation. The section after concentrates on the employment that is the third part of our problematic. In the end of this chapter, a conclusion to sum up the essential of the links between innovation, training and employment.

For the empirical part, it is based on the Business Environment and Enterprise Performance Survey (Beeps dataset) for MENA region. The sample of the survey covered nine countries of the MENA region that are Egypt, Morocco, Palestine, Yemen, Lebanon, Djibouti, Israel, Tunisia and Jordan.

Before launching the empirical part, the chapter four contains some realities about both of training and innovation in the MENA region starting with the presentation of National Innovation Systems proposed by Professor Djeflat. Also, the chapter contains theoretical parts of the Logit and Probit model.

In addition, the empirical part starts in the first step with descriptive analysis of the sample in general. Also, the selection of empirical analysis of relationship between innovation as dependent variable of the research and some available determinant such as Research and Development, training and employment in addition to the characteristics of the firms such as size and sector of work. In the second step and to estimate the effect of training and employment on innovation, the logit and probit model is used to measure and estimate the effect of training as dichotomic variable on the innovation.

At the beginning of the empirical study, we start with the descriptive analysis to present the characteristics of the sample. Second, the study includes also cross tables to look for the distribution of the sample through the important characteristics. The essential of the empirical study start by using both binary logit-probit model. The study focuses on the main questions and the items of the research that are human capital, training and innovation. Third, it used the cross table to select the distribution of the response between the important question. In the end, conclusion contain the important results of the research.

Statement of the problem and significance of the study:

Statement of the problem:

This thesis will focus in the formal training programs in the firms of MENA region and its effect in addition to the employment on the innovation ability of the firms in the first step. Where in the second step, the study focuses on the effect of training and employment in different types of innovation using both logit and probit regression and comparing their results. According to the previous background, this research is based on, and aims to answer the major following questions:

? Do the formal training programs offered by the firms enhance the innovation in the firms of MENA region?

Thus, this thesis aims to answer the following sub-questions:

? Does innovation exist in the firms of MENA region?

? What are the different types of innovation exist in these firms?

? Have the characteristics of the firm such as size and sector of work an effect in its innovativeness?

?Among the different independent variables of the innovation, what is the suitable one to foster innovation in MENA region?

Research Hypotheses:

This research entails the following hypotheses:

H1: The majority of the firms in MENA regions are interested in the innovation,

H2: The majority of the firms in MENA regions offered formal training for their employees,

H3: The training affects positively the innovation in the firms of MENA region,

H4: The employment has a significative positive effect on innovativeness of the firms in MENA region.

Aim of the thesis:

The aim of our thesis is turned around:

- Determining the importance of human capital on economic growth
- Look for the factor affecting the human capital.
- Focusing in the necessity of training as an engine of creativity and innovation.
- Look for the relationship between employment and innovation,
- Determine the reality of innovation in the firms of the MENA region
- Determine the effects of selected variables in the firm on their innovativeness.

- Look for the effect of employment and training as a policy taken by the firms to foster innovation.

The significance of the study:

This study may be relevant to different groups interested in the topic of innovation and to how a study of the relationship between training and creative performance is of high relevance. First, the study is relevant to business organizations and innovators. The organization's ability to constantly innovate and come up with fresh solutions that will improve products, services and processes is a key ingredient for success in today's competitive environment characterized by rapid and constant change. Achieving high level of creative performance is crucial for innovation to occur. Thus, additional empirical knowledge about the factors that affect creative performance is valuable to business organizations in their quest to achieve and maintain their competitive advantage within today's turbulent conditions.

By providing empirical evidence regarding two factors that have the potential to effect creative performance, the study is relevant to business organizations and innovation alike. Knowing about the effect of the type of training on innovation can help human resource managers and creativity consultants to implement the most efficient training programs to boost employees' creative performance and innovativeness. Similarly knowing about the relationship between the nature of the task and creative performance may help managers to structure and formulate tasks in such way that they stimulate creative responses. The factors and conditions that affect creative performance are relevant not only for business organizations but also for the academia. Although the study of innovation can be traced back to the Greek philosophers, more systematic research efforts have started in the 1950's with the pioneering work of J.P Guilford and E.P. Torrance (Guilford 1950; 1967; Guilford, Hendricks, and Hoepfner 1968; Ellis Paul Torrance 1968; 1974). Since then, the study of innovation has intensified and the field is now multidisciplinary. As such, many different theoretical perspectives have proposed a multitude of factors that affect creative performance. However, most of research developed in this sense has examined only a limited set of factors that affect innovation, such as personal characteristics and individual personality traits, cognitive styles, creativity skills, ability and experience and certain contextual factors. Yet, given the high complexity of the topic, there are many other factors that have been either under-examined or not researched at all.

The present study is thus relevant to the academic research in innovation as it aims to examine the effect of employment and training on innovation in the MENA region. These factors are relatively under-examined by previous research and, hence, extending the empirical evidence to such factors may help understand the most effective ways of nurturing that’s mean enhancing innovation through training. This study is also relevant to education level of the employees and their effect on innovativeness of the MENA firms. One of the factors under examination is training delivery method. Although, it has been recognized that training in creative thinking enhances creative performance as it provides trainees with both knowledge

and skills in creativity techniques, little is known about the relationship between the type of training and innovation. Training can be provided in different formats (e.g. lecture-based training, active learning, etc.) and such formats should be adapted to the learning audience (e.g. children vs. Adult learning).

The thesis examines the effect of employment and formal training programs offered by the firms on the ability of innovation in the MENA region. The results of the study could in any way to open new fields of research to touch the real important of the different policies implied on human capital and their effect on the innovative ability of the state.

Methodologies and Methods:

Following the study of (Crotty 1998), the academic research referred to methodology as a strategy, plan of action, process or design that governs the choice and use of methods. We used **Mixed methodology strategy** in the study. The Table 0-1 contain the important methods of research used in the study:

Table 0-1: steps of methodological research

Historical research	Qualitative methodology
Statistical research analysis	Quantitative methodology

Source: edited by the student

Findings generated using both quantitative and qualitative research methodologies were needed to address the research questions. Therefore, the use of different data collection methods of documents analysis, statistical research, "implies greater validity than if single similar methods had been used" (Neuman 1997).

Key concepts and definitions:

The key concept are concepts defined or clarified in this part because they are words or terms within, or closely related to the key research question:

- Approaches of human capital;
- Education;
- Training;
- Research Training system;
- Employment;
- Innovation;
- National innovation system;
- Research and development (R&D).

This part starts with the different approaches of human capital in the firm performance because the subject of thesis focuses on the role of training of the employees in creating innovation or the integration

of training as a research process in the national innovation system (starting from the rank of training in the innovation leaders and how to integrate training in our countries).

If we implement it in the right way in our firms. Following these points, I gave it an important interest, and I start to study the effect of the training because some of our firms start to train their employees such as ALGERIE TELECOM, SEROR, TEXALG and others. Therefore, these firms will spend money to train the employees, but the result still unknown.

From another side, I would like to generalize the study of the effect of training on innovation in all MENA region to look for the effect of the training on the level of the innovation. From another side, the possibility of proposing new ideas to catch-up the developed countries.

Definitions:

Because the following terms are used frequently throughout the thesis, it is worth defining each of them in the introduction. They are presented here in alphabetical order. Most of the terms are clarified further in specific chapters.

Capital market:

The capital market is a financial market in which long-term debt or equity-backed securities are bought and sold. Capital markets are defined as markets in which money is provided for periods longer than a year (Arthur O'Sullivan and Steven M. Sheffrin 2001)

Human capital:

Human capital is the knowledge, skills, competencies and attributes embodied in individuals that facilitate the creation of a personal, social and economic well-being (Healy and Cote 2001).

In addition, it is the knowledge, skills, competences and other attributes embodied in individuals that are relevant to economic activity"(OECD 1998).

Human capital formation:

Human capital formation is the process of further developing the productive capacity of human resources through investment (Wykstra 1971).

Human capital strategy:

The human capital strategy is the plan for how an organization will produce sustained competitive advantage through people (Hall 2008).

Innovation:

Innovation is A technological product or process (new or significantly improved) innovation that has been implemented; or an organizational innovation that has led to a measurable change in output (Sandra Haukka 2005).

Investment:

Investment is an initial cost that one hopes to recoup over some period of time (Ronald G. Ehrenberg and Smith 2011).

Knowledge-based economy:

An economy in which the production, distribution and use of knowledge is the main driver of growth, wealth creation and employment across all industries (L. Lee and McKeon 2001).

Learning economy:

A dynamic concept that involves the capability to learn and expand the knowledge base. It refers not only to the importance of the science and technology systems – universities, research organizations, in-house R&D departments and so on – but also to the learning implications of the economic structure, the organizational forms and the institutional set-up (B.-äke Lundvall and Johnson 1994).

National innovation system:

A system of interacting market and non-market institutions that continuously learn how to generate, diffuse and use new knowledge to form product, process and organizational innovations. The role of government is to provide a framework of policy instruments that support systems growth and address problems that restrict the functioning of the system (Sandra Haukka 2005)

Research and development (R&D):

It is creative work undertaken on a systematic basis in order to increase the stock of knowledge, including the knowledge of man, culture and society; and the use of this stock of knowledge to devise new applications (OECD 2002).

Training:

It is a planned and systematic effort to modify or develop knowledge, skill, and attitude through learning experience, to achieve effective performance in an activity or range of activities (Dhar 2015; Buckley and Caple 2009).

Research training system:

Research training systems have an important role in training people to produce new knowledge within economies where knowledge is the fundamental resource driving competitiveness" (Sandra Haukka 2005)

The stock of human capital:

It is the accumulation of knowledge, skills and competence held at any time by the individual.

Difficulties in the research (study obstacles):

The current research has so far been challenging at different levels, including finding the primary sources, conducting the literature review, undertaking the practical research, and even citing the theoretical framework, especially in the case of a research region that is MENA region and the scarce studies about the innovation in this region. This is for the theoretical parts, however, for the empirical part, the study faces different obstacles following the inexistence of the data of this region (even macro-economic data).

The thesis has ventured to enlighten this area of research (following its necessity) in spite of that challenge, which was successfully handled, once the study was conducted in English, which enabled the study to widen the scope of the research and include theoretical sources and using estimation methods to look for the effects of the independent variable on the dependent variables.

CHAPTER ONE

1 Chapter one: Human Capital and Economic Growth

1.1 Chapter Introduction:

In the organization, we cannot select which human resources programs or activities created measurable value to customers. The first-generation endogenous growth models, assuming human capital accumulation following the study of (Maria Rosaria Carillo 2003) as a major engine of growth. This latest have grounded their analysis on the Beckerman model of human capital, where homogeneous agents in the presence of perfectly competitive markets forgo leisure and current income in order to increase their knowledge and obtain a higher future income".

The knowledge and skills of a worker has-which come from education and training, including the learning that experience yields—generate a certain stock of productive capital. The value of this productive capital is derived from how much these skills can earn in the labor market (Ronald G. Ehrenberg and Smith 2011).

This chapter investigates the role of human capital in economic growth and in cross country income differences. Our main purpose is to understand which factors affect human capital investments and how these influences the process of economic growth and economic development. Human capital refers to all the attributes of workers that potentially increase their productivity in all or some productive tasks. The term was coined because many of these attributes are accumulated by workers through investments. Human capital theory, developed primarily by (Becker 1965; Mincer 1974), is about the role of human capital in the production process and about the incentives to invest in skills, including pre–labor market investments (in the form of schooling) and on-the-job investments (in the form of training). It would not be an exaggeration to say that this theory is the basis of much of labor economics and plays an equally important role in macroeconomics.

This chapter is organized as follows, it is started with definitions and measurement of human capital followed by some important models of human capital such as Romer and Lucas. Next, a part of the important factors affecting the Human capital. However, in the last part of this chapter, it is focused on the development of human capital.

1.2 Human capital: definitions; measuring and impacts:

1.2.1 What's a human capital:

Human capital is one of the important capitals in the economic society. It is defined fairly tightly as it mentioned in the definition following the (OECD 1998) as "the knowledge, skills, competences and other attributes embodied in individuals that are relevant to economic activity." From the side of the individual, learning and working provide people to contribute in the society or the firm. However, from the side of the worker, the workers skills could lead to productivity and innovation".

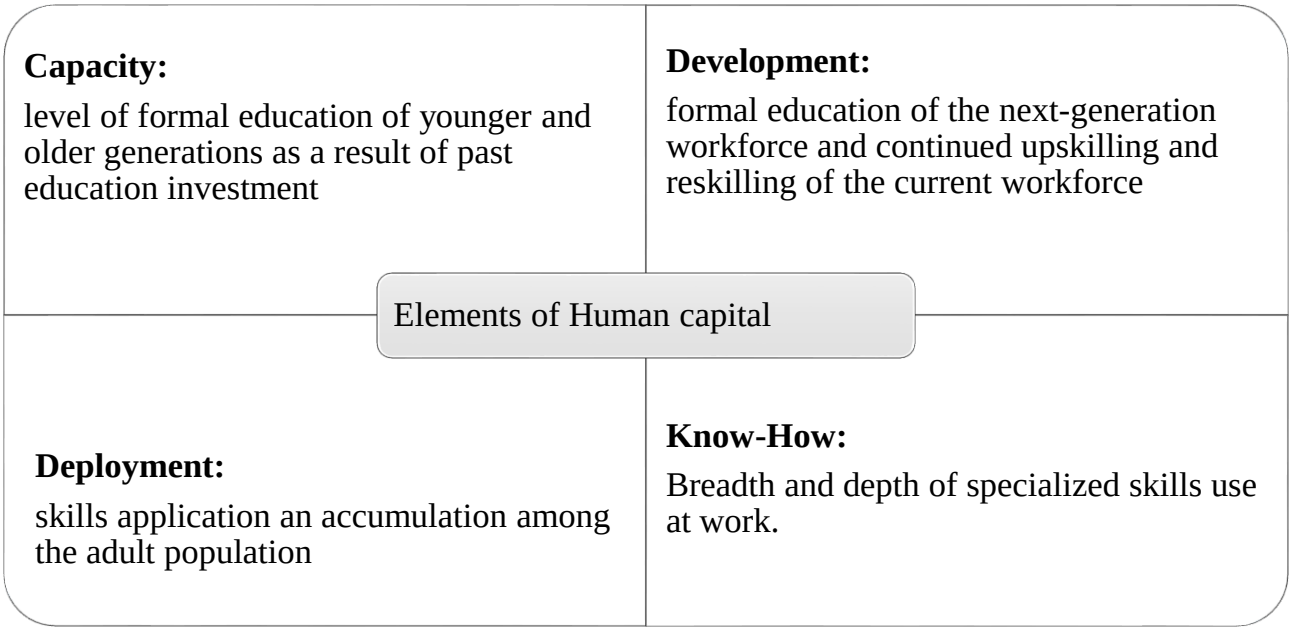
Also, it includes following the study of (Ronald G. Ehrenberg and Smith 2011) the accumulated investments in different activities such as education, job training, and migration. In addition to the study of (Mtiraoui 2016) and according to the Lucas model (Lucas 1988), "in the new theory of growth, the economic growth ratio depends to the government investment in the human capital especially in the education and Research and Development". From another side, there are other definitions of the human capital that are the key role of the human capital in the society or the firm. According to (World Economic Forum 2017, 3), "the human capital is defined as a key role for growth, development and competitiveness". These definitions stress that the human capital is an important factor in both of society and organization following to its role in all of them. However, how it could be measured?

1.2.2 Measuring human capital:

"Single-index measures of human capital need to be complemented with more specific measures based on direct measurement of knowledge and skills in organizations" (Healy and Cote 2001)

To identify and to measure the many different attributes that make up human capital requires a focus directly on what it is that individuals bring to work and economic activity, it is necessary at first to understand the different elements of the human capital. According to the human capital report, there are four elements of human capital. These latest are presented in Figure 1-1 below:

Figure 1-1: Elements of human capital



source: (World Economic Forum 2017, 3)

Following the Figure 1-1, there are four elements of human capital. These elements are the essential for developing or measuring human capital. Starting with the capacity, this element it englobes the educational capacity of the person. However, for the development, it summarizes the methods followed by the firm to develop their human capital capacities following the selection of formal specific

education for next generation workforce and upskilling the current workforce. Also, the deployment represents the sharing of knowledge and skills between old and young employees where know-how is an essential element also of human capital because it touches depth of the skills of the employees.

There for, we can summarize that the measurement of "human capital" have been based on completed years and levels of schooling, and on the return deriving from higher earnings of those with more education. However, there were far from the sufficient level in relation to a broad definition of human skills and other attributes (OECD 1998). These are touched in different situation such as:

- A preoccupation with quantitative measures of participation, especially in formal education, neglects learning, knowledge and skills as such – which knowledge and skills to promote, under which conditions. These are vital policy questions with respect to human capital.

- The narrow focus on completed educational level and associated qualifications marginalizes the issue of depreciation of human capital, since it assumes that qualifications confer permanent gains. Obsolescence is now an important consideration – hence the policy objective of making learning a lifelong activity. Strategies to achieve this are inadequately informed by drawing information only from initial education, where it is most plentiful. Measuring and quantifying the investments by individuals, organizations and governments to maintain or further develop initial human capital endowment is important.

- Frameworks focused on the individual as the main unit of analysis downplay the role of organizations, and their use of human resources. An understanding of the use as well as the potential of human capital must take into account the ability and willingness of firms and other bodies to become "learning organizations"

Therefore, the analysis and measurement of human capital is thus not about proposing any simple single measure. It is about building new understandings and typologies, supported by indicators, that address its multi-faceted, dynamic nature. Such understandings need to relate to people's experiences both over time and in various settings: "life-long" as well as "life-wide". Invest in human capital by improving the skilled labor force with expanded tertiary education. Because, the human capital is the essence of the change in the society.

The total human capital stock within a country can influence its prosperity and international competitiveness. The distribution of knowledge and skills has an important bearing on social participation and access to employment and income. So, different governments are interested in both the overall human capital stock and ways in which specific skills and competences are distributed within the population. This stock is heterogeneous where there is no single type of attribute can adequately represent the many human characteristics that bear on economic activities.

In general, there are three approaches to measuring human capital stock.

The first is the educational attainment: that is the use of highest level of education completed by each adult. The second is to perform direct tests on adults to determine whether they have certain attributes relevant to economic activity. The third is related with the market value of these attributes (looking at the differences in the adult's earnings that appear to be associated with particular individual characteristics, to estimate the market value of these attributes and hence the aggregate value of human capital stock)

To measure human capital, there are different important factors that should take in consideration for the result of good measurement of human capital. Starting with Figure 1-1, the Table 1-1 demonstrates the important factor used to measure human capital in a direct relation with the age because there are indicators related in the first degree with the age of the human.

Table 1-1: human capital components

Age group (share of total population range of country values*)						
Component (sub-index weighting)	indicator	0-14 (13%-48%)	15-24 (9%-22%)	25-54 (26%-70%)	55-64 (3%-14%)	+65 (1%-27%)
Capacity (25% of total index score)	Literacy and numeracy					
	Primary education attainment rate					
	Secondary education attainment rate					
	Tertiary education attainment rate					
Deployment (25% of total index score)	Labor force participation rate					
	Employment gender gap					
	Unemployment rate					
	Underemployment rate					
Development (25% of total index score)	Primary education enrolment rate					
	Quality of primary school					
	Secondary education enrolment rate					
	Secondary enrolment gender gap					
	Vocational education enrolment rate					
	Tertiary education enrolment rate					
	Skill diversity of graduates					
	Quality of education system					

	Extent of staff training					
Know-how (25% of total index score)	High-skilled employment share					
	Medium-skilled employment share					
	Economic complexity					
	Availability of skilled employees					

Source: (World Economic Forum 2017, 6)

*: individual countries age group distributions are used for weighting indicators in the capacity and development sub-index to arrive at an overall sub-index score/

Table 1-1 contains the four principal elements of the human capital that are: capacity, deployment, development and know-how. These four elements are related in the first relation with the age of the human. The first element, capacity is the ability of people to adapt with the new technologies. Therefore, its sub-index features four common measures of formal educational attainment, disaggregated across age groups in the workforce. These capture the percentage of the population that has achieved at least primary, (lower) secondary or tertiary education, respectively, and the proportion of the population that has a basic level of literacy and numeracy. For that, the sub-index of the first element are related with the majority of the age groups except the first group (0-14years). The second elements that is deployment is considered for the same groups of age as the first components. However, the deployment measures how many people are able to participate actively in the workforce as well as how successfully particular segments of the population women, youth and older people, those who tend to be particularly inefficiently engaged in labor market are able to contribute. Concerning the third sub-index that is the development, it is divided into two sections following the sub-indexes that are the indicators and their relationship with the age group. The first section concerns the indicators with relation to education such as enrollment rate of primary and secondary school in addition to the quality of education. These latest indicators are founded in the second age's group. At the end, there is also the indicator of know-how that it concerns people in the first step of work that are the two age groups from able two work (from 25 years to 65 years old).

1.3 Human capital theories and economic growth:

Human capital is a key factor for growth, development and competitiveness. The link between the human capital and these operations is due to different movement starting from the human being. At first, the development of the human capacities and skills, this latest is a self-development in addition to the outputs as development in the society or the organization. The growth of the organization appeared in this level. For the competitiveness in the case of a firm with skilled human and firm with unskilled human, the human capital is not limited following (Lucas 1988; Romer 1990; Aghion and Howitt 1997)

just for increasing labor productivity only, but it is considered also as the process, that it increases the innovative capacity of the economy in the general. The human capital theory expects that workers who invested more in schooling will also invest more in post-schooling job training (Ronald G. Ehrenberg and Smith 2011).The human capital is one of the essential factors for the economic development (Mtiraoui 2016). According to the (Benhabib and Spiegel 1994)," the accumulation of the human capital is considered as an important factor for the economic development". Following the results of this study, the human capital has an indirect effect on the economic growth following its effect on the growth of the total factor of productivity in two mechanisms. In the first mechanism, the gathered results show that the human capital influence directly the rate of domestically produced technological innovation. Where in the second mechanism, they found that the human capital stock affects the speed of the adoption of technology from abroad.

1.3.1 Romer model: knowledge spillover and growth

Following the study (Romer 1986) where Paul Romer provided a model that yielded positive, long-run growth rates without assuming exogenous technical change. At the center of the model is the idea that when a firm generates new knowledge (to use in its production technology), some of this new knowledge could be helpful for the other firms. Assuming that there is no payment associated with the transfer of knowledge, this is called a knowledge spillover, or a knowledge externality(Christine Greenhalgh and Mark Rogers 2010, 227). Romer model 1986 has three characteristics that are: first, the firms use knowledge as a capital goods. Second, knowledge grow until the level of global knowledge, where the third characteristic is the firms are competitors where it takes the prices and global knowledge as it given, where it selects optimally the other factors of production and knowledge.

Firm i selects factor of knowledge as input K_i, the Global knowledge (capital knowledge) is presented in the Equation 1-1 below:

Equation 1-1:

$$K \equiv \sum_{i=1}^{N} K_i$$

This latest means that the global stock of capital is defined as "the stock of global knowledge, this knowledge provide external effect on the productivity of the firm i".(Turnovsky 2000, 426)

Following Cobb-Douglas equation of production that is:

Equation 1-2:

$$Y = F[K(t), L(t), A(t)] = AK^{\alpha}L^{1-\alpha},$$

$with\ 0 <\propto< 1$, L: labor, A: factor of technology, K: capital

As long as the firm gets technology and global knowledge as given, the *A* of production function could be replaced with K^{β} $(0 < \beta < 1)$, (in the expectation that is equation of capital stock *K* of the economy, i.e. $A = K^{\beta}$). This latest means that technological growth is defined internally with the level of accumulated capital stock in the economy. Therefore, the production equation will be:

Equation 1-3:

$$Y_i = K^{\beta} K_i^{\alpha} K_i^{1-\alpha}$$

All firms have the same production equation. Therefore, with the addition of production quantities of all the firms in the production function, the global production function will be:

Equation 1-4:

$$Y = K^{\propto+\beta} L^{1-\propto}$$

In the assumption of $\beta = 1-\propto$, and the division of both sides of function on L(labor). It is possible to present the production function in terms of production per capita:

Equation 1-5:

$$y = K^{\beta} k^{\propto}$$

In addition, the rate of production per capita can be gathered also by:

Equation 1-6:

$$g_y = \beta g_K + \alpha g_k$$

This function shows that the sources of sustainable growth, with the assumption of production function in the model of Cobb-Douglas, the rate of capital in labor remain stable. Also, the rate of production per capita applies positively with the growth of capital knowledge.

Also, Romer assumes that the capital knowledge has a full increase in marginal output that is $\beta > 1-\propto$ (Romer 1986, 1015). Therefore, the expected growth rate of the model will be increased. The factor K in Romer model 1986 represents the stock of public good that is integrated in the production function of all firms.

1.3.2 Uzawa-Lucas model: growth with education

There are different important models of endogenous growth make the human capital accumulation on the center of economic growth process. The term human capital is defined as all the knowledge, education, training, and experience that is embodied in workers. Many economists feel happier with talking about human capital, rather than technology or knowledge, since it emphasizes the fact that there

is always a human element to production technology (Christine Greenhalgh and Mark Rogers 2010, 229).

The model assumes the existence of two canals that allow the individuals to get the human capital. These canals are: education and learning by doing.

The previous studies of human capital in the dynamic models does not achieve to analyze the sustainable growth until 1965 where (Hirofumi Uzawa 1965) gave dynamic model with the proposition of using qualified employees as a variable that it grows in time to achieve permanent growth. Where Lucas enlarges the idea by integrating the exogeneous effect of human capital(Lucas 1988).

In time t, there is the middle level of human capital *h* that it represents global available knowledge for every person. The individuals who get this knowledge can get more through education. In addition, every person gets nonleisure time t that will be devoted for the education. However, the remaining time will be devoted for work. To more simplify, the assumption that the human capital increase is related with the equation below:

Equation 1-7:

$$\dot{h} = h\Phi(t)$$

With $\Phi(t) > 0$

h represents the average of human capital, and the human capital stock of the individual have it through education in the next period. The augmentation in the human capital is based at first on the amount of time spent in the education (the accumulation of human capital comes from investment in education) in addition to the level of human capital prevailing in the economy (Weber 2010, 127). The individuals chose *t* to maximize their profitability. When an individual accumulates the capital, there will be new level of knowledge available for all individuals of the firm.

With human capital, the available labor efficiency units are equal to $L = (1 - t)hM$. Therefore, the production function will be:

Equation 1-8:

$$y = (1 - t)hAk^{\alpha}$$

And, GDP Growth Rate Per Capita will be:

$$g_y = g_{(1-t)} + g_A + g_h + \alpha g_k$$

So, the GDP growth rate based on *A*, *h*, *t* and *k*.

Therefore, following the decrease in the capital returns, and $g_A = 0$. In the stable situation (i.e. the Balanced growth path), the rate of capital to the labor will stay stable $g_k = 0$. Moreover, *t* is consistent on the equilibrium path that is $g_t = 0$, this means that the human capital growth rate in the stable situation equal to:

Equation 1-9:

$$g_h = \Phi(\tilde{t})$$

With $\tilde{t}$ is the value of *t* in the stable situation. For that, the GDP Growth Rate Per Capita will be:

Equation 1-10:

$$g_y = g_h = \Phi(\tilde{t})$$

With another expression, the GDP per capita grow in the same rate with the human capital growth, that is based on the value of *t* on the stable situation, and this value (that is $\tilde{t}$) is chosen internally by the individuals. In this model, the economic growth bases on the $\tilde{t}$ value. Therefore, every factor affect this value could affect the economic growth rate in the long run (Jones 1997, 152).

From another side, this model explains also the disparity in international growth rates that the new classical model has failed. Following (Azariadis and Drazen 1990, 524–25), if two countries has the same technological level, it is possible for these two countries to have different rates of growth in the stable situation following the changes in the time allocated to education by individuals or different education policies in both countries.

However, (Stokey 1990) succeed to enlarge Lucas-Uzawa model through integrating channel of individuals with different level of human capital, in addition to channel of different situations of production. Assuming that the competitive companies employ individual with high levels of human capital to produce a product with high quality. Following the results of (Stokey 1990), the human capital accumulation has a negative relationship with the rate of time preference from a side, and a positive relationship with the elasticity of intertemporal substitution. However , Grossman and Helpman enlarge also the model of (Findlay and Kierzkowski 1983) in the study (Grossman and Helpman 1993, sec. 5.2) through two changes: integrating innovation in addition to making the determinant of education internally. Following the study of (Grossman and Helpman 1993, sec. 5.2), the innovation is the factor to lead the economic growth and not the education. However, hiring qualified employees has important positive effect on the innovation.

From another side, (Eicher 1996) follows different ways through analyzing the education sector, because education sector is considered as technological spillovers in addition to the consideration of education and human capital accumulation. Following the results of Eicher, the high levels of relative

wage and low offer of labor could be followed by important rates of technological growth in addition to high rates of economic growth.

However, all of (Jensen and Wong 2010; Galor and Cheng 1994; Ohyama 1991) proposed that the investment in human capital need the existence of real resource. Where, (Bond, Wang, and Yip 1996) developed different models of education sector that needs all of physical capital in addition to time to work in the production process of human capital.

1.3.3 Arrow-Lucas model: Growth and training

In the next side of the education, the training on the job from the channels that contribute in the human capital accumulation and sharing knowledge.

Following (Arrow 1962), learning is the results of experience. Therefore, learning takes its place through trying to solve faced problems at work (Arrow 1962, 155). The experience gathered through learning helps to increase the worker's productivity that is could push different sources of production in the economy. With another meaning, through the production process, the workers learn more about the production techniques, the way that through time, the workers will be able to produce more in less time. The results will be production more, with high quality and less mistakes. Therefore, the human capital accumulation through the training channel is like human capital accumulation through learning with difference in number of resources. Learning through training do not need more resources.

To explain the term learning through training following the study(Arrow 1962), he assumes that the productivity of a firm is an increasing function of cumulative investment in the industry. Also, he assumes that experience through training is based on the work volume of the workers (Arrow 1962, 157). Nevertheless, the growth rate of consumption in Arrow model approach to zero because of the assumption of the marginal output of capital for the economy as a whole eventually fell to zero.

However, (Lucas 1988) eliminates the hypothesis of defends returns presented by Arrow through mentioning the possibility of using positive economic growth on the rate of human capital accumulation by the way of training. In the same frame, there are other equations of exogenous growth through training (Stokey 1990; Young 1991).

To understand the effect of training on the economic growth, I base on the production function of Cobb-Douglass, by assuming that worker do not make time to learn, the production function will be:

Equation 1-11:

$$y = hAk^{\alpha}$$

Or

Equation 1-12:

$$g_y = g_A + g_h + \alpha g_k \ (in\ relation\ with\ growth\ rates)$$

Assuming that:

Technological growth rate is stable

Human capital growth rate on labor is stable ($g_k = 0, g_A = 0$)

Therefore, the growth rate per capita is based on the growth of human capital.

Assuming that human capital stock is a positive function of z that it represents the experience accumulation, that is:

Equation 1-13:

$$h = \odot(Z)$$

where: $\grave{\odot}(Z)$>0, on the function of growth rate, the previous function will be:

Equation 1-14:

$$g_h = \varepsilon_g g_Z$$

With: ε_g the elasticity of the function $\odot(.)$

To guaranty the balanced growth requirement , (Lucas 1988; 1994) assumes that the existence of primary human capital at time 0, and it gives Z that is human capital accumulation at time (Lucas 1994, 263–65)

Equation 1-15:

$$\odot(Z) = a \int_0^t uhd\,\vartheta$$

With:

u: part of time of work (selected internally) ($u < 1$),

a: actif unity of work ($a > 0$)

Following the equation above, the human capital growth rates is equal to $a\,u$. Therefore, the equation shows that human capital growth rates commensurate with time given to produce a product:

If the time given to produce a product X is big, the human capital will be more and production per capita will be faster. In the stable state, u will be stable. However, in the abscence of technological growth, the

human capital growth rate and production per capital will equal to $a\,u$. Where, the second method to model human capital accumulation by assuming that Z is the product accumulation:

Equation 1-16:

$$\odot(Z) = a\int_0^t Y d\,t$$

The last equation mentions that the actual level of human capital based on the experience accumulation presented with the level of production accumulation.

By integrating both equation:

Equation 1-17:

$$y = hAk^{\alpha}$$

And

Equation 1-18:

$$\odot(Z) = a\int_0^t Y d\,t$$

The result is: $\dot{h} = aAhMk^{\alpha}$

With the assumption of no technological growth and no population growth. The human capital growth rate and production per capital in the stable state will equal to $aA\widetilde{Mk^{\alpha}}$.

Following the studies (Stokey 1990; Young 1991; 1995), there are other assumptions for the human capital accumulation through training that makes the growth rates internally. However, these models have some weakness points. It is possible that the rate of learning of individual is faster at the beginning. Over time, it starts declining until zero in the end. Therefore, (Arrow 1962) realize this fact, but it finds that learning process of the worker stay fast and continuous following the appearance of new goods, that is followed by the disappearance of old goods. From another side, (Lucas 1988) finds that the appearance of new product is not always. Also, all of (Stokey 1990; Young 1991; 1995) find that there is a decrease in the returns of training for every product. This means that the rates of individual learning production process back through time to zero. The results of this explication shows that to save high rate of learning, it will lead to fast human capital accumulation, that will lead also to high rates of demand that is changing the labor force in the economy to produce new product (creating new activities) that could create and support the economic growth.

1.4 Factors affect human capital:

According to (Ronald G. Ehrenberg and Smith 2011), there are three major kinds of labor market (human capital) investment that are education and training , migration and look for new jobs. From another meaning, these three factors from the important factors that affect the human capital.

1.4.1 Education and human capital:

The theory of capital, which was introduced by Schultz and Becker in the early 1960s, it stresses the importance of intangible factors such as knowledge, skills and health in attaining higher incomes and achieving economic growth. The process of developing human capital is regarded as an investment that yields future returns to the individual and his society. By quantifying the cost and its future benefits, returns to investments in human capital can be calculated.

Human capital investments affect the whole economy through an improved supply of labor and its organization. Humans are regarded as "an important part of the wealth of nations. Measured by what labor contributes to output, the productive capacity of human beings is now vastly larger than all other forms of wealth taken together" (Schultz 1961).

According to (Becker 1994), education and training are the most important contributors to human capital formation. His research has shown that high school and college education in the united states greatly raise a person's income, even after netting out direct and indirect costs for schooling and after adjusting for the better family background and greater abilities of more educated persons. Similar evidence is now available for many points in time and for a large number of countries.

The cost of human capital formation consists of a direct part attributed to the attainment of education and training as well as an indirect part resulting from forgone income during education. According to (Schultz 1961), forgone income comprises the greater part of the cost of building human capital. This finding, however, cannot be generalized as in many countries. From a side, the lack of national education capacities leads to a significant number of students seeking education abroad, where the cost of which can compromise the dominant part of the investment in human capital. However, the high unemployment rates reduce the cost of forgone income.

Based on data provided by (george psacharopoulos 1972) for 18 countries of which 10 were "less developed", Blaug finds in his study (Blaug 1973) that the private rates of return to education in these countries exceed the social rates of return despite the fact that the private rate takes into account only personal earning after deducing income tax, whereas the social rate is calculated on earnings before income tax. He suggests that the reason for this is that the total resource costs of education everywhere exceed the costs that students and their parents have to bear themselves. His findings suggest also that

the private and the social cost of education have to be determined in any regional study to assess the gap between private and aggregate impact of investment in human capital. New findings by (Psacharopoulos and Patrinos * 2004) confirm that the private returns to educations remain higher than social returns as it is presented in Table 1-2 below:

Table 1-2: Returns to investment in education by level, latest year, averages by per-capita income group (%)

Per-capita income group	*Mean per capita (US$)*	*Social*			*private*		
		Primary	Secondary	Higher	Primary	Secondary	Higher
High income ($9266 or more)	22530	13.4	10.3	9.5	25.6	12.2	12.4
Low income ($755 or less)	363	21.3	15.7	11.2	25.8	19.9	26.0
Middle income (to $ 9265)	2996	18.8	12.9	11.3	27.4	18.0	19.3
World	7669	18.9	13.1	10.8	26.6	17.0	19.0

Source: (Psacharopoulos and Patrinos * 2004)

As it presented in Table 1-2, the returns of investment in education is higher in the private than the social in all categories (high income to low income). This means that the individuals give more interest for private education than social education.

These findings are challenged by two different points of view. On the first hand, researchers' questions whether other factors besides formal education cause the increase in personal income. On the second hand, they pose the question of whether the straight forward relationship between education and income, which is supported by evidence on the micro economic level still holds on the macroeconomic level (Psacharopoulos and Patrinos * 2004).

Following (Mincer 1974), not only formal education but also experience plays an important role in determining income of individuals. He introduces a model of human capital with two inputs that are education and experience. The latter expressed by the number of years working in a certain job. Using income data from non-farming, white US males, Mincer's model shows that schooling and experience account for two thirds of income equality in the reference group. Whereby, both factors have the same magnitudes of influence. More recent research by (Bils and Klenow 2000) using mincer's model show similar results for 52 countries with an average of 5000 observation per country.

Unlike the human capital approach, (Thurow 1975) job competition model states that productivity and earnings are more related to job characteristics than to the worker's educational attainment and that job skills are acquired either formally or informally through on-the-job training after a worker finds an entry job. The job-competition model entails a matching process in which two queues have to be brought into two lines that are the job queue and the person queue.

The jobs in the job queue are sorted according to the skills they require. Individuals competing for these jobs also form a queue, their relative position being determined by the qualifications that they have acquired. Employers are likely to assign the job to the individuals with the highest qualifications as this minimizes the expected training cost. Instead of competing against each other on the basis of wages, individuals compete for jobs on the basis of background characteristics (Muysken and Weel 1998). The consequence of the model is that individuals tend to invest more in their education than required by the jobs they fulfil which in turn implies a sub optimal use of resources and a reduced return to education.

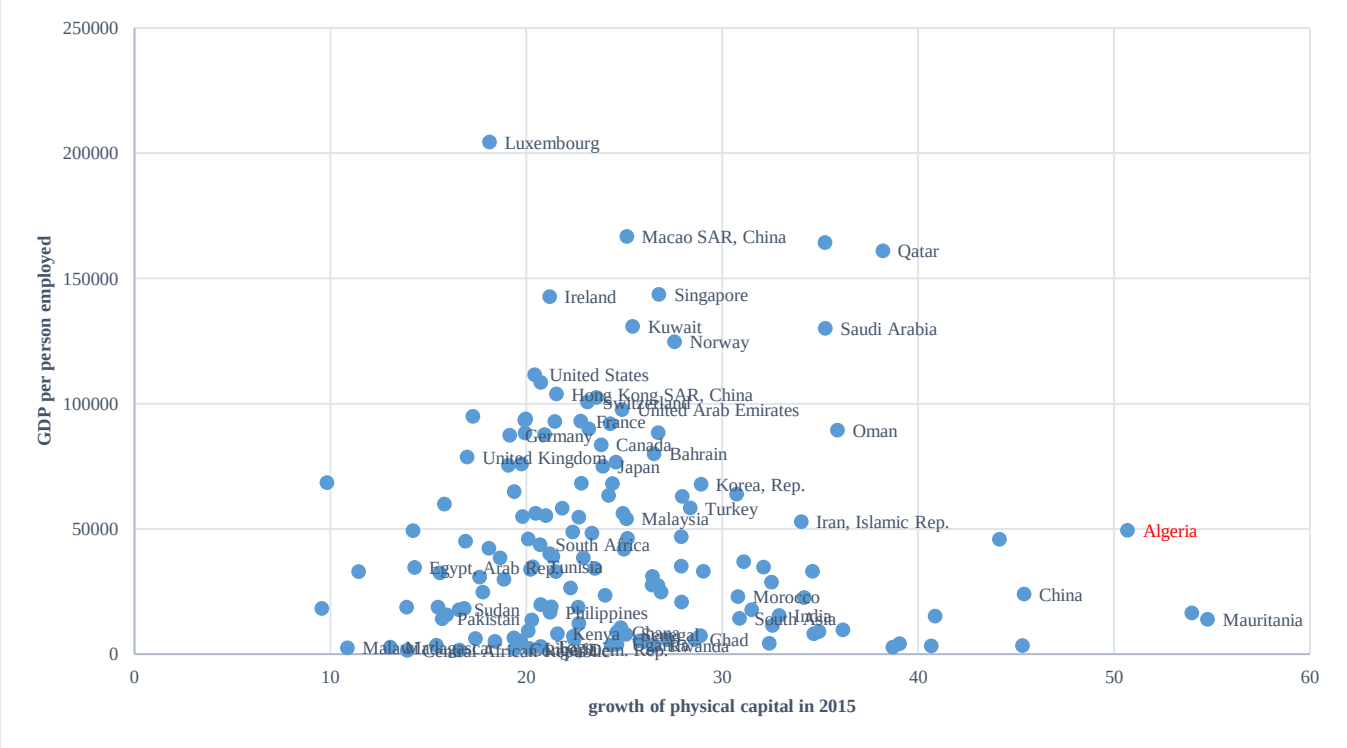
Some researchers are directed towards the investigation of signaling the effect of education, i.e. whether educational attainment acts mainly as a screening or sorting device that enables employers to allocate individuals to higher-earning occupation.

If this is the case, there is a risk that the expansion of learning opportunities will simply increase the supply of credentials and produce only limited or no social returns. The results of the study (Wim Groot and Joop Hartog 1994) show that the screening and investment roles of education are not incompatible to some extent as employers may use educational qualifications as a signal to human capital. The authors of the study (Altonji and Pierret 1996) empirically analyse how quickly employers learn about the true productivity of workers, and adjust their relative wages accordingly. Their results suggest that the value of education in predicting future wages does not decline over time, because the increased information about the individual's productivity that employers acquire by observing them on the job confirms the expected relationship between productivity and education levels. Over time, they claim that the "signaling component" of educational qualifications account for a relatively small part of the wage differential associated with education. Further research evidence confirms that education appears to play a significant role in human capital formation, over and above any role, it plays as a screening device (Psacharopoulos 1994).

Turning to the macroeconomic impact of education, evidence remains inconclusive. Lau, dean, and louat investigate in (Lawrence J. Lau, Louat, Frederic F, and Jamison,Dean T 1991) the effects of education level expressed as the schooling years of the population in the age of 15 to 64 in five regions and find that education has a negative effect in Africa and Middle East and North Africa and insignificant effects in south Asia and Latin America. Following the results of (Spiegel 1994; Benhabib and Spiegel 1994), there is a negative correlation between increased years of schooling and the growth of per worker productivity (GDP divided by the labor force). Spiegel mentions in his study (Spiegel 1994) that the negative effect is robust to the inclusion of a wide variety of variables such as regional dummies, the size of the middle class, political stability, the share of machinery investment, and inward orientation. The (World Bank 1995) also notes on labor issues that the lack of importance of education in explaining

aggregate growth (world bank,1995, fig 2.4). Lopez in his study (Lopez 1999) offers three explanations for the "education puzzle", stating that the quality and an equal distribution of education as well as the policy environment are important factors in determining the impact of human capital on economic performance. Using data from 921 countries by using data from(Barro and Lee 1993), the results of the studies (Nehru, Swanson, and Dubey 1995; Pritchett 1996) mention that the existence of significant negative correlation between human capital accumulation expressed in the years of schooling of the labor force and productivity growth expressed in the growth of GDP per worker. His analysis offers three explanations shown in all of Figure 1-2, Figure 1-3 and Figure 1-4 below:

Figure 1-2: investing in physical capital in 2015

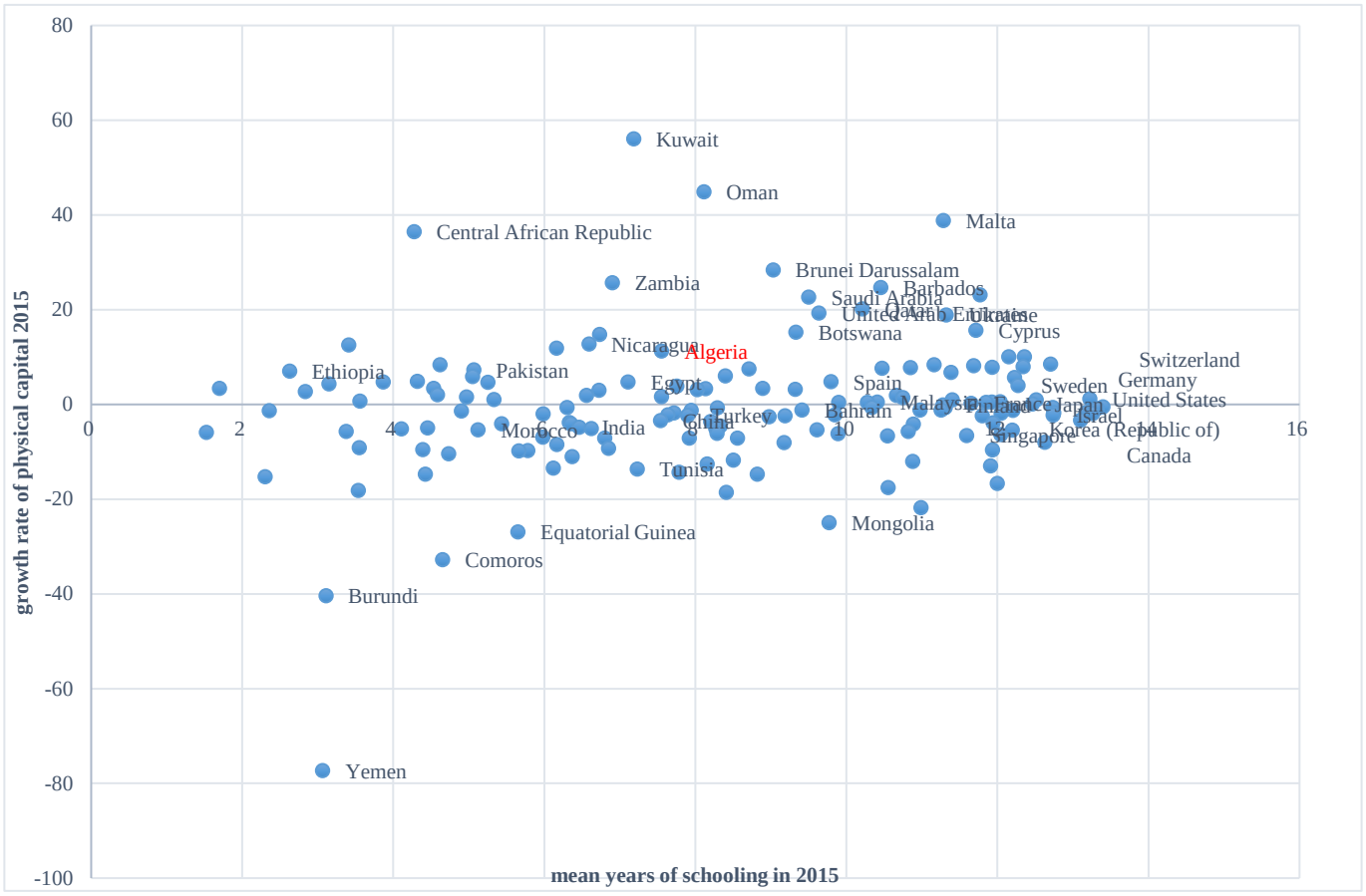


Source: edited by the student using data from www.wdi.org and www.undp.org

Following the Figure 1-2, there is no relation between the physical capital presented by the gross capital formation as proxy variable and the growth presented by the GDP per person employed in 2015. The coefficient of determinants R^2 between the growth of physical capital and GDP per person employed in 2015 is equal to 0.0012. This latest confirms the inexistence of relationship between the variables.

In the second side of the physical capital as proxy variable to determine the human capital, the schooling years average is also presented as determinants of the human capital. There for, the Figure 1-3 below demonstrate the relationship between the schooling years average in 2015 and the growth rate physical capital.

Figure 1-3: growth rate of physical capital vs average of schooling years 2015

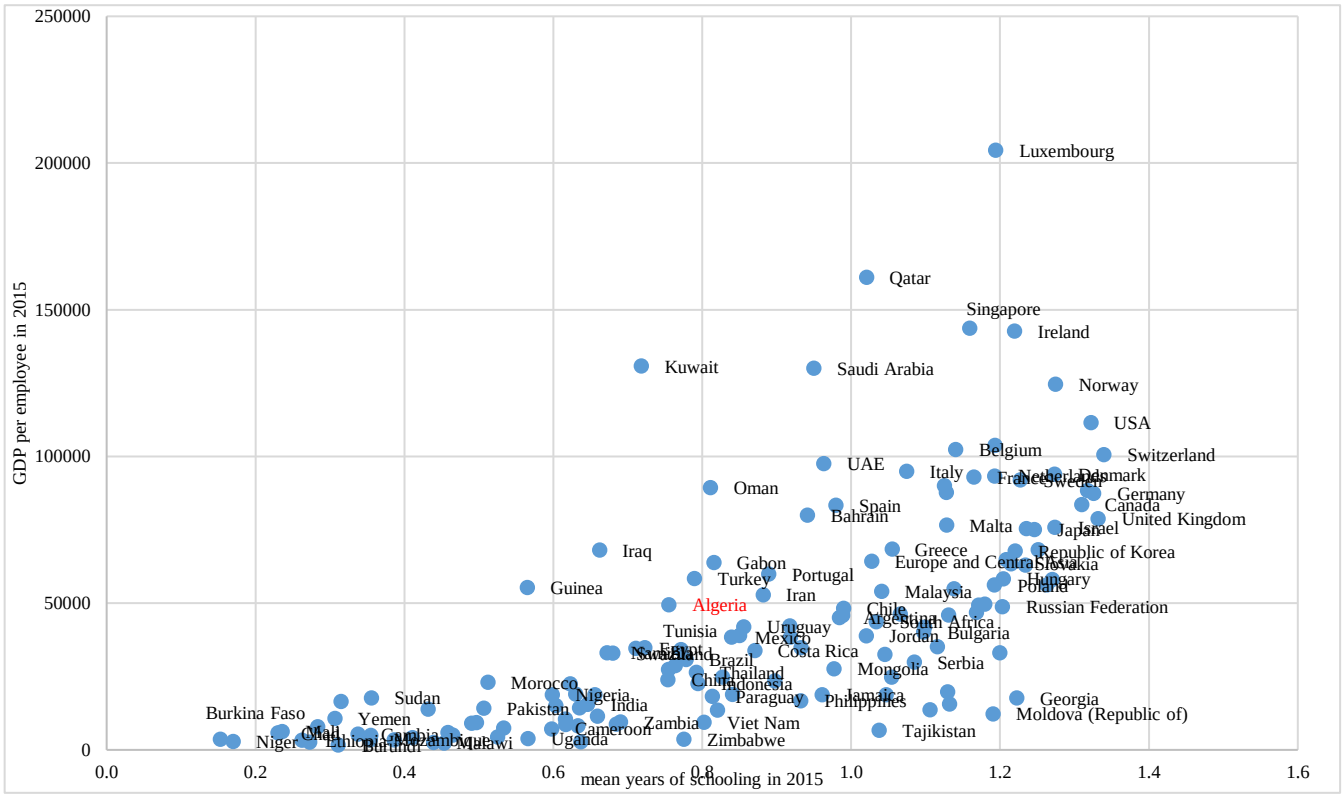


Source: edited by the student using data from www.wdi.org and www.undp.org

The Figure 1-3 explains that there is no correlation also between the growth pf physical capital and average of schooling years in 2015 (with R^2=0.0269). These latest confirmed in different situation, all of Switzerland, Germany, Canada and United states have average of schooling years more than 13 years. Where in the second side, there is deterioration in the physical capital. For the underdeveloped countries, there is deterioration in the both variable as in Yemen and Burundi for example. The growth in physical capital in 2015 is so negative (-77,28 and -40,39 respectively for Yemen and Burundi).

However, to look for the effect of the schooling years on the GDP growth per employee, the Figure 1-4 present points of chart for the average of the schooling years on the growth of the GDP per employee and the mean years of schooling for different countries in 2015.

Figure 1-4: mean years of schooling vs growth rate of GDP per employee in 2015



Source: edited by the student using data from www.wdi.org and www.undp.org

Following the Figure 1-4 above, the countries with low level in the mean years of schooling such as Burkina Faso, Niger, chad, Sudan, and Yemen have low levels in GDP per employee. In addition, the determination coefficient is 0.42 that it confirms the correlation between the mean years of schooling in 2015 and the GDP per employed. The Table 1-3 below contains the data for these countries:

Table 1-3: mean years of schooling and GDP per employed in some underdeveloped countries in 2015

Countries	mean years of schooling in 2015	GDP per employed in 2015
Burkina Faso	1.5	3623
Niger	1.7	2867
Chad	2.3	5787
Sudan	3.6	17780
Yemen	3.1	10752

Source: edited by the student using data from www.wdi.org and www.undp.org

In the first view, the GDP per employees for Burkina Faso that it has 1.5 year of schooling as a mean in 2015 is 3623$. In comparison with the other countries, Chad had a mean for schooling higher than Burkina Faso (2.3 years of schooling). In addition, the GDP per employee in chad is more than the one in Burkina Faso (5787$). In addition, Sudan also has low mean in years of schooling but more than Burkina Faso and Chad (17780$).

Table 1-4: GDP per employed and mean schooling years in some developing countries in 2015

Countries	mean years of schooling in 2015	GDP per employee in 2015
Egypt	7.1	34629
Tunisia	7.2	34898
Algeria	7.6	49446
Brazil	7.8	30843
Turkey	7.9	58400

Source: edited by the student using data from www.wdi.org and www.undp.org

Concerning the developing countries, the means of schooling years, there is higher than the underdeveloped countries as it presented in the Table 1-4. At first, the mean years of schooling in Egypt for example is more than the mean years of the underdeveloped countries. In the second side, the GDP per employed is also higher than the one in the underdeveloped countries. In addition, for the developed countries as it presented in the Table 1-5 such as USA, Luxembourg and Switzerland, the GDP per employed

Table 1-5: GDP per employed and mean schooling years in some developed countries in 2015

Countries	mean years of schooling in 2015	GDP per employed in 2015
Luxembourg	11.9	204437
Switzerland	13.4	100654
USA	13.2	111561
Norway	12.7	124695
Ireland	12.2	142759

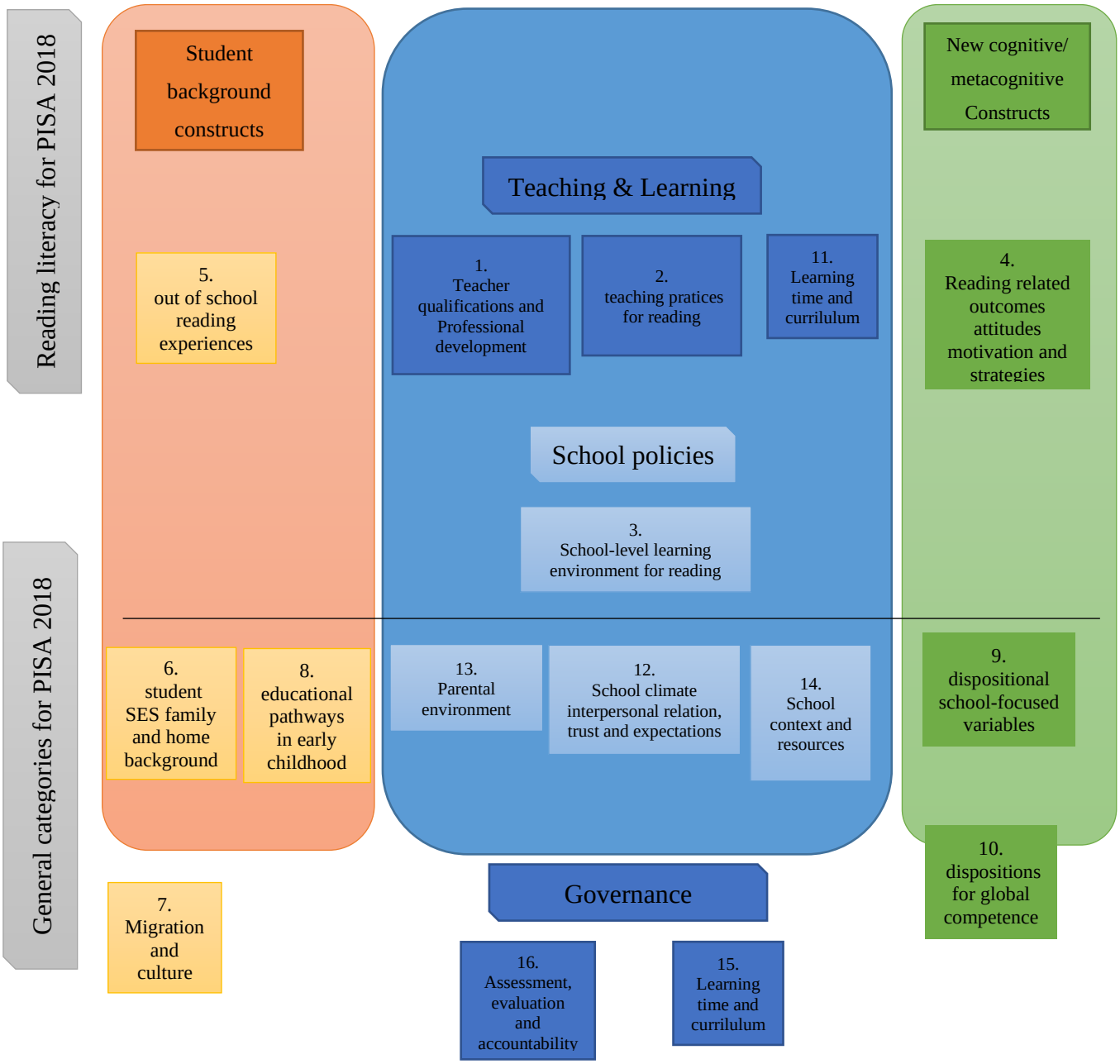
Source: edited by the student using data from www.wdi.org and www.undp.org

Therefore, and with the aim to evaluate the education at the international, there are different programs for the international assessment such as TIMSS “Trends in International Mathematics and Science Study “, PIRLS “Progress in International Reading Literacy Scale”. Also; there is the PISA “Program for International Student Assessment”, TALIS “Teaching and Learning International Survey” and the PIAAC “Program for the International Assessment of Adult Competencies”.

However, the most known program is the PISA program due to its large utilization in evaluating the education in the scientific studies such as (French, French, and Li 2015; Morsy, Khavenson, and Carnoy 2018; Giambona and Porcu 2018). As it said by the OECD secretary general Angel Gurría in (OECD 2018a, 2):”It has become the world’s premier yardstick for evaluating the quality, equity and efficiency of school systems. By identifying the characteristics of high-performing education systems, PISA allows governments and educators to identify effective policies that they can then adapt to their

local contexts". The PISA program based on questionnaire to collect data about education; these questionnaires are based on the framework below:

Figure 1-5: PISA 2018 questionnaires modules

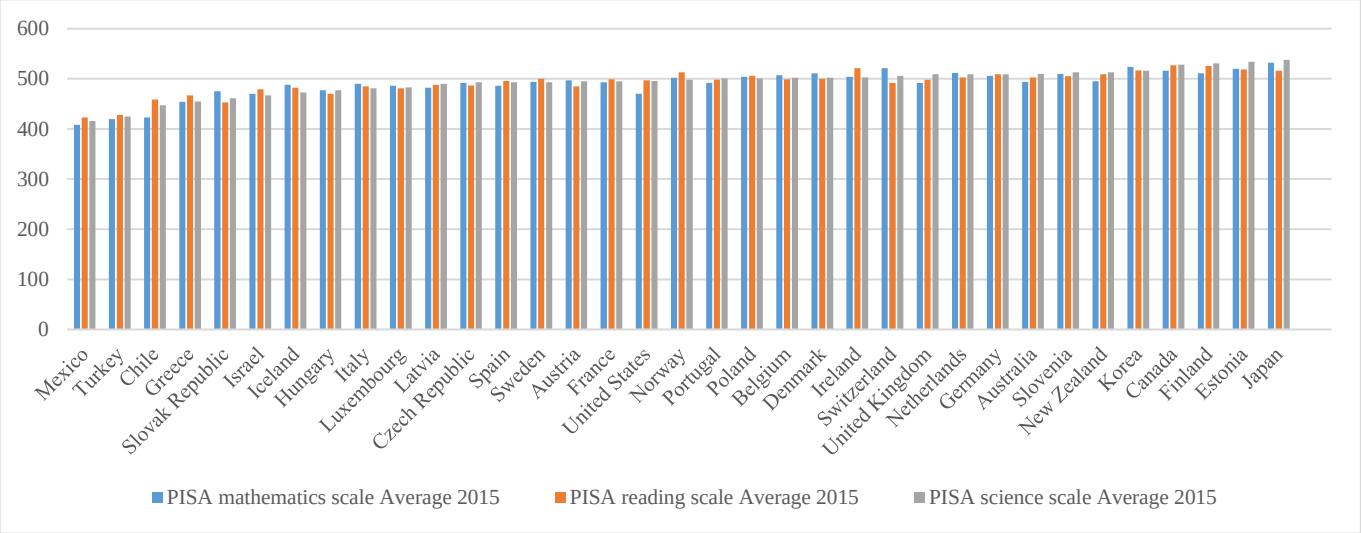


source: (OECD 2018b, 96)

Following Figure 1-5, Pisa questionnaire touch different items that are related directly with the education, starting from the teacher to the governance role in education. For the results of Pisa, Figure 1-6 mention the scale average of OECD countries for 2015. At first, there are three programs of PISA (mathematics, reading and sciences). This separation between the fields facilitates touching if the state

focusses their efforts in special field rather than others. Japan leads all OECD countries following the education programs implemented, followed by all of Estonia, Finland and Canada as it presented in Figure 1-6. In the other side of the figure, turkey and Mexico take the last two ranks.

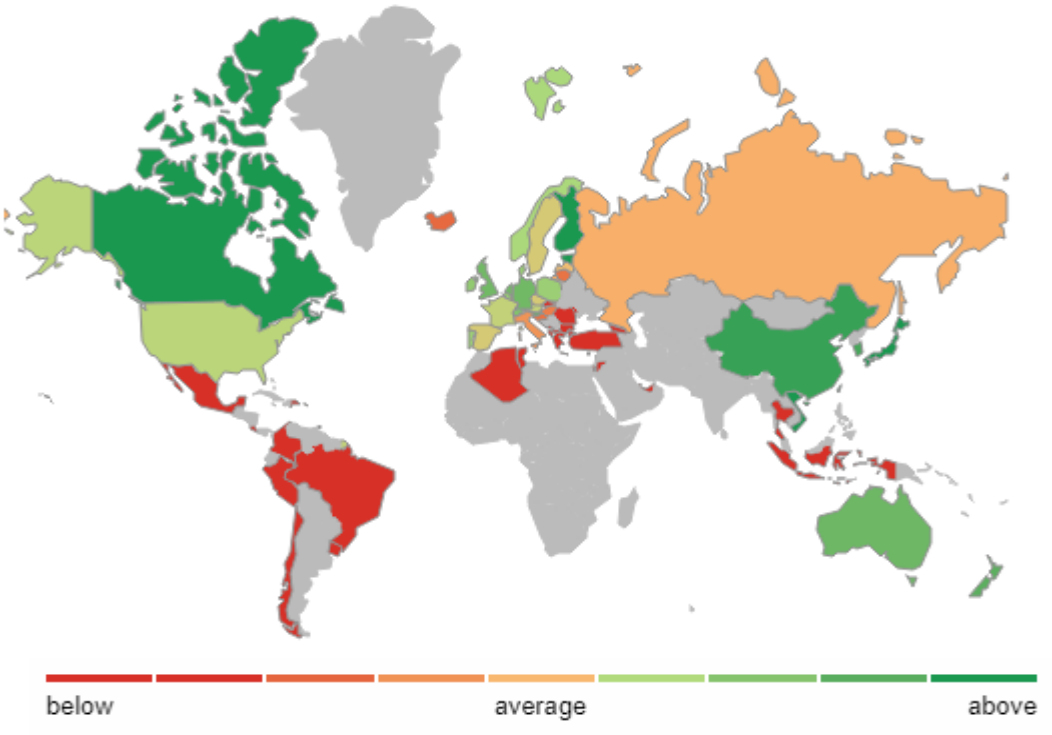
Figure 1-6: PISA scale average of OECD countries 2015



Source: edited by the student using data from OECD data bases

Figure 1-7 shows the state of the majority of the countries following PISA where USA from the countries in the beginning. However, Algeria and Tunisia are in the last of the countries.

Figure 1-7: map of PISA rankings in 2015



Source: www.oecd.org/pisa/

1.4.2 Migration (brain drain)

Starting from the report of (Soumitra Dutta, Bruno Lanvin, and Sacha Wunsch-Vincent 2014a), the number and the geographical spread of students, researchers and entrepreneurs could be a sign of innovation and can drive the innovation effectively. From these latest results, it is necessary to return to the important role of the brain drain. The brain drain discussion lends insight into the economic impact of migration on the sending country. The human capital migration has an important effect on the economy from a long period, these effects was captured in the brain drain. The brain drains emerged in the early 1960s and referred to the out-migration of British scientists to the US and Canada. In the following years, the expression turned into a "description of the tendency for talent people from poor countries to seek employment in richer ones" following the study of (Giannoccolo 2006).

The welfare consequences of the brain drain are captured following the different researches into two competing views that are the international views and the national views. In the first and following the study of (Johnson 1968; 1965). The internationalists look at the world as a whole and argue that the world only loses from brain drain if the net social cost of it exceeds the private gain to the migrants. A net social loss, however, would only occurs if the loss of externalities to the sending countries is greater than the gain of externalities to the receiving countries (H. B. Grubel and Scott 1966; H. G. Grubel and Scott 1966). While, supporting the nationalist view also argue that no loss to the sending countries is associated with the brain drain as they assume that the national objective is to maximize welfare for the nation, including its migrant population abroad. They reject the argument that educated emigrants gave debt to the society and argue that there are several important ways in which brain drain increases the welfare of the sending country such as increasing the sending nation's capital-labor ratio and thus raising the long-run average income if those left behind. In addition, emigrants significantly raise the incomes of their families at home through remittances. The potentially largest benefit to those left behind, however, it is claimed to arise from the research of scientist and engineers in the receiving country because the product of basic research is a free good and becomes available to all. Because most scientist emigrate to countries where conditions for conducting research are better; there is a high probability that out-migration will increase the scientist' overall productivity. For these reasons, they conclude that the continuation of policies supporting the free movement of human capital would be beneficial to all parties.

(Godfrey 1970) criticizes Johnson's international view as based on the value-judgement that the international distribution of income does not matter and suggests that the welfare goal should be that of equal distribution of income among individuals in the world. Given this view, the question as to the effect of the brain drain upon this distribution would have to be raised. Similarly, (Hymer, Weisbrod, and Johnson 1966) also comments on grubel and scott's national view that it ignored redistribution effects, which in his opinion are likely to be the most important consequence of the brain drain. Godfrey

argues that the question of compensation from the emigrants to the sending countries for the education they received should depend on the extent of externalities of education. At the same time, he acknowledges that these externalities are almost impossible to measure. He concluded that there is a net cost resulting from brain drain to the sending country and that the best policy measure is to try to keep the skilled workers in the sending countries. As restricting out-migration is seen to be a difficult task, Godfrey suggests that the sending countries would have to decrease the number of students who study abroad and increase the number of students who study in their home country. In addition, domestic education should be specific enough so that it would be completely unacceptable to foreign employers, preventing highly educated persons from migrating after their graduation.

The externalities related to human capital can also contribute to redistribution effects where income between the sending and the receiving countries diverge. This polarization concept with fast growing centers and slowly growing peripheries, was introduced by (Myrdal 1956; 1958). The centers have an advantageous position due to capital and knowledge intensive production. Individuals there can become more productive than in the peripheries by accumulating knowledge and benefiting from more learning by doing opportunities. As a result, a cycle of increasing income differentials and, thus, increasing migration incentives takes place.(Krugman 1991; 1992) arrives at similar conclusions by modeling the emergence of income diverging center-periphery pattern through migration. As the production function exhibits increasing returns to scale in the center, migration from the periphery to the center is likely to occur and will clearly benefit the center and leave the remaining immobile factors of production in the periphery worse off.

Externalities occurring as spill-over effects such as economies of scale and externalities related to human capital and which are not internalized by the market in the form of price changes are termed non-pecuniary externalities(Straubhaar 2000). Pecuniary externalities occur when the market internalizes the externalities in its pricing of the goods. For the sending country, this could mean that the resulting scarcity of skilled labor following out-migration might lead to increased wages for the skilled labor and hence to reduce returns to capital holders. In addition to that, it might also lead to a reduction in the wages of unskilled labor, if unskilled labor is complementary to skilled labor as the ratio of unskilled to skilled labor increases.

Financial externalities following the study (Layard et al. 1992) occur when the investment of the sending countries are lost due to the out-migration of individuals in whom this investment was made. This cost can increase considering the selective nature of migration, which leads to the out-migration of the most skilled persons in the society. Furthermore, if as above described, the skilled labor is complementary to unskilled labor and enhances its productivity, out-migration of skilled labor leads to

an overall loss in productivity in the sending country. The quality of services, i.e. health care and education may suffer due to the out-migration of human capital(Lucas 1994). Therefore, outmigration would have an adverse impact on the productivity of those left behind.

To counter all these negative effects in the sending countries, a migration tax was proposed (Bhagwati and Dellalfar 1973). This tax would be levied in the receiving country and transferred to the sending country. The problem with this tax is that the receiving countries have no incentive to sign such an agreement with the receiving countries. The issue is revived in the context of a more comprehensive "general agreement on movements of people" were (Straubhaar 2000) suggests an arrangement, whereby the sending and the receiving countries profit. Sending countries would collect an exit fee from educated persons emigrating and tax all their citizens living abroad in addition to the taxes levied by the receiving country. This way is a compensation for brain drain would be achieved. At the same time receiving countries would collect an entrance fee from all unskilled workers, who potentially could crowd out local labor. The net result would be an increasing cost of migration and, it affects the reduction of movement of skilled and unskilled labor across borders.

The 1980s marked a turning point in the brain drain debate. According to (Blomqvist 1986) , the stocks of educated manpower expanded in many low-income countries. The earlier shortage of university graduates to fill key positions turned into a situation where graduates faced increased difficulties in finding jobs. The view, that out-migration of human capital would not adversely affect the sending country, if there were an excess supply of educated persons is discussed by (de Tinguy and de Wenden 1993; Lucas 1994) in the case of East European states.

(Reichling , F 2001) states, that in the presence of brain drain, individuals have greater incentives to become educated because they have the opportunity to receive employment at higher than domestic wages abroad. When considering restrictions on the number of individuals that are able to migrate, e.g. due to visa restrictions, his theoretical model shows that levels of education will be higher with a positive probability of migration than with no probability of migration. He assumes that levels of education play a crucial role in economic development and, therefore, the increase of the supply of educated persons supports development.

Even studying abroad, which in the early brain drain literature was synonymous with the loss to the sending countries finds empirical evidence to the contrary. (Rogers 2004a) finds that countries with relatively high numbers of students studying science and engineering abroad experience faster subsequent growth. However, he also indicates that the significance of coefficients varies across specifications and samples, suggesting caution in focusing on individual results.

(Ladame 1970; Hunger 2003) remarks that a conclusive assessment of the brain drains in the 1950s and 1960s, it would only be possible at a later point in time. Only when it would be possible to judge whether the migrations of the elites would not return one day and contribute to a brain gain to the sending countries similar to the gain of the receiving countries. To allow this possibility, he introduce the term "circulation des élites"; which is now established as "brain circulation". Another alternative, is the term "brain exchange", which expresses a "balance between the number of qualified persons emigrating from and returning to the sending countries and suggesting possible impacts from the migration of these elites" (Hunger 2003).

An increasing number of studies state the buildup of diaspora networks and return migration or a combination of both are beneficiary to the sending countries (Meyer 2001; Iredale, Guo, and Rozario 2002; Hunger 2003). These networks can be scientific in nature and contribute to the transfer of knowledge and technology either virtually (e.g. though the internet) or physical through forums and exchange programs for scientists between the sending and receiving countries. The other forms of networks is commercial and involves the investments of firms in the sending countries such as India, as cited by (Hunger 2003). The aim of these studies is to analyze the influence of emigrants who returned and founded firms, thereby, utilizing the knowledge gained in the receiving countries and the cost advantage of labor in the sending countries.

Based on the data from around 1500 Egyptian returnees, (McCormick and Wahba 2001) found that foreign employment played a significant role in determining whether individuals became entrepreneurs after returning home. This results from both the influence of total saving overseas, which may help avoid liquidity constraint, and from the length of overseas employment, which may reflect skill and ideas acquisition. According to the study, the migrants on average saved 40% of their income earned abroad.

Although the brain drain literature delivers numerous insights as to where costs and benefits incur to the sending countries. According to (Beine, Docquier, and Rapoport 2003), the debate has remained almost exclusively theoretical. The main reason for this is thought to stem from the lack of harmonized international data on migration flows by origin country and education.

There have, however, been attempts to quantify the cost of labor out-migration. One study by (Reddy, Mohanty, and Naidu 2004) attempts to measure the cost of "human capital loss" from Fiji islands between 1994 and 2001 by adding the expenditure on education and health, the net present value of forgone income over the period in which the person was not replaced (income was proxied by the per capita income) and the transfer of the migrants savings out of the country. The loss adds to 35 million US$ or roughly 6500US$ per person.

1.4.3 Looking for new job:

Looking for new job has direct relationship with human capital. Looking for new job that is means the individual is unemployed or is employed in an involuntary work. Therefore, the individual look for changing the actual situation through changing work or looking for work. Therefore, to get the new work, it is necessary to have such skills or experiences or knowledge that allow the individual to get the job. The steps of looking for new job allow the individual indirectly to have such ideas about the needs of the labor market from the first side. From another side, the individual evaluates its knowledge about what is demanded in the market. Therefore, looking for new job will be an opened door for the individual to evaluate its capacities and knowledge, enrich the skills to get new job, that is improve the human capital capacities. According to (Ronald G. Ehrenberg and Smith 2011) , the job search and migration are activities that increases the ones human capital by increasing the price received for a given stock of skills.

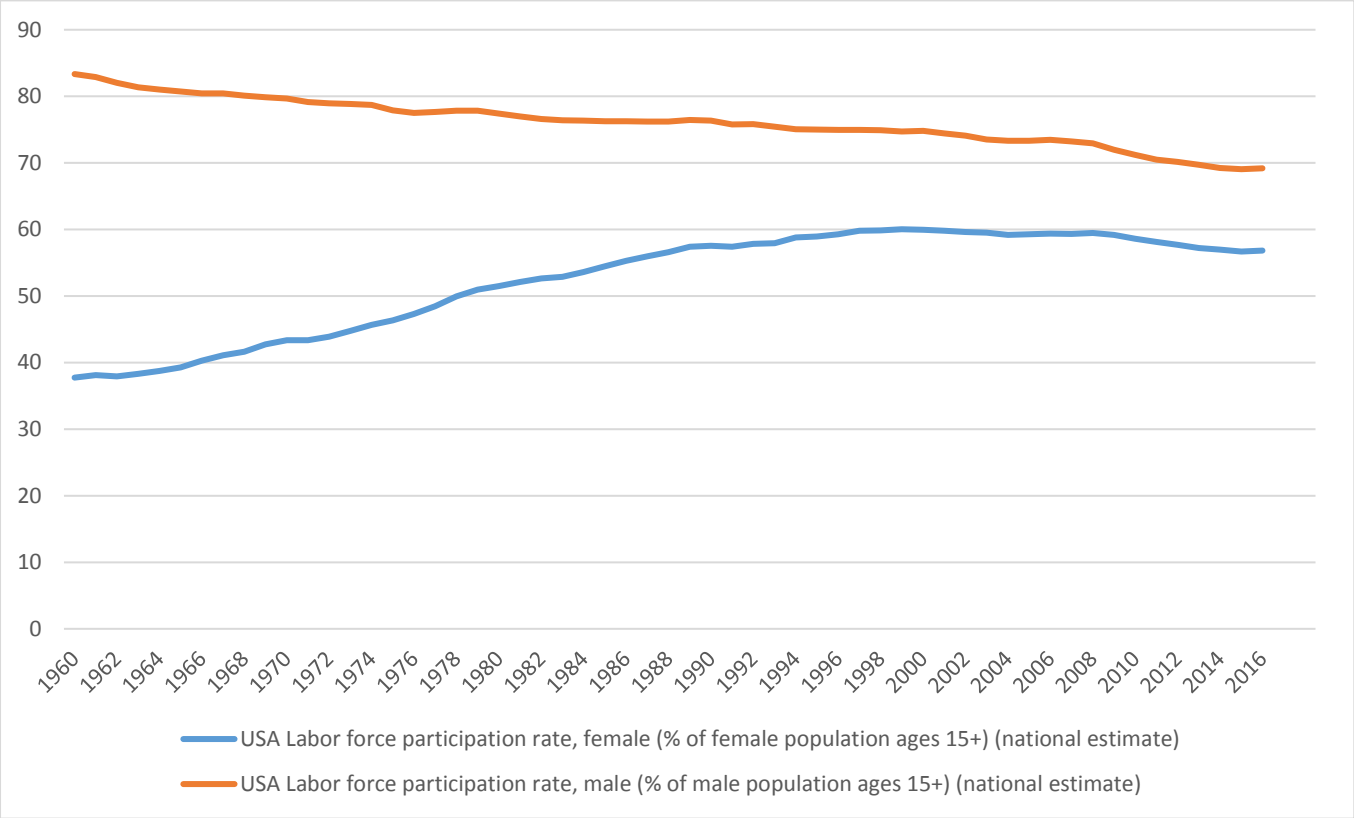
1.4.4 Gender and human capital:

According to (Krishnan and Park, D. 2006), gender is a richer, more complex demographic variable than other variables, such as age, education, functional career, or seniority of members of the management team, since its effects originate in managers' socio-cognitive base. Gender diversity constitutes an important measure of the top management team's diversity and provides all of the benefits that a diverse team can give the organization (Catalyst 2004).

Following the literature on gender such as (Ruiz-Jiménez and Fuentes-Fuentes 2016) , women have different management styles than men, to suggest that gender diversity in the top management teams of technology-sector SMEs will positively encourage the relationship between management capabilities and innovation performance.

Starting from the important role of the female in the society, so she attracts her parts in the human capital. Starting with the labor force, Figure 1-8 below presents the USA labor force participation of both male and female from 1960 to 2016.

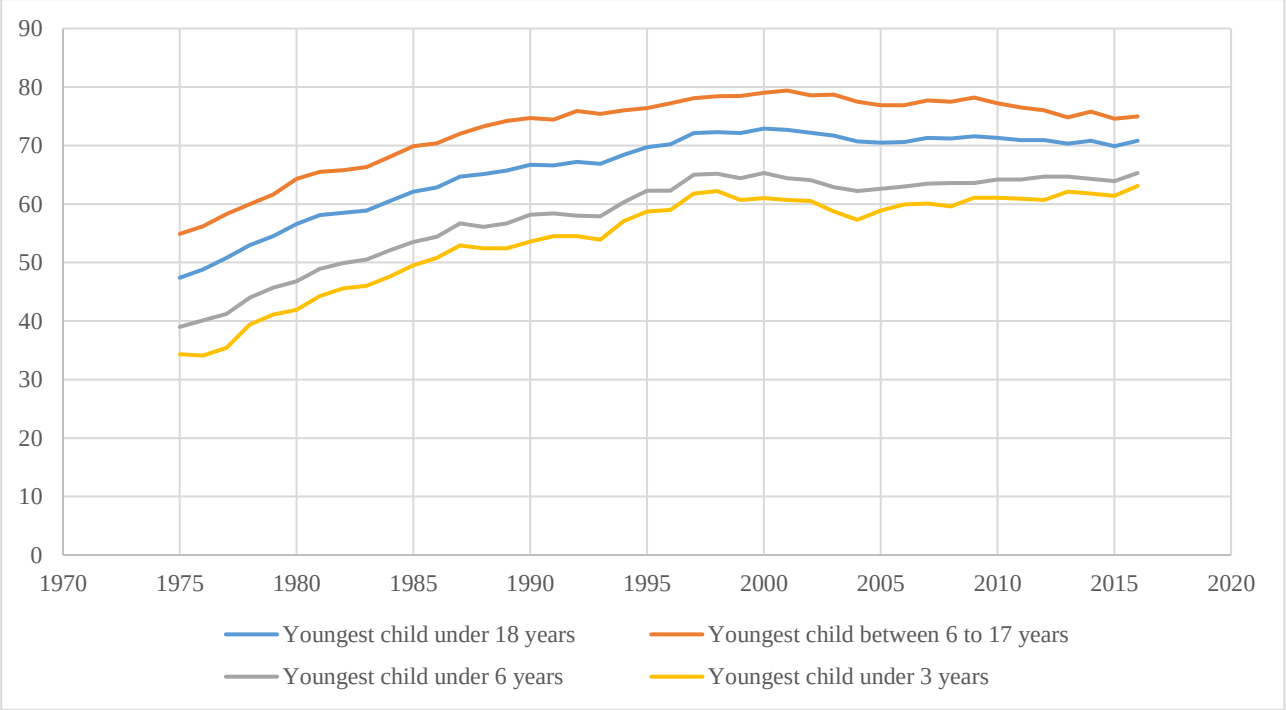
Figure 1-8: participation of male and female in the USA labor force from 1960 to 2016



source: edited with the student using data from wdi data.

Following the figure above, in the previous years, there were a huge gap between the participation rate in labor force between the both genders. The women were less likely than men to be in the labor force. This latest is the results of the traditional works of the woman at home. There for, she dropped out of the labor market. As it is known for the work life of woman than for man, the woman plays the important role (that it is a traditional role) in childrearing and household production. In 1960 for example, the rate of woman participation in labor force was 37.74%. This rate was growing due to the continuous access of girls to education and training (Tzannatos 1999) . This latest enhances their ability to inter to the labor force. Therefore, there is a continuous growth till it reach the rate 56.80% in 2016. However, from the important factors that touch women participation in labor force are in the first the age of their children. Because the majority if we cannot say all the role of child rearing is for the mom. Therefore, the age of the kids appears as a factor that affect the ability of the mom work. The Figure 1-9 capture the growth of the rate of woman in labor force. There are four categories for women divided following the age of their children. There is the first category of women with children less than 3years. During all the period (1975-2016), it is the smallest rate (even it sees a growth) because the women will be busy with their child rearing. In addition, the age plays an important role also in the participation of the human being in the labor force. It affects also the female participation.

Figure 1-9: Labor force participation rate of mothers by age of youngest child march 1975-2016

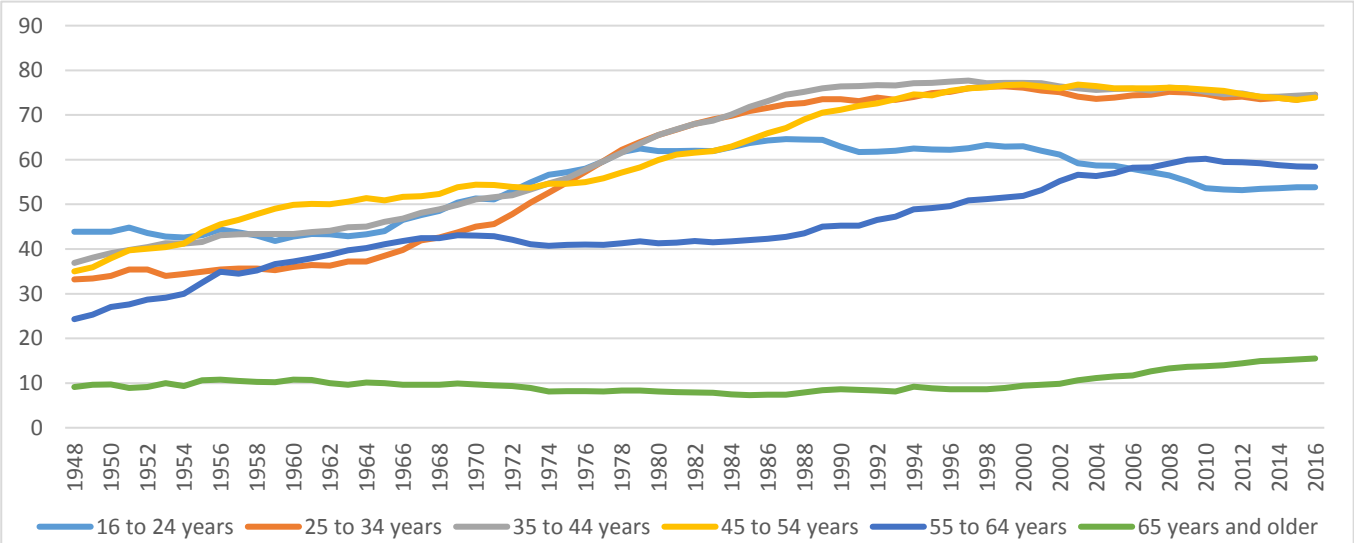


Source: 1975-2016 Annual Social and Economic Supplements, Current Population Survey, U.S. Bureau of Labor Statistics

Therefore, the Figure 1-10 capture the segmentation of women in USA labor market. The majority of age segments grow. This latest mention that majority of females till 64 years old are participating in labor, looking for work.

However, there is a huge gap between the segment more than 65 years old and the other. This gap is according to oldest age of segment, the health situation of the female in add addition to the few sectors that accept to hire old females.

Figure 1-10: Labor force participation rate of women by age 1948-2016



Source: 1948-2016 annual averages, Current Population Survey, U.S. Bureau of Labor Statistics.

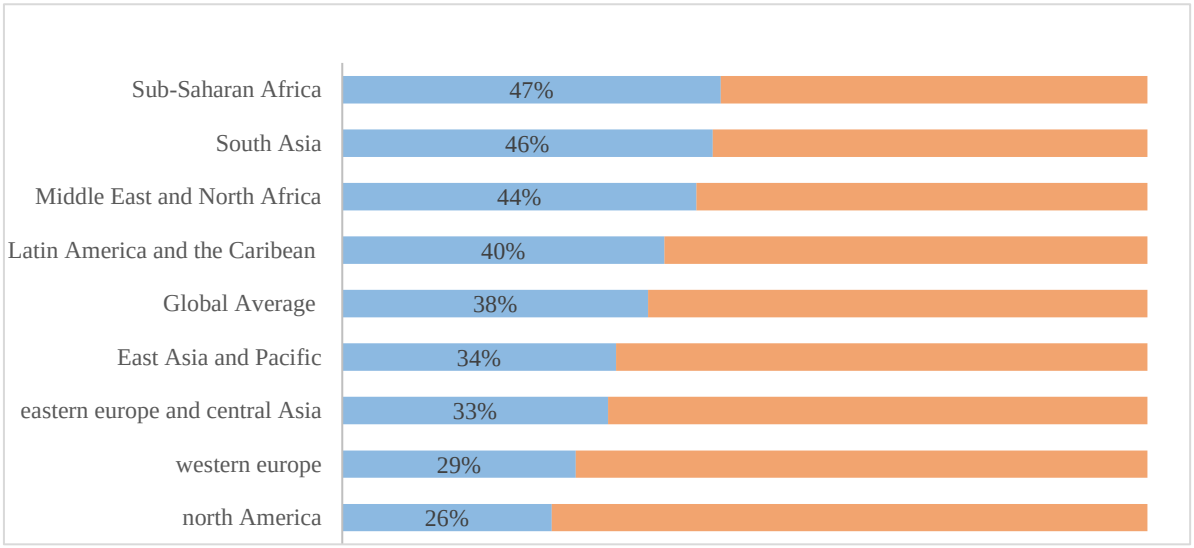
1.5 Developing human capital:

1.5.1 The HCD "Human Capital Development":

After observing that there is a wide gap between industrialized and developing countries in terms of years of schooling as it presented in the section education and human capital, it could be considered the existence of a gap in the human capital between the countries and regions.

Following the data presented in Figure 1-3, Figure 1-4,Table 1-4 and Table 1-5, there is an observable difference of the stock of human capital that is measured with different factors related with the human capital (Liu 2014) in all of developed , developing and under-developed countries . In addition, the geography and location and climate have large effects on income levels and income growth following the study of (Gallup, Sachs, and Mellinger 1998; Gallup John Luke, Jeffrey D. Sachs, and Andrew D. Mellinger 1999), through their effects on transport costs, disease burdens, and agricultural productivity, among other channels. Furthermore, geography seems to be a factor in the choice of economic policy itself. There for, the human capital is also affected by the region as it presented in Figure 1-11 bellow:

Figure 1-11: Gap in human capital development, by region, 2017



source: (World Economic Forum 2017, 7)

According to the global human capital index, the human capital development gap is smallest in North America and Western Europe i.e. the developed countries. In the second side, South Asia and Sub-Saharan Africa have large gap in human capital development. However, there are a wide variety of overall human capital outcomes within each region and across different aspects of human capital globally.

1.5.2 Investing in the knowledge and the skills (human capital investment):

The need for coherent policies to encourage people of all ages to engage in learning is recognized well beyond education ministries, at the highest political levels. The 1997 OECD Council meeting at Ministerial level agreed "... on the urgent need to implement effective strategies for lifelong learning for all, to strengthen the capacity of individuals to adapt and acquire new skills and competences (OECD 1997a). OECD Labor Ministers, meeting in October 1997, "... stressed the importance of lifelong learning as a determinant of long-run growth in a knowledge-based economy (OECD 1997b, 5; 1998).

The investment in the knowledge and skills of the workers follow three stages following the research of (Ronald G. Ehrenberg and Smith 2011). At First, it is the stage of the early childhood. In this stage, the acquisition of human capital is largely determined by the decisions of others such as Parental resources and guidance, plus our cultural environment and early schooling experiences. These latest resources could help to influence the basic language, the mathematical skills, attitudes toward learning, and general health life expectancy (which themselves affect the ability to work). Second, this stage concerns the teenagers and young adults. They acquire knowledge and skills as full-time students in a high school, college, or vocational training program. Finally, after entering the labor market, workers' additions to their human capital generally take place on a part-time basis, through on-the-job training, night school, or participation in relatively short, formal training programs.

1.5.2.1 Basic model of human capital investment:

The investment in human capital like any other investment as it defines above (see definitions), it entails costs that are borne in the near term with the expectation that benefits will accrue in the future. In general, the cost of adding to human capital can be divided into three categories that are out-of-pocket (direct expenses), forgone earning (arise because during the investment period, it is usually impossible to work, at least not full time) and psychic losses (occur because learning is often difficult and tedious).

Investing in human capital must be sustainable to following the economic and technological changes. There for, and following the explication of Ehrenberg in (Ronald G. Ehrenberg and Smith 2011), to know the present value of human capital investment, it must sum all the expected present values in all period as it presented in the equation below:

Equation 1-19

$$present\ value = \frac{B_1}{1+r} + \frac{B_2}{(1+r)^2} + \frac{B_3}{(1+r)^3} + \cdots + \frac{B_T}{(1+r)^T}$$

With:

B: future value of investment

r: rate of investment rates

T: Time (number of periods)

The simple model of human capital base on the points below:

- People are utility maximizers;
- Time: lifetime to take decisions
- Near term investment costs (C) (ex: in additional schooling) must be less than the present value of future benefits. The equation below explains this explication:

Equation 1-20

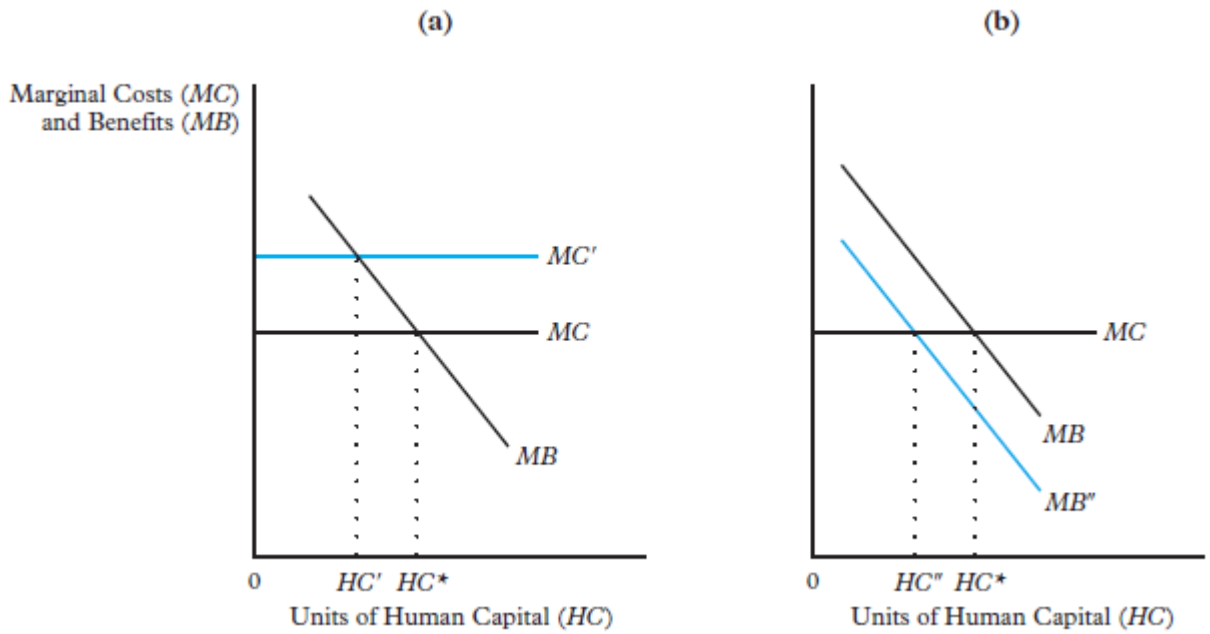
$$\frac{B_1}{1+r}+\frac{B_2}{(1+r)^2}+\frac{B_3}{(1+r)^3}+\cdots+\frac{B_T}{(1+r)^T}>C$$

This latest means that people continue to invest in human capital except when the benefits of additional investment are equal or less than the additional costs.

Starting from the Equation 1-20 , some basic implications are illustrated graphically below which depicts the human capital decisions in terms of marginal costs *MC* and marginal benefits *MB*.

The marginal costs of each additional units of human capital such as the tuition, the psychic costs of an additional year of schooling, forgot earning and supplies are assumed to be constant.

Figure 1-12: the optimum acquisition of human capital



source:(Ronald G. Ehrenberg and Smith 2011)

As it presented above, the present value of the marginal benefits *MB* is shown as declining because each added year of schooling means fewer years over which benefits can be collected. For the utility-

maximizing amount of human capital (*HC**) for the individual is shown as that amount for which *MC* = *MB.*

In the left figure (a), individuals with higher Marginal Costs (*MC*) will acquire lower levels of human capital *(HC' < HC*)*. Where in the second figure (b), the individual who expect small future benefits from additional human capital investment will acquire less human capital.

For the college education, there are at least four predictions concern the demand for it. In the first, the present orientedness i.e. present oriented people are less likely to go to college than forward-looking people. Second is the age where most college student will be young. The third prediction is related with the cost, there is a negative correlation between the college attendance and the cost of college (if the cost of college rise, the college attendance will decrease). The fourth prediction is for the comparison between the college and the high school. The college attendance will increase if the gap between the earnings of college graduates widens.

1.5.3 Economic and non-economic impacts of human capital:

The importance of human capital could be illustrated as it is cited in (Ronald G. Ehrenberg and Smith 2011) by some interesting facts about several war-damaged cities. At first, the atomic attack on Hiroshima destroyed about 70 % of its buildings and killed about 30% of the population. Survivors fled the city in the aftermath of the bombing, but within three months, two-thirds of the city's surviving population had returned. Because the air-burst bomb left the city's under-ground utility networks intact, power was restored to surviving areas in one day. Through railways service began again in two days, and telephone service was restarted in a week. Plants responsible for three-quarters of the city's industrial production (many were located on the outskirts of the city and were undamaged) could have begun normal operations within 30 days.

Second, In Hamburg Germany, a city of around 1.5 million in the summer of 1943, allied bombing raids over a 10-day period in July and august destroyed about half of the buildings in the city and killed about 3 percent of the city's population. Although there was considerable damage to the water supply system, electricity and gas service were adequate within a few days after the last attack, and within four days, the telegraph system was again operating. The central bank was reopened and business had begun to function normally after one week, and postal service was resumed within 12 days of the attack. The strategic bombing survey reported that within five months, Hamburg had recovered up to 80 percent of its former productivity.

As a result, the speed and success of recovery from these disasters has prompted one economist to offer the following two observations: the fraction of the community's real wealth represented by visible material capital is small relative to the fraction represented by the accumulated knowledge and talents

of the population. Second, there are enormous reserves of energy and effort in the population not drawn upon in ordinary times but which can be utilized under special circumstances such as those prevailing in the aftermath of disaster.

1.6 Chapter Conclusion:

Following this chapter, Human capital is considered or characterized as one of the most important engines to foster the economy due to its positive direct effects. Starting from the theoretical background, many researchers in the previous studies and even in today's studies are always looking for the effect (positive and negative) of the human capital in the different phenomena that touch the state.

In addition, the human capital is a very sensible factor following the different variable that it affects such as education, migration, gender and social capital. From the important variables that affect human capital, is training because it is considered from the variables that helps individuals to enlarge their knowledge, experience and skills. In the next chapter, the study will focus on the training.

CHAPTER TWO

2 Chapter two: Training: Theory and Practice

2.1 Chapter Introduction:

Training has been a preferred, if not the favored, approach for enhancing creativity. Both organizations and educational institutions have invested substantial time and resources in the development and deployment of creativity training. [...] 25% of the organizations employing more than 100 people offer some form of creativity training. Creativity training has been developed for occupations ranging from marketing, business management and educational administration, to medicine and engineering. Creativity training, moreover, executed as either distinct course segments or embedded exercises, is often a key component of educational programs for the gifted and talented. Creativity training, in fact, has been developed for virtually every student population […].(Scott, Leritz, and Mumford 2004, 362)

The way nations develop their human capital can be an important determinant for their long-term success in all sectors. By "human capital" as it mentioned in the first chapter, we mean the knowledge, the skills, the competencies, the experiences that people possess that enable them to create value in the global economic system. The human capital is not related solely with education and experience of work. It can be enhanced over time. It grows through using, learning during the life time i.e. exploiting time for improving human capital capacities. Also, it is depreciating in the case of the lack of use.

The view that everyone, without focusing on their intellectual level, the employees can enhance, improve, and develop their creativity and innovativeness ability if they find the correct tactics, developing it and practicing them in the right way (Plucker J. A. and Runco M.A 1999). Starting from that point, they attracted the attention not only creativity scholars, but also the corporate executives interested in ensuring the creativeness and innovativeness needed for innovation to occur in their organizations. As a result, this role is not only for creativity scholars but also for highly paid management consultants as well (Sawyer 2006) who designed and proposed multiple techniques, tactics and programs in the aim of improving innovativeness of the employees.

The execution of these programs and techniques aimed to help and lead people to think creatively with the aim of contributing to the view of the field of innovation, that is lacking of scientific rigor and created an image of "a noisy and crowded bazaar in which merchants compete to sell their 'creativity wares'"(Puccio et al. 2006, 19). Such an image led some interested creativity scholars to interrogation of the validity of creativity enhancement methods. For example,(Sternberg 1999, 6) argues that such methods are lacking of any theoretical basis as well as serious attempts and goals in the way of validating them. Early reviews of training programs concluded that innovation can be enhanced with training (Parnes and Brunelle 1967; Ellis Paul Torrance 1962; 1968; Rose and Lin 1984). As a positive results , following some studies such as (Parnes, S. J. 1993; Ellis Paul Torrance 2011; Ma 2006; Scott, Leritz,

and Mumford 2004), the evaluations of the effectiveness of creativity training programs provide some indications that at least some of the programs available have the potential to increase post-training creative performance. However, other studies provide a divergent conclusion indicating conceptual and methodological problems in most evaluation studies (Mansfield, Busse, and Krepelka 1978).

Therefore, the chapter presents internationally agreed and recognized definitions and explanations of the training in general at first followed by the parts that is focused on the links between training and education. However, for the next part, it is concentrated on some experiences of training in few sectors of work followed by the part that explain the relationship between training and innovation

2.2 The determinants and effects of training:

2.2.1 Training: Definition, approaches and Benefits

According to (Dhar 2015; Roger Buckley and Jim Caple 1995) ”the training can be defined as a planned and systematic effort to modify or develop knowledge, skill, and attitude through learning experience, to achieve effective performance in an activity or range of activities”.

Training motivation can be conceptualized as the direction, effort, intensity, and persistence that trainees apply to learning-oriented activities before, during, and after training (Ruth Kanfer 1990; Tannenbaum and Yukl 1992).

Following the study of (Salas and Cannon-Bowers 2001; Nazir et al. 2015),” Training is an essential component of industrial safety as it enhances the level of skills, comprehension, productivity, motivation, reliability, and commitment among the trainees”.

The training is also one of a series of factors affecting organizational performance (R. Kaufman and Keller 1994; Parry 1996; Bee and Bee 1994).

Starting from these different definition and according to (Galia and Legros 2004), the importance of the training strategy cannot be neglected because it represent from the important competitive advantages of the firm.

However, from the important barriers faced the training activities is the unknown results. According to (Aragón-Sánchez, Barba-Aragón, and Sanz-Valle 2003), the companies cannot understand how the investment in training affect the business value.

2.2.1.1 Training approaches:

Following (Úbeda-García et al. 2014), there are three approaches of training that link between the human resources practices and the performance. These approaches are:

- *Universalist approach*:

It proposes the existence of human resource management practice, which are better than others are. In addition, and following the universalist approach, the firms that are providing more training will be more effective than the firms that are not (Harrell-Cook and Appelbaum 2001). This approach known also the best practice, it implies a direct relationship between the HRM and performance, so it proposes that the role of the human resource management better than the others. So, as a result of this approach, the organization which provide more training for their employees, will be more effective (Youndt et al. 1996; Úbeda-García et al. 2014).

- *Contingent approach*:

The training policy is related with the strategic approach of the firm. This approach shown that the organization's strategic posture either augments or diminish the impact of HR practices on performance. From another side, the results of the training is depends the strategies of the firms (Peña and Villasalero 2010; Youndt et al. 1996; Úbeda-García et al. 2014).

- *Configurational approach*:

The training will improve organizational effectiveness to a greater extent when used in conjunction with other complementary human resource practice such as: careful selection of applicants for potential and trainability, practices aimed at reducing staff turnover, use of internal promotion and internal labor markets; adoption of contingent performance incentive systems, broadly defined jobs, and providing opportunities for employee participation. This approach suggests that to get a great result in the organizational effectiveness, it is important to implement other human practices for the employees beside the training (Úbeda-García et al. 2014). From another meaning, we cannot expect great effect of the training alone in the performance of the organization.

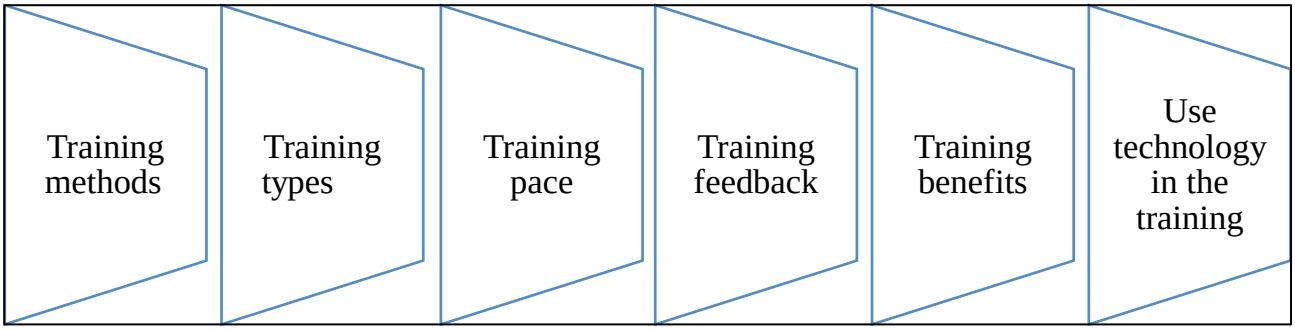
Following (Salas and Cannon-Bowers 2001), there are different new training related approaches such as:

- Action learning,
- Just-in-time training,
- Mentoring,
- Coaching,
- Organizational learning,
- Managing skill portfolios.

2.2.2 Training sub-themes:

Following the study of (Rubin and Rubin 2011), there are six sub-theme under the field of the training structure that are presented in Figure 2-1:

Figure 2-1: Sub-theme of the training field



source: prepared by the student based on (Rubin and Rubin 2011)

These sub-themes are discussed in the following parts.

2.2.2.1 The training methods:

The training methods are specified following the goals in the future. According to (Lynch 1992; Hara 2014), they distinguish between three method of training that are:

1- OJT: On-the-job training:

This kind of training is invoked following (C. Albert, García-Serrano, and Hernanz 2005) as one of the main mechanisms to promote the creation of internal labor markets. According to the studies of (Doeringer 1971; C. Albert, García-Serrano, and Hernanz 2005), "the on the job training provides workers with qualifications to make the properly performance of their job tasks easy". (Harris and Bonn 2000; Ravichandran et al. 2015) found that on-the-job training was the most frequently applied method followed by Classroom instruction, Textbooks and manuals and Case studies and simulations.

Training tools that were used the most included texts and manuals followed by transparencies and flip charts, teleconferencing, computers, and audio-videotapes.

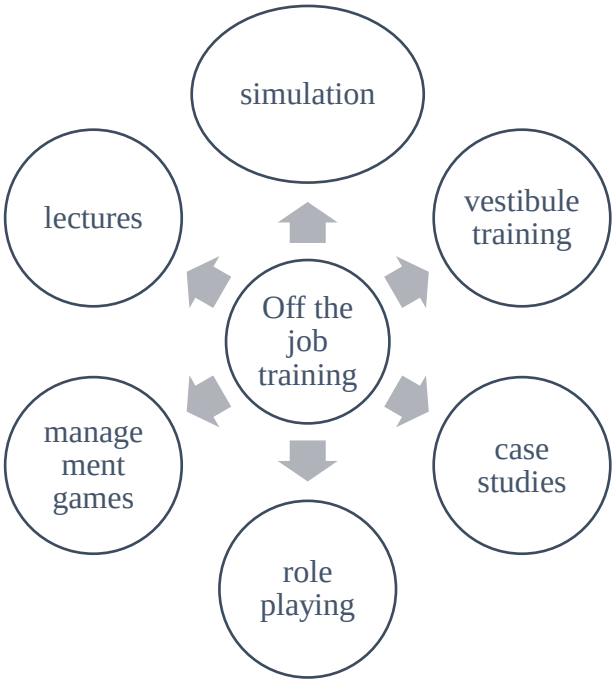
2- Training as apprentice (apprenticeship):

The apprenticeship is cited from the ideal training method for the most participant following the study of (Ravichandran et al. 2015) to learn the necessary skills for the new employees.

3- OFF-JT: Off-the-job training:

The Off the Job Training is the training method wherein the workers or employees learn their job roles away from the actual work floor. It comprises of a place specifically allotted for the training purpose that may be near to the actual workplace, where the workers are required to learn the skills and get well equipped with the tools and techniques that are to be used at the actual work floor. To explain more the off the job training, Figure 2-2 demonstrates the different methods of the off the job training:

Figure 2-2: different methods of off the job training



source: (Jargons 2015)

Simulation: Under this training, the trainee is required to learn the operations of machines and equipment, that are reasonably designed to look similar to those installed at the actual work floor.

Vestibule Training: is specifically given to the technical staff, office staff and the employees who learn the operations of tools and equipment assembled at a place away from the actual work floor. This type of training is conducted to give the real feel to the trainees, that they would be experiencing at the actual plant.

Case Studies: the trainees are given the situation or a problem in the form of a case study, and are required to solve it as per their learning from the training program.

Role playing: is essential in case of customer services. Under this, the trainees assume roles and enact as per the given situations. It is also called as *socio-drama or psycho-drama*, wherein the employees act as if, they are facing the situation and have to solve it spontaneously without any guidance.

Management Games: the trainees are divided into groups and then they are presented with the simulated marketplace or the situations, wherein they are required to apply their learning and solve the problems accordingly.

lectures or classroom training: the employees are given lectures about the job requirements and the necessary skills required for implementing the job.

2.2.2.2 Types of training:

Barrett and his colleagues argue in his paper (Barrett and O'Connell 2001) that there are two types of training:

1- General training: this type of training will contribute to the worker's general human capital, increasing his productivity with a range of employers. After distinguishing between the two types of training,(Barrett and O'Connell 2001) found a positive effect of the general training on the productivity growth.

2- Firm Specific training: this provides a worker with firm-specific skills, that is, skills that will increase his or her productivity only with the current employer.

2.2.2.3 Training benefits:

Following the study of (Wong and Pang 2003), the training and the development program from the important factors to enhance the staff creativity.

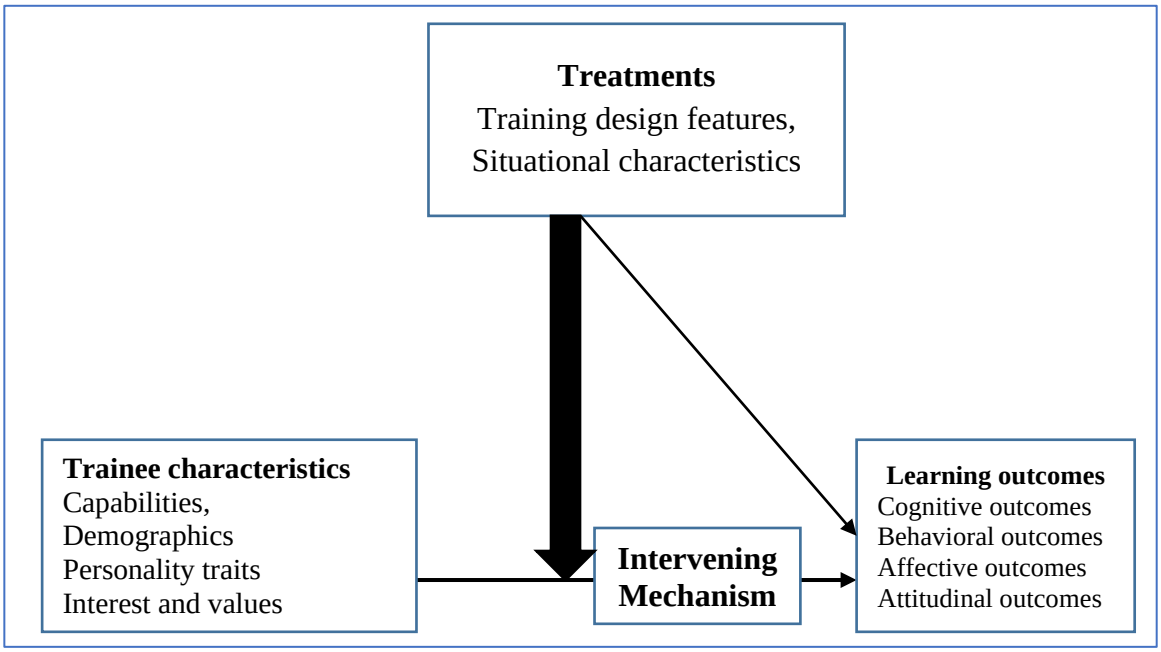
According to (Kurt Kraiger 2003; Tharenou, Saks, and Moore 2007; Ballesteros-Rodríguez, De Saá-Pérez, and Domínguez-Falcón 2012), the training improves the organizational performance through the creation of workforce with rich skills and extensive knowledge. Where from another side, self-efficacy lead to more positive training outcomes (Mathieu, Martineau, and Tannenbaum 1993; Martocchio and Webster 1992; Martocchio and Dulebohn 1994; Stevens and Gist 1997)

In addition, there are other studies based on questionnaire such as the study of (Truitt 2011). As a result of this study, there is a strong positive relationship between the training and proficiency. From the sample of 237 persons, 86.8% of persons who had training, they have most positive attitudes about training.

From the modern forms of the training that is predicted to gain popularity is the internet-based training (Ravichandran et al. 2015). This method allows the employee to train at their own pace and at the time and place convenient for them. According to the study of (Noe 1986), from the different key determinants of the training effectiveness, there are locus of control, Career and job attitudes and Trainee motivation.

Also, training outcomes are determined by the combination of mechanisms that influence how people process information, focus their attention, direct their efforts, and manage their effect during the period of learning. There are different studies focus on the training outcomes where they find four kinds of training outcomes as it shown in the Figure 2-3 below:

Figure 2-3: training Framework



Source:(Kozlowski and Salas 2012)

The figure above includes these outcomes:

1- The cognitive outcomes include all of:

- Declaration,
- Procedural,
- Strategic knowledge,
- Structure and organization of such knowledge.
- Cognitive transfer.

2- The affective and motivational outcomes include:

- Satisfaction,
- Self-efficacy,
- Expectancy,
- Perceived the utility of the training.

3- The attitudinal outcomes include:

- Changes in attitudes toward task, jobs and others.

4- Behavioral outcomes include:

- Skill development,
- Automaticity,
- Maintenance,
- Skill generalization
- Adaptability.

2.2.3 Factors affecting training

Before analyzing training in the firms, it is necessary to measure it in the first step. Because, following the study of (Úbeda-García et al. 2014), "the training measured in the firms by the volume of expenditures in it"

From the important model that it evaluates the training process, there is the model of the four levels or Kirkpatrick model. It is the most widely used model due to its simple and practical ideas(Aragón-Sánchez, Barba-Aragón, and Sanz-Valle 2003). It includes four levels of evaluation that are:

- Workers opinion and level of satisfaction,
- Learning evaluation, (the advancement in skills and knowledge through training)
- Changes in performance after training,
- The effects of training in business results in the both sides' workers and products. (see Appendix 0-1and Appendix 0-2)

2.2.3.1 The cost effects on the training:

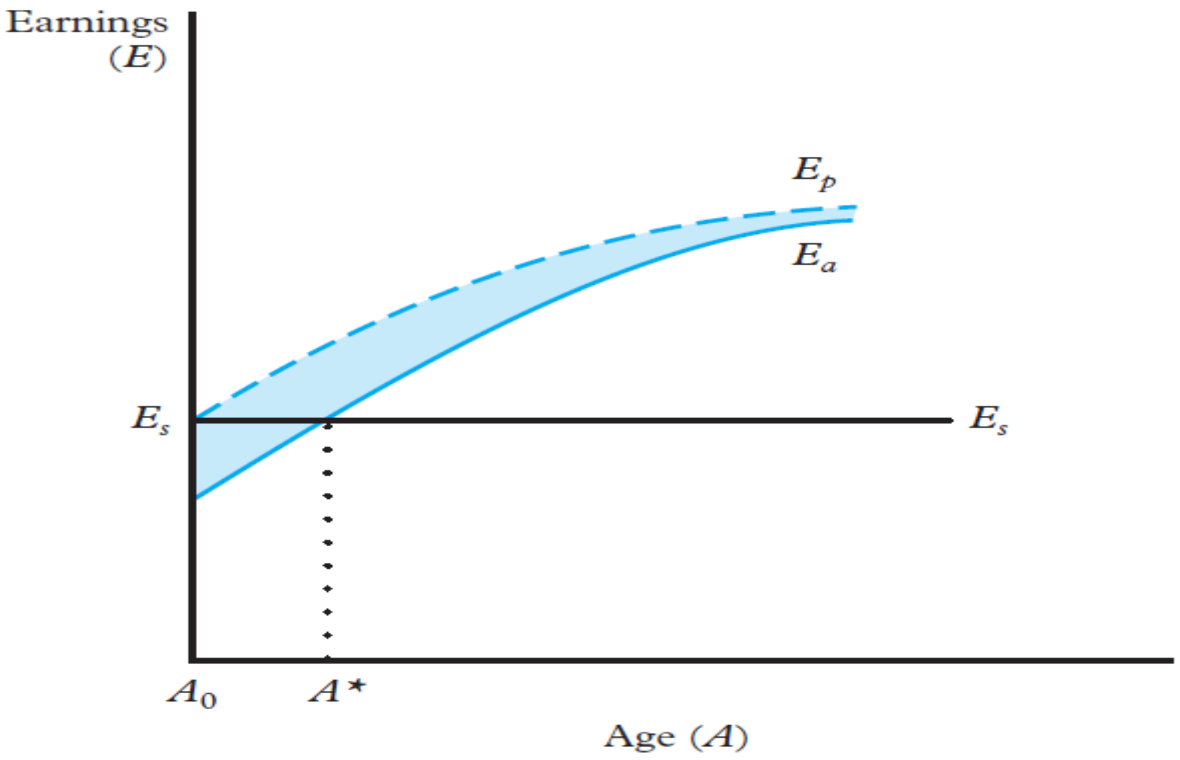
From the perspective of workers, during the learning period, the training depresses wages (because during the period of training, the number of employee's work hour reduced, there for his productivity reduced also, in the end he will earn less) but it allows them to rise with enhanced productivity. Therefore, the workers who opt for jobs that require a training investment are willing to accept lower wages in the short run (during the training period) to get higher pay later on.

2.2.3.2 The age and the training:

Starting from the cost effect on the training, the returns of human capital investment will be more in longer period than in short period, this latest mention that the number of the workers will be in a negation correlation with their ages (i.e. the number of the young workers will be more than old worker to give them more ability to product more contrary with the old workers).

The figure below depicts the life cycle implications of human capital theory to the on-the-jo training:

Figure 2-4: Investment in On-the-Job Training over the life cycle



source:(Ronald G. Ehrenberg and Smith 2011)

The individuals depicted has completed full-time schooling at age A_0 and able to earn primary wage E_s.

Following the Figure 2-4 above, there are three situations:

First situation, if the worker does not have training and his knowledge and skills do not depressed, he will remain in the first earning (E_s) over the life cycle.

In the second situation if the worker chooses to invest in on-the-job training, his future earning potential can be enhanced (shown in the figure with the curve E_P). As it mentioned before, with the on the job training, the earning will be less than the earning. there for, there is the third curve in the figure E_a that it represents the growth of the earning during the live cycle. It mentioned also that there is a common point between the earning E_S and E_a at age A* that is called the overtaking age, i.e. in this age, the worker with on the job training will have the same earning as the worker without on the job training, but the earning follows the growth due to the knowledge and skills gathered from on the job training. The little difference between the E_p and E_a is that the E_a lie under E_p as long as the worker is investing.in the training (training cost).

2.2.3.3 Problems as source of training and creativity:

Some researchers suggest that the nature of the task upon which groups and individuals are asked to work may affect the quality and quantity of the outcomes or results of the work (Watson, Michaelsen,

and Sharp 1991). In addition , some researchers indicate that the type of problem to be solved may have an effect on the performance of the ideation process by affecting both the quantity and the quality of the ideas generated (Scott G. Isaksen 1998; Paul A. Mongeau and Mary Claire Morr 1999). A closed problem is one for which the solving method is known (e.g. an algebra problem (Taylor and Getzels 1975)) whereas an open problem is one for which the participant is required to find, invent or discover the problems according to (Dillon 1982) most artistic endeavors), (Unsworth 2001)

For example, (Unsworth 2001) is one of the researchers who propose a conceptual framework for studying creativity. This latest takes into consideration the type of problem faced as an important determinant of the creative response and, consequently creative performance. Also, the type of problem (e.g. closed vs. open problem) bares an effect upon people's engagement in the creative process. Indeed, motivational research following the research of (Deci and Ryan 1987) has established that behaviors are either initiated through self-determined choice, or as responses to external demands. Also, Self-determined behaviors are those in which "people experience themselves as initiators of their own behavior" (Deci and Ryan 1987, 1025). Therefore, researchers suggest that an intrinsic type of motivation i.e. performing an activity for its own sake and not for external rewards, underlies this kind of behavior. From another side, creativity researchers suggest that in comparing with extrinsic motivation (where performing an activity in pursuit of external rewards), the intrinsic motivation favors creativity or innovation and enhances creative performance more than extrinsic motivation(T. M. Amabile 1983; 1988; Teresa M. Amabile 1996; Teresa M. Amabile and Hennessey, B.A 1999; Teresa M. Amabile 2012). According to (Jacob W. Getzels and Mihaly Csikszentmihalyi 1976; Jacob W. Getzels 1980), the right formulation of the problem founded is a key for creative achievement that will lead indirectly to innovation. According to (Jacob W. Getzels and Mihaly Csikszentmihalyi 1976, 81) the problem-solver must become a problem finder at first, and her task should be not only to find the solution, but also discover the problem itself. Following the research of (Unsworth 2001), the types of problems play an important role as a dimension of creativity engagement and develops four distinct types of creative behavior (e.g. responsive, expected, contributory and proactive). Because the level of engagement is different across the different types of creativity, the underlying motivation may be also different. Hence, the four types of creative behavior may yield different creative performance outcomes (e.g. one person may show superior creative performance during the ideation process if that person is creative because it is expected to behave so, as compared when it is proactive or voluntarily wishes to contribute and to solve the problem). There is yet another way in which the type of problem can affect creative results, namely its realism. Most empirical research examining the factors that are affecting creative performance, this latest is based on laboratory studies that use fictitious problems with little, if

any, relevance to the solvers. According to (Scott G. Isaksen 1998) fictitious problems lack ownership. A task has ownership if:

(1) is of interest,

(2) can be acted upon or actually influenced by a member of the group,

or (3) if it engages the imagination of the problem solver because it demands a fresh new approach which is meaningful (Scott G. Isaksen 1998, 16). These aspects defining problem ownership have the potential of affecting the level of engagement into the creative process, as well as the type of motivation and, on this basis, the creative outcomes. However, problem realism appears to be neglected by previous creativity research.

2.2.4 Human capital and training:

Starting from the paradigm of Becker and according to (Acemoglu 1997), "the workers should pay for any general training which allows him or her to use the new skills when it employed by other firms". Also, the human element is considered from the important sources of competitive advantage in the firm according to its intangible characteristics.

According to (Yoo and Park 2007; Dhar 2015), the training helps to increase the employee performance. According to (OECD 2001), the training expenses from the forms of investing in the human capital. Baldwin and Johnson find in their study (J. R. Baldwin and Johnson 1995) that the training facilitates the human capital development. In addition, it is necessary for the firm to give importance to the training of the employees as the importance given to the research and development and other strategies that are related to the innovation. From this latest point, we can summarize that they suggest the necessity of the training to foster innovation in the firm.

Starting from the assumption that innovation or creativity is trainable, it follows that the individuals that are trained in creative thinking will exhibit better post-training creative performance than untrained individuals. Training has long been recognized by creativity researchers as having the potential to enhance creative performance (Parnes and Brunelle 1967; Ellis Paul Torrance 2011; Rose and Lin 1984). Nevertheless, training delivery (i.e. the specific format in which training is provided to trainees) is rarely examined within previous research of factors affecting training effectiveness and post training creative performance. Nevertheless, education research studies provide evidence that different educational approaches produce different results. For example, research comparing active learning programs (e.g. experiential learning and problem-based learning) reveal performance differences between individuals and/or groups educated through such training methods as compared to lecture-based education (Stepien, Gallagher, and Workman 1993; Boaler 1997; Kayes, Kayes, and Kolb 2005). If

different training methods yield different post training performance outcomes, it may be that different training formats of creativity enhancement programs bare different effects on post-training creative performance.

2.3 Training and Education:

Education and training are encouraging the creativity and innovation that can transform economies and societies. At the same time, innovation in new forms of cooperation and changes in curricula, teaching and technology are bringing greater flexibility and modernizing vocational education and training.

2.3.1 Education and training policies

In this case, there is another factor that could affect the three different variables that are on the job training, age and earning that is the education level of the worker. Therefore, different researchers found the tendency of the better educated workers is high in investing more in job training that it explain their low stars level of age and earning but rise quickly to achieve highest levels rather than the other counterparts.

The Innovation Union Scoreboard shows that the impact of upper secondary education on innovation in the EU is increasing. This matter because, according to Eurostat, in 2013, around 49% of the 22 million learners at upper secondary level in the European Union (EU) were in vocational and education training (VET). Developing their ability to innovate can bring considerable economic and social benefits. Learning at the workplace also has a positive impact on innovation performance.

EU countries recognize this and are trying to tap the potential of all VET learners. The Netherlands regards VET as the basis of a ‘learning’ economy. In 2013, France set a national goal to improve VET to support economic recovery. Denmark integrates creativity and innovation in its VET programs to strengthen its position as a knowledge society.

VET also supports social innovation. Civic competences and social awareness skills acquired through VET not only improve work organization, but also strengthen civil society. In Germany, VET programs to integrate young adults with special needs into mechatronics apprenticeships illustrate the close partnership between VET and social innovation.

The programs were awarded the Hermann Schmidt prize for innovation in VET and contributed to social innovation. They promoted equity by integrating people at a disadvantage into the labor market while developing social and interpersonal skills, including tolerance in society as a whole. Other countries are also using VET to change society. Under Hungary’s social inclusion strategy, key competences of the Roma population are being developed through continuing VET tailored to their

specific needs. Estonia and Lithuania are influencing attitudes by using VET to develop key competences, not only for employment, but also to promote an inclusive and tolerant society.

2.3.2 The relationship between education and training:

The Table 2-1 below captures the relationship between the adult training and existing education

Table 2-1:The Relationship between adult training and existing education

Participation rate during one year					
Level of education		Lower secondary	Upper secondary	Tertiary	All levels
Austria		5	19	37	19
Belgium		6	15	30	16
Canada		6	20	35	25
Czech Republic		3	10	21	11
Denmark		22	36	54	39
Finland		20	32	54	36
France		9	19	33	19
Germany		3	10	24	12
Hungary		1	4	9	4
Ireland		5	10	20	11
Italy		1	6	12	4
Luxembourg		3	12	27	12
Netherlands		5	11	13	9
Poland		1	7	29	9
Portugal		4	15	27	7
Slovak republic		6	19	37	19
Spain		3	7	14	6
Sweden		24	37	57	40
Switzerland		8	27	44	29
United Kingdom		7	26	46	27
United states		12	32	56	37
OECD average	All	7	17	31	18
	Males	8	18	31	19
	Females	6	17	32	17

Source:(Brian Keeley 2007, 134)

Following the data presented above, the participation rate of in the training are differ from a country to another. However, the importance of these training is seen in the highest degree of education rather than the lowest degree. These changes are due to the knowledge gathered that clarify the importance of training in the job. From another side, with the highest level of education, the human got knowledge that allow him to get more skills and knowledge from training

2.3.3 Training and learning:

There are different important studies focus on the role of learning in innovation. According to (Archibugi, Howells, and Michie 1999), the collective learning is an essential for the existence of innovation system. In addition and following the study of (Amara et al. 2008), the are many types of leaning characterized as follows where they have highest impact on the degree of novelty of innovation of the established SME's in the study. These types are:

2.3.3.1 Learning by doing:

This form of learning is very important for the firm to improve their growth and innovative capability (Germain 1996; Gatignon and Xuereb 1997; Tether 2002; Koberg, Detienne, and Heppard 2003). Following (Amara et al. 2008), the firms become more efficient as they get more practice at doing what they do.

2.3.3.2 Learning by training:

The investment in the staff training pool the knowledge in the firms to develop innovations, whether it is incremental or radical innovation (Romijn and Albaladejo 2002; Darroch and McNaughton 2002; Subramaniam and Youndt 2005; Freel 2005).

2.3.3.3 Learning by interacting:

In addition to these three forms of learning, there are other forms of learning capabilities to innovation successfully following the researches of (Wes Cohen 1995; Chris Freeman 1995; C. Freeman 1995):

2.3.3.4 Learning by searching:

Learning by searching is associated with the internal R&D activities according to the studies of (J. Lee 1995; Inzelt 1996; Romijn and Albaladejo 2002). This latest (R&D activities) are necessary to create the new knowledge required to develop innovations.

2.3.3.5 Learning by using:

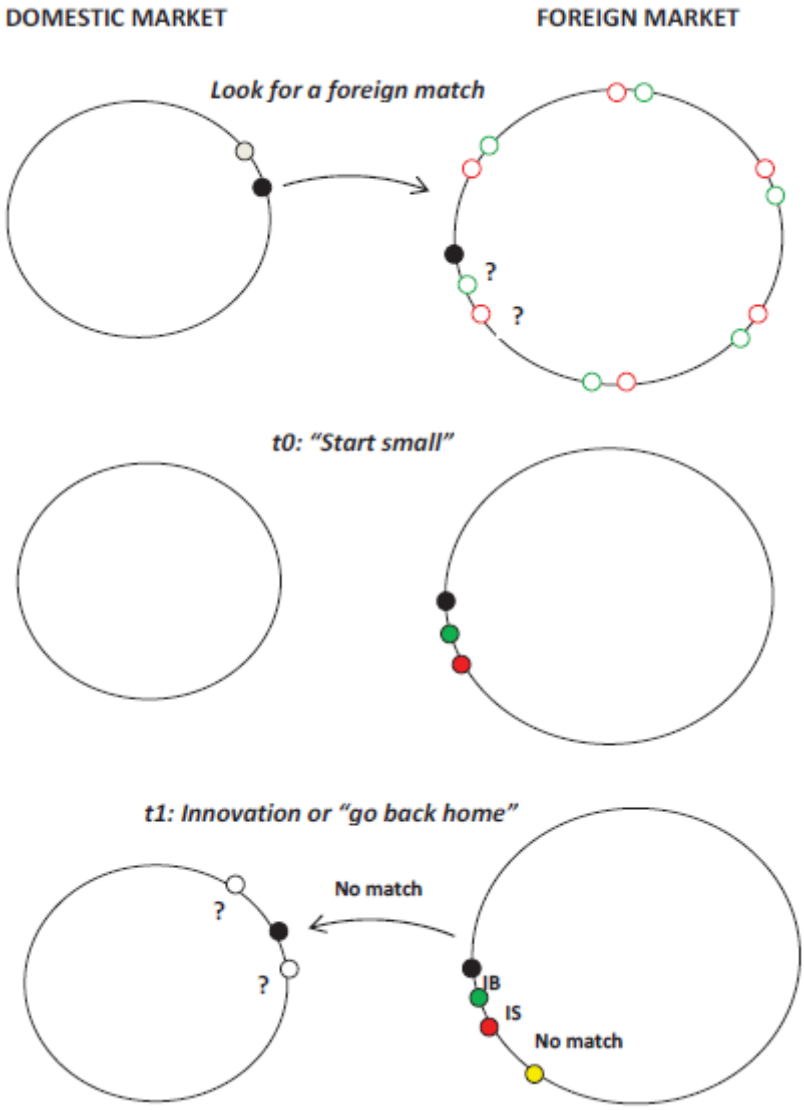
According to the studies of (Rosenberg 1982; Chandy and Tellis 1998; Gatignon and Xuereb 1997)Using advanced technologies boost learning. Some of these technologies codified knowledge

which creates new opportunities for experimentation and problem solving. According to the study of (Wuyts, Dutta, and Stremersch 2004).

2.3.3.6 Learning by exporting:

Following the research of (Massimiliano Brat and Giulia Felice 2012), the elements of the firm environment help the firms to learn from the market and to innovate. Figure 2-5 shows three steps of the integration to a foreign market using to element of the environment that are buyer and supplier.

Figure 2-5: integration to foreign market basing on environment element



Source:(Massimiliano Brat and Giulia Felice 2012, 17)

With: B: buyer, S: supplier, IB: International Buyer, IS: International Supplier

In the exportation process (enter a new market), the firms have different information to learn and knowledge to acquire about the new markets. In the domestic market, the domestic buyer is already matched with the nearest domestic supplier. However, the actual distance from the nearest foreign

supplier in the foreign product space (foreign market) is unknown, where only the distribution is known (i.e. the expected distance). In the time t_0 (time to inter to foreign market), the buyer buys from the supplier what he is already producing. After entering the foreign market, the buyer's distance from the nearest supplier in the foreign product space is revealed. At time t_1 (domestic product in the foreign market), the buyer in the time decides whether to "match" with the foreign supplier and the innovation strategy or not and go back home. In this time, the distance from the domestic supplier is unknown. Following this type of learning, we discover the role of the relationship between buyer and supplier in the innovation process.

2.4 Training and sector of work:

2.4.1 Training and tourism:

In special sectors such as tourism (Úbeda-García et al. 2014), the human capital qualification is a key factor in the customer satisfaction following the important role of the human capital in the hotel (reception, services, …etc.). Also and according to (Dhar 2015), there is a strong relationship between the employee training and the quality of services offered in tourist hotels.

2.4.2 Training and hospitality industry:

The Training can be defined as" the process that provides new and currently employed staff with the short and longer-term knowledge and skills required to perform successfully on the job" (Hayes and Ninemeier 2009)

2.4.3 Training and restaurant industry:

The training could be considered following the study of (Eaglen, Lashley, and Thomas 2000) as a competitive strategic advantage used to increase customer and employees satisfaction while also improving the productivity of the employees.

2.5 The creativity training:

Over the years, multiple creativity training programs have been developed. This latest is based on the premise that creativity is a characteristic inherent to all individuals and that people can be taught how to be creative. Therefore, the main argument of those that point out to the importance of creativity training is that, by providing people with tools they can use to increase their creative thinking abilities, it has the potential to enhance creative performance. In addition, many of these programs have been criticized for not being grounded in a theoretical foundation and for being based on biographical reports and case studies (Runco 2006, 368), in the meaning that they are not fully generalizable but may "only work for some people, some of the time". Empirical examination of the effectiveness of creativity training programs begun in the late 1950's with the work of E. Paul Torrance (and colleagues) who was the first to report some results indicating that creativity training could work (Sawyer 2006). Further

evidence in this sense was provided by Torrance again, when he identified 142 studies showing that creativity training could enhance creative performance (Ellis Paul Torrance 2011). Torrance's findings inspired practitioners and researchers to develop a variety of creativity training programs aimed at instilling and improving creative thinking abilities in people.

2.5.1 Creativity program training:

There are numerous creativity training programs available. There are many methods and techniques that have been designed aimed at the development and improvement of creative abilities and innovative abilities in people. The most notorious creativity enhancement training programs following the research's (Mansfield, Busse, and Krepelka 1978; Sawyer 2015) are included as follows:

1) Creative Problem Solving e.g. (Osborn 1963);

2) The Productive Thinking Program(Covington 1972);

3) The Purdue Creative Thinking Program(Feldhusen, Speedie, and Treffinger 1971);

4) Khatena's Training Method(Maria M. Clapham 2003, 368);

5) Myers – Torrance Workbooks(Maria M. Clapham 2003, 369);

6) The Cognitive Research Trust or CoRT, founded by Edward de Bono(Edward de Bono 1983, 115).

According to (Plucker J. A. and Runco M.A 1999), anyone regardless of their intellectual level, can enhance their creative abilities if they discover and practice the right tactics. Nevertheless, and although the aforementioned programs are widely adopted and used, little is actually known about their effectiveness and, in case they are effective, what makes them to be so. One frequent critique of creativity training programs is that they lack both a theoretical basis as well as empirical validation (Sternberg 1999).

2.5.2 Effectiveness of creative problem solving:

Following the study of (Puccio et al. 2006, 19), the Creative Problem Solving (hereafter *CPS)* has been "one of the rare exceptions" of combination between theory (via scientific research) and practice (via applications in real-world situations). The different research's conducted over the years on this topic generally indicates that CPS training have an effect on attitudes towards creativity, new idea generation and divergent thinking, among other aspects (Basadur, Graen, and Green 1982; Basadur and Hausdorf 1996; Basadur Min, Runco Mark A., and VEGAxy LUIS A. 2011; Basadur Min, Taggar Simon, and Pringle Pam 2011). In addition, Other studies in the area of the effectiveness of *CPS as* (Basadur, Graen, and Green 1982; Kabanoff and Bottger 1991; Basadur Min et al. 2002; Runco Mark A. and Basadur Min 2006; Wang Ching–Wen and Horng Ruey–Yun 2002) indicates that training enhances creativity-related abilities at the individual level – e.g. fluency, originality and flexibility in thought; problem finding, evaluating ideas…etc.

A third sub-area of research in this stream examined whether training affects group creativity (Firestien and McCowan 1988; Firestien 1990; Fontenot 1993; Basadur Min et al. 2002) and provides evidence that trained groups show higher creative performance in problem finding, improved communication skills in the case of small groups (i.e., participants got more involved in the problem-solving process; criticized ideas less; supported ideas more; smiled and laughed more; and produced significantly more ideas than groups that did not receive training,(Puccio et al. 2006, 27)). According to (Runco 2006), there have been so many studies that examine the effectiveness of creativity training "that a number of review papers have been published that do not report any new data but merely summarize and compile findings from the large number of earlier studies [meta-analyses]".

2.5.3 Evaluation of creativity training effectiveness research:

Following the research of (Scott, Leritz, and Mumford 2004), meta-analysis of 70 empirical studies of the effectiveness of creativity training considers not only the content, but also the delivery method of the different programs of the training. Overall, the findings of the previous analysis indicate that training bares a positive influence on creative performance as well as on creativity related attitudes and behavior.

The results obtained of the analysis indicate that creativity training affects positively the creative performance in various settings, for distinct age groups, and also for all differences of intellectual capabilities. In addition, the creativity training has also a particularly strong effect on creative performance in the case of those creative thinking programs focused on divergent thinking and problem solving. After focusing on the content of the different creativity training programs examined, the results indicated that those programs focus on the development of cognitive skills and the heuristics involved in skill application as the most effective creativity training programs. Also, the study (Scott, Leritz, and Mumford 2004) have also examined the effect of training delivery method (i.e. course design, type of media used and the type of practice exercises) may have on the effectiveness of creativity training programs. The purpose of examining these aspects was to provide evidence indicating how the basic parameters of instruction influenced the relative effectiveness of training programs. Different Courses design variables included course duration (number of days and number of minutes in the course) and intensity (distributed versus massed training), the general model applied, domain specificity, the realism and amount of practice included in the course, the depth and difficulty of the material, holistic training, component skill trained and, the amount of instructional feedback. Following the study, course design was found as having an important effect on the effectiveness of creativity training. In general, it was found that most effective training programs are longer in duration, distributed over longer periods of time (as opposed to massed, intensive courses), are based on a specific theoretical model of creativity (as opposed to and ad-hoc assembly of creative thinking techniques) and focus on the development of cognitive skills. In addition, these effective courses base their practice on realistic exercises and are using

course material that is presented in such way that it facilitates the initial acquisition of relevant concepts and procedures. In addition, the media used in creativity training also appears as influencing its effectiveness. The authors examined the influence of ten different media options namely: lectures, exposure to audio-visual material, computer assisted course, individualized coaching programmed instruction, discussion, social modeling, behavior modification, cooperative learning and case-based courses. The overall results indicate that the use of media that provides information is positively related to the success of creativity training. From the different types of media, the use of both lecture-based instructional techniques and audio-visual media were positively related to course effectiveness.

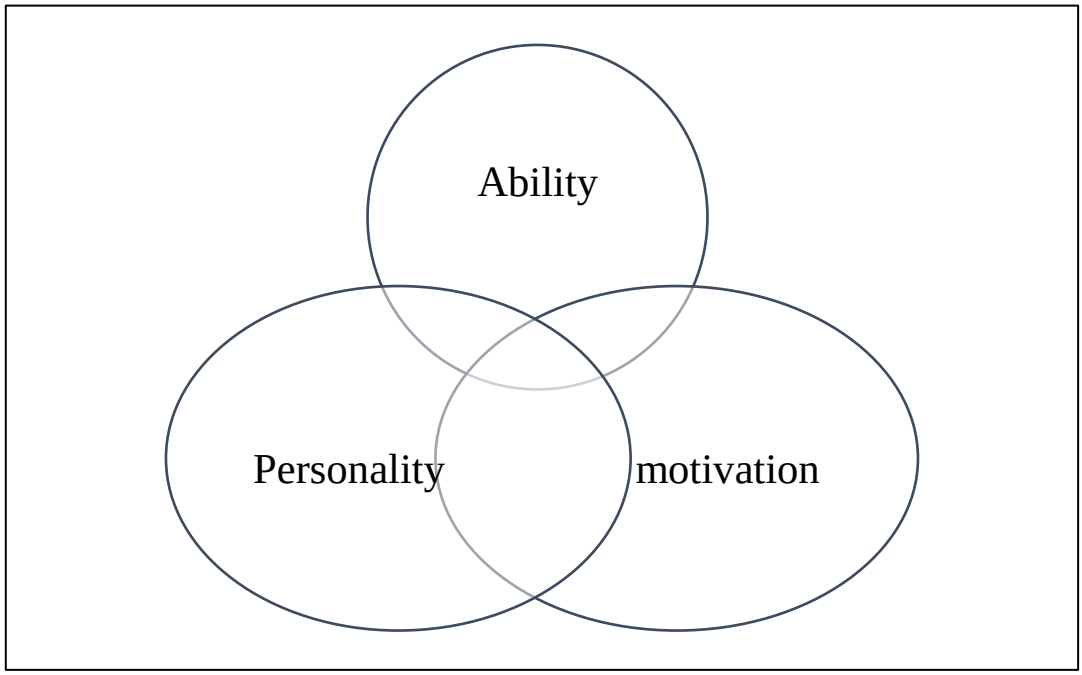
In addition to that, media that encourage knowledge application (specifically the use of social modeling, cooperative learning and case-based instruction) was also found as variable that affect positively the outcomes of the training. Following the results of (Scott, Leritz, and Mumford 2004), training delivery method and creative performance are in line with findings of education research indicating that different educational approaches produce different results in learners. Also, following the studies (Khan 1997; Martins and Kellermanns 2004; Wang and Wang 2009), following the exponential growth in internet usage growth, this growth is followed with the growth in schools and universities that are adopting web-based training.

Therefore, different studies such as (Khan 1997; Rivera, McAlister, and Rice 2002; Kearns, Shoaf, and Summey 2004) examined the performance of such training indicate that student tend to show higher performance in web-based courses. Therefore, there are some empirical evidences indicate that methods of learning have its impact on the results and performance of employees, that individuals trained through active learning methods exhibit different learning performance than individuals and groups trained trough traditional training methods (e.g. teacher-centered and lecture-based training). From another side, research in the effectiveness of Problem-Based Learning as an approach to learning, challenges students to learn by engaging them in a real problem by placing them in the active role of problem-solvers confronted with ill-structured problems. This latest method indicates that students enrolled in this type of training performed better on assessments of content knowledge as compared to students in traditional classes (Gallagher, Stepien, and Rosenthal 1992; Stepien, Gallagher, and Workman 1993; Gallagher Shelagh A. et al. 2010; Boaler 1997). Similarly for the experiential Learning that is a learning approach based on (David A. Kolb 1987), experiential learning theory according to which experience should be used in teaching as it is a rich source of learning and adult development . This latest provides evidence that teams are more effective if they learn from experience (Kayes, Kayes, and Kolb 2005).

Following the findings of the study (Scott, Leritz, and Mumford 2004), the specific way in which creativity training is delivered to trainees that it touches all of the teaching methods, course contents and duration, the media used and the type of practice offered are affecting the outcomes of such training.

Before looking for the effect of training on the creativity and the Innovation, it is necessary to look for the characteristics of the trainee that will be the engine of the innovation. Following the study of (T. T. Baldwin and Ford 1988) , the most important trainee characteristics used in the model of the determinants of the training transfer are as shown in the figure below:

Figure 2-6: the trainee characteristics



source:(Kozlowski and Salas 2012)

In addition, the trainee play an important role as a ring to share and transfer the trained skills to the work environment (Kozlowski and Salas 2012).

Following the studies of (Chen and Huang 2009; Vila, Pérez, and Coll-Serrano 2014)," the strategic human resources practices positively relate to knowledge management capacity, which, in turn, has a positive effect on innovation performance".

From the important characteristics of the **efficiency driven economies** is the integration of the training following the study of (Alicia Bonner Ness 2013) as an important tools to grow up the economy starting from the role of the human capital in the firm.

2.5.3.1 Training as policy for innovation:

The necessity of the training is seen in different parts of the firm life. From the idea of the creation to the execution. According to the study of (Riel, Tichkiewitch, and Paris 2015), " the student have to be trained in systematically opening their mindset to generate and structure ideas with high innovation potentials". From this study, we understand that to ensure the innovation in the long run of the firm, the

training of the student is so important to open their mind to generate innovative ideas. The ideas that they will implement it in the process of the firm.

The training is one the sources that could bring innovation into the firms, following the data gathered from the (OECD 2009), the table below present the rate of the training in innovation in different countries following the factor analysis based on survey data from different countries:

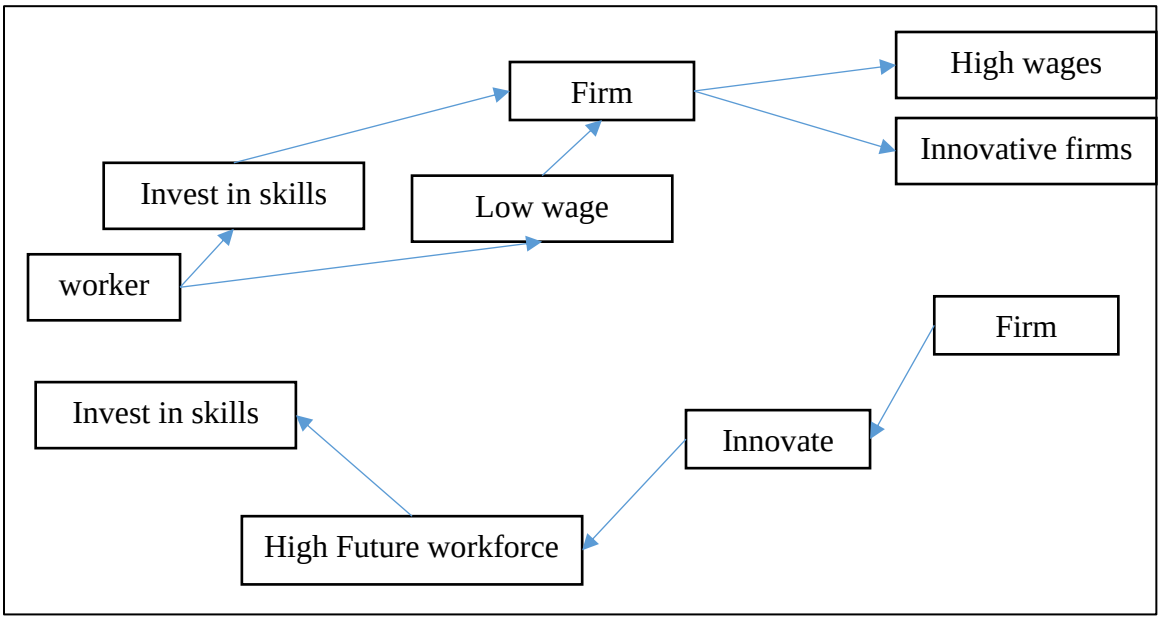
Table 2-2: rate of training in innovation in both Austria and brazil

Country	N	Factor1: new-to-market innovating	Factor2: wider innovating	Factor3: process modernizing	Factor4: marketing-based imitating
Austria	5203	0,05	**0,71**	0,24	-0,07
Brazil	4476	0,43	-0,11	**0,56**	0,43

Source: (OECD 2009)

Following the study of (Acemoglu 1997), in the first side, the workers are more willing to invest in their skills (get training) by accepting lower wages if they expect more firms to innovate and pay them higher wages in the future. In the second one, the firms are also more willing to innovate when they expect a high quality of the future workforce. The high future workforce is due to the worker's investment in their skills. The model below demonstrates these relationships:

Figure 2-7: the different maps of innovation



Source: edited by the student

2.5.4 The need for further evidence on training delivery methods:

Based on what it is cited above, it appears to be a need for further empirical evidence regarding the influence that delivery method may bear upon creative performance.

While the studies reported in (Scott, Leritz, and Mumford 2004) examined the effect of training formats such as lectures, cooperative learning and case – based learning, other training formats that were not considered by previous research.

In addition, given the nature of the study, the analysis provided by (Scott, Leritz, and Mumford 2004) does not compare among different training formats. Nevertheless, there are other findings provided by education research suggesting the existence of a relationship between training format and training effectiveness (Gallagher, Stepien, and Rosenthal 1992; Stepien, Gallagher, and Workman 1993; Gallagher Shelagh A. et al. 2010; Boaler 1997; Kayes, Kayes, and Kolb 2005). Hence, the implemented comparisons among different delivery methods may provide useful evidence that may help to improve the effectiveness of extant creative training programs. In addition, in the following, there are two delivery methods will be compared namely lecture-based training versus creativity training delivered through experiential learning. The experiential learning was chosen as delivery method alternative to lecture-based training for several reasons. First, the importance of previous experience to creativity has long been recognized (T. M. Amabile 1988; Csikszentmihalyi 1988; Sawyer 2006). Research in organizational creativity also shows that having experience in a particular field is necessary for creative success (T. M. Amabile 1988; Runco and Chand 1995; Runco, Dow, and Smith 2006). Second, experiential learning is a form of adult learning. Organizational actors (employees, supervisors, managers, etc.) are all adults.

However, according to different education research, there are certain teaching approaches find that there are more adequate in the case of adult learners (i.e. adult learning theories). Adult learning theories (also known as andragogy theories, e.g. (Knowles 1950; 1970; 1980) de-emphasize lecture and other teacher-centered forms of instruction and emphasize the value of the process of learning, recommending active approaches to learning that are problem-based and collaborative rather than didactic. Given that, as education research suggests, some training methods (e.g. adult learning) may lead to better learning results in the case of adults. Also, it may be the case that adult learning-based training may produce better creative performance results as compared to individuals trained within traditional teaching-learning paradigms.

Last but not least, another reason for selecting experiential learning is based on suggestions of education research. According to traditional schooling methods, based on instructionism (Papert 1994) – i.e. a view of education which considers that knowledge is a collection of static facts and procedures, known by teachers, which have the task to get these tasks and procedures in students' heads (Sawyer 2015) – are not adequate for teaching creativity. However, according to (Sawyer 2011), the findings from cognitive science are indicating that “the conceptual understanding that underlies creative behavior emerges from learning environments in which students build their own knowledge”(Sawyer 2011, 8).

For stimulating creative behavior, a constructivist view of schooling is proposed, according to which learning is always a creative process based on experimentation, building on previous knowledge and collaboration.

2.6 Chapter Conclusion:

This chapter provided an overview of the training, factors, approaches and benefits. In second steps, it contains the links between training and all of education and learning following the similarity of these terms. Also, the chapter summarize the effect of training on the economy through the training effect on some sectors such as tourism, hospitality and restauration. Through this chapter, training plays an important role in improving the capacities, knowledge, skills, and experiences of the individual. Also, Training is considered a field among the important aspects that has a direct and positive effect on the human capital. In addition, it is used also in the aim of solving problems and creativity.

CHAPTER THREE

3 Chapter Three: Links Between Innovation (national innovation system), Human capital (training) and employment:

3.1 Chapter Introduction:

Genius. Invention. Talent. And, of course, creativity. These words describe the highest levels of human performance. When we are engaged in the act of being creative, we feel we are performing at the peak of our abilities. Creative works give us insight and enrich our lives. Creativity is part of what makes us human. Our nearest relatives, chimpanzees and other primates, are often quite intelligent but never reach these high levels of performance. And although advanced "artificially intelligent" computer programs hold the world title in chess and can crunch through mounds of data and identify patterns invisible to the human eye, they still cannot master every-day creative skills (Sawyer 2006, 3).

There are many reasons to consider the possibility that creativity can be enhanced. Most obvious may be that there are clear benefits in applied settings, such as schools and any organization that is concerned about innovation. There is, however, much more to enhancement than this. There is, for example, the idea that each of us has creative potential that can be fulfilled. If creative potentials are fulfilled, or at least maximized, the benefits of creativity (e.g., for psychological and physical health) are the most likely to be realized. The benefits will be apparent on both societal and individual levels […]. You might even say that there is a clear need for creativity on both social and individual levels, and thus a need to invest in techniques and programs that are designed to enhance creative skills (Runco 2006, 320).

This chapter is organized as follows, the next section demonstrated de necessity of innovation and creativity followed by section of innovation and its relation with all fields. The last section demonstrates the relationship between innovation and labor market changes, this latest touch all of labor market flexibility, labor quality and gender diversity. In the end, this chapter conclude with conclusion that summarize the essential of the chapter.

3.2 Innovation and creativity:

Many studies are agree that the innovation or creativity is from the important key factors that drives the civilization such as the research (Beth A. Hennessey and Teresa M. Amabile 2010).

Following the continuous progress of the humanity into 21st century, it faces different and major challenges in the incessantly changing environment. As it shown in the all life, the humanity is facing many interdependent challenges in different fields and sectors such as energy, water shortages and food, health and environmental issues, wars, problems of money and poverty, the issues related with population growth and the limited sources. All these challenges are demanding for novel and creative solution. To solving these challenges, different individuals and institutions are contributing to solve

the problem and get the solution. Therefore, many of the challenges are solved through the efforts of institution. However, in different cases, single individuals can solve strong problems with bright ideas (Sawyer 2006).

Albert Einstein once said that "the significant problems we face cannot be solved at the same level of thinking we were at when we created them" (Calaprice, Dyson, and Einstein 2005), and that "a new type of thinking is essential if mankind is to survive and move toward higher levels" (New York Times 1946).

The growth of the humanity follows its ability to find, create or innovate solution to solve actual problems, and adapting of these solutions with the environmental changes.

Following the study of (Csikszentmihalyi 1996, 11)"new solutions will not appear magically by themselves. Problems are solved only when we devote a great deal of attention to them and in a creative way". Following the study (Beth A. Hennessey and Teresa M. Amabile 2010, 570) that it globalizes the results of different researches and studies, "it is only with creativity that we can hope to address the myriad problems facing ours schools and medical facilities, our cities and towns, our economy, our nation and the world". Therefore, in a global instable environment; that it changes very fast than before, it is necessary to understand, follow and apply the innovation and creativity in different sectors. From a side, some researches such as (Beth A. Hennessey and Teresa M. Amabile 2010, 570) argue that "the study of creativity must be seen as a basic necessity". Following the research of (Sawyer 2006), there are different reasons allow us to understand the innovation or creativity. At first, if we understand the right meaning of the innovation, it will help us to determine or select the skills, talents of creativity or innovative capacities of every person. Therefore, according to (Sawyer 2006, 4) if we hope to solve all problem faced in the society, we have to exploit and take advantage of all innovative capacities of all individuals. Second, after understanding the real meaning of innovation, it could "help our leaders to respond better to the challengers that face modern society" (Sawyer 2006, 4). Innovation is one of the important characteristics of effective leaders. Following the research of (Sawyer 2006, 4), these leaders need to be" especially effective at handling novel challenges that force them to go outside the typical routines". In the end of the explanation of innovation, the right understanding of innovation leads us to be better in resolving our daily lives problems. This latest can helps us to solve bigger problem. According to (Sawyer 2006, 5), "some of these problems can be solved simply by a single individual having a good idea; others will require groups of individuals to work together creatively as a unit".

Following technological growth, and appearance of different needs and desirous, the world we currently live in is also becoming more complex. Following the study (Runco, Dow, and Smith 2006)," from a side of technology, it makes our life easier. However, it makes it so difficult. These

latest two sides of technology make huge effect on our lives. Therefore, following these changes, the individuals are obliged to follow the technological changes in the way of satisfying their needs, by upgrading sustainably their skills to use the new technologies, and to satisfy their needs. Following the results of (Runco 2006, 658), all the changes and growth happened on the technology that increase the world's complexity make the innovation more important than before. This latest (that is innovation) is an effective response to the evolutionary changes. In addition to the innovation function that is solving problems, the innovative thinking allows the individual to be flexible. From another side, the innovation is related directly with the original behavior of the individual, and this originality is necessary for innovation but it is not sufficient. Following the different sides of innovation, it will be complex, where the flexibility is an important part of it. The flexibility of the innovative individuals is the characteristic that allow them to behave with different changes such as technological that is a part of our daily lives.

As a result, the innovation is defined following the study of (Teresa M. Amabile 1996) as the production of new and useful ideas in different domain. Also, following the study of (Ken Robinson 2011), innovation is a key in order to solve the challenges posed by the highly complex and fast changing world we live in nowadays. As put by Sir Ken Robinson, in order to deal with the increasing world complexities and to realize our true potential we must learn to be creative.

Around the world, different researchers, academics, decision-makers, policy-makers and business leaders mention the necessity of innovative workforce in different domain in the society. From another side, there is increased recognition of innovation as "an economic engine or driver for generating wealth, employment, sustainable development of world cities, technological changes, business innovation and enhancement of competitiveness of individual cities and countries" (Hui, NG, and Mock 2004, 26). Based upon such arguments, there is an increasingly wide spread agreement that more attention should be given to nurturing innovation.

As a result of what it explained above, the innovation is a complex topic from the first side, and not a new topic. According to (Treffinger et al. 2002), the first researches of innovation was traced with the Greeks. Following the growth interest of the innovation as key role of human development, economic and social growth (Florida and Boyett 2014); different researcher such as (Richard W. Woodman, John E. Sawyer, and Ricky W. Griffin 1993) are launching researches to define exactly the term innovation. However, through the complexity of the innovation, they could not arrive to give definition of innovation, and what are the best ways to improve the innovative performance. According to (Richard W. Woodman, John E. Sawyer, and Ricky W. Griffin 1993, 316), " researchers still knows surprisingly little about how the innovative process works"

Following the definition of innovation through (John Man 2001), they use the term of innovation or creativity as the same meaning, but there is clear different between these two terms.

About the creativity, it is the generation of an idea. Following the study (Mehta, Chandani, and Neeraja 2014), there are three types of creativity:

- Individual creativity,
- Group creativity,
- Organizational creativity.

Following the definition of (Cook 1998), the creativity can be seen as starting point for the innovation process that is the idea generation following with three other stages that are:

- Idea screening,
- Idea feasibility,
- Idea implementation.

The table below present different changes between creativity and innovation:

Table 3-1: the different changes between the creativity and innovation

CREATIVITY	INNOVATION
- Idea generation	- Implementation stage
- Need divergent thinking process	- Needs convergent thinking process

Source: Edited by the student

Not only that there is a lack of agreement on a single theory of creativity but also there is a lack of agreement on how to define creativity. (Runco 2006) explains that the difficulty of defining creativity is related to its diversity, the same word being used to describe different processes (from an individual inventing a breakthrough technology to a child exhibiting original artistic expression). A first aspect of such diversity is its diverse expression, creativity playing a role in various fields from technical innovation to arts, from sciences to business, etc. Second, a distinction is also made between eminent creativity ("big C") and everyday creativity ("little c"). As indicated by (Runco 2006, ix) "many famous people have earned their reputation from their creativity […] Other adults are highly creative, though perhaps in the everyday sense of coping, adapting and solving novel problems". Third, there is a lot of ambiguity regarding how to define creativity given its connections to other concepts such as innovation, imagination, intelligence, originality, invention, discovery, serendipity, adaptability; each associated with creativity but also distinct concepts (Runco 2006, 376). Although the debates regarding the definition of creativity continue today, most researchers and theorists agree upon two definitional criteria namely novelty and value (Beth A. Hennessey and

Teresa M. Amabile 2010). For example, some influential definitions of "big C" creativity consider creativity to be "the achievement of something remarkable and **new**, something which transforms and changes a field of endeavor in a significant way […], the kind of things that people do to change the world" (Feldman 1999) or "a person's capacity to produce **new or original** ideas, insights, restructurings, inventions or artistic objects, which are accepted by experts as being of scientific, aesthetic, social or technological value" (Vernon, P.E. 1989, 94). The newness and usefulness criteria also appear in definitions of "little c" creativity. (Puccio et al. 2006, 19) indicate that the production of novel ideas that are made useful is the most widely accepted definition of creativity. This can also be observed in the stream of research focused on creativity in organizations. For example, (Teresa M. Amabile 1996) defines creativity as the production of novel and useful ideas in any domain. In the same fashion, (Richard W. Woodman, John E. Sawyer, and Ricky W. Griffin 1993) propose a definition whereby the creative result is a new product, service, idea, procedure or process that is valuable and useful and was produced by individuals working together in a complex social system. Although the concept of creativity receives different definitions from different theoretical approaches, many authors agree that creativity is related to the ability to conceive, find or do something novel and useful (e.g. (Richard W. Woodman, John E. Sawyer, and Ricky W. Griffin 1993; Teresa M. Amabile 1996; Sternberg 1999)). As pointed out in (Scott, Leritz, and Mumford 2004, 362) "creativity ultimately involves the production of original, potentially workable, solutions to novel ill-defined problems of relatively high complexity". The current researcher ascribes to such definitions and defines organizational creativity as the production of novel and original ideas regarding how to solve a specific problem with given organizational value. As previously discussed creativity has a broad value. (Sternberg and Lubart 1993, 3) say it is a "topic of wide scope that is important at both the individual and societal levels for a wide range of task domains". On different levels both business organizations and public institutions frequently look to support and encourage creativity. Yet, as put by (Sawyer 2006) being creative is not easy. "Creativity research shows that creativity is hard work; creativity is usually an incremental step beyond what has come before; creativity often emerges from a team, not a solitary individual; and increasing creativity often requires substantive organizational change" (Sawyer 2006, 301). Regardless of the theoretical approach or the definition of creativity, most paradigms of creativity share the assumption that all human beings have a potential for creativity and this potential can be enhanced if the right training is applied (Plucker J. A. and Runco M.A 1999; Runco 2006; Sawyer 2006).

3.3 Innovation: a multidisciplinary field of research

In 1950 the American psychologist J.P. Guilford, after examining the index of Psychological Abstracts and finding that only 186 articles out of 121,000 titles indexed were on the subject of

creativity, drew the attention upon the relevance of scientific research on creativity and upon the scarcity of research on the topic (Guilford 1950). In addition, he also proposed a psychometric approach to the study of creativity and made the claim that creativity is not limited only to eminent individuals and geniuses but can be also observed in the everyday life of regular individuals. As put by Guilford himself: "creative acts can therefore be expected, no matter how feeble or how infrequent, of almost all individuals" (Guilford 1950, 446).

Starting from innovation following (Huarng and Ribeiro-Soriano 2014) ," Innovation has become important as the global economy seeks to escape from a period of major recession". To define the term innovation following the study of (Rennings 2000) , "the source of innovation is from the Latin word Novus which means new. It is referred sometimes as **new idea**, **new method** or **new device** or the **process** of creating **something new**.

(Guilford 1968) also identified the following three dimensions to be measured by creativity researchers: fluency (quality of the idea), flexibility (variability of idea categories) and originality (idea uncommonness) of mental operations involved in creative thinking. These dimensions were later incorporated in many composite measures designed to measure creativity; Torrance in his studies (Ellis Paul Torrance 1968; 1974) tests of creativity which, to date, "remain the most widely used assessments of creative talent" (Sternberg 2006, 87). Since Guilford's (1950) pioneering work (Guilford 1950), the field of creativity research has blossomed, and numerous researchers developed batteries of creativity tests and composite measures in order to examine the creative potential of regular people in the general population. By the end of the same decade over one hundred different definitions of creativity were formulated (Taylor Irving A. 1959). (Feist and Runco 1993) note that in the following 30 years, about 9,000 creativity references have been added to the literature. Nowadays, the field evolved to become a very fertile ground characterized by pluralism of approaches and multidisciplinary, the topic of creativity attracting the attention of researchers in diverse fields, e.g. psychologists, economists, entrepreneurship scholars, organizational researchers, sociologists, and cultural theorists among others (Aaron Kozbelt, Ronald A. Beghetto, and Mark A. Runco 2010). Table 3-2 presents a summary of the main categories of creativity theories as classified in Kozbelt et al. (2010).

Table 3-2:main theoretical approaches on creativity (innovation)

Approach	Primary assertation	Major studies
Developmental	Creativity develops over time (from potential to achievement); mediated by an interaction of person and environment.	(R. S. Albert and Runco 1988; Helson 1999; Arnold, Noble, and Subotnik 1995)

Psychometric	Creativity can be measured reliably and validly, differentiating in form related constructs (IQ) and highlighting its domain specific nature	(Wallach and Kogan 1965; Guilford 1967)
Economic	Creating ideation and behavior is influenced by "market-forces" and cost-benefit analyses	(Rubenson and Runco 1992; Sternberg and Lubart 1992; 1995; Florida 2002)
Stage and componential process	Creative expression proceeds through a series of stages or components, the process can have linear and recursive elements	(Graham Wallas 1926; Runco and Chand 1995; Collins and Amabile 1999)
Cognitive	Ideational thought processes are foundational to creative persons and accomplishments	(Mednick 1962; Guilford, Hendricks, and Hoepfner 1968; Finke, Ward, and Smith 1992)
Problem solving and expertise based	Creative solutions to ill-defined problems result from a rational process, which relies on general cognitive processes and domain expertise	(Ericsson 1999; J. C. Kaufman and Sternberg 2010; Weisberg R. W. 1999; Abraham Carmeli, Ravit Meitar, and Jacob Weisberg 2006)
Problem finding	Creative people proactively engage in a subjective and exploratory process of identifying problems to be solved.	(Jacob W. Getzels and Mihaly Csikszentmihalyi 1976; Feist and Runco 1993)
Evolutionary	Eminent creativity results from the evolutionary-like processes of blind generation and selective retention	(Campbell 1960; D. K. Simonton 1988; D. Simonton 2003)
Typological	Creators differ along key individual differences, which are related to both macro- and micro-level factors and can be classified via typologies	(EKELUND 2002; Galenson 2006; Aaron Kozbelt, Ronald A. Beghetto, and Mark A. Runco 2010)
Systems	Creativity results from a complex system interacting and interrelated factor	(Csikszentmihalyi 1988; Sawyer 2006)

Source: edited by the student

Each theoretical perspective has its own assumptions regarding what may affect creative performance. The developmental theories of creativity e.g., (R. S. Albert and Runco 1988; Arnold, Noble, and Subotnik 1995; Helson 1999) examine the roots of creativity by looking at the background

of acknowledged creative people. Early theories belonging to this category were developed by examining the lives and background of eminent creative people and suggested a correlation between developmental paths and creativity. The psychometric theories e.g.,(Wallach and Kogan 1965; Guilford, Hendricks, and Hoepfner 1968) focus on measurement and are concerned with the reliability (i.e. consistency of measurement) and validity (i.e. accuracy) of creativity assessment. By focusing on measurement, psychometric theories inform all other theories of creativity (Aaron Kozbelt, Ronald A. Beghetto, and Mark A. Runco 2010). The economic approaches claim that creative performance is determined by market forces or by the relationship between the demand and supply of creative ideas e.g.,(Rubenson and Runco 1992; Sternberg and Lubart 1992; 1995; Florida 2002). These theories focus on the creative efforts which are conceptualized in terms of investments and examine creative processes as resource allocation mechanisms dictated by the demand and offer existing in markets for creativity. The stage and componential theories of creativity e.g.,(Graham Wallas 1926; Runco and Chand 1995; Collins and Amabile 1999) set out to understand the nature and structure of the creative process in terms of stages which can be sequential or recursive, or underlying componential cognitive processes (Aaron Kozbelt, Ronald A. Beghetto, and Mark A. Runco 2010). Cognitive theories of creativity e.g.,(Mednick 1962; Guilford 1968; Finke, Ward, and Smith 1992) depart from the assumptions that creative performance has a basis in cognition and that differences in cognition can play a major role in creative achievement and, that creative individuals have some specific cognitive abilities. There are also some theories based on problem solving and expertise e.g.,(Ericsson 1999; Weisberg R. W. 1999; Abraham Carmeli, Ravit Meitar, and Jacob Weisberg 2006; J. C. Kaufman and Sternberg 2010; Simon 1989) which draw on cognitive psychology to emphasize problem-solving processes and expert knowledge as fundamental to creative performance. As a reaction to the problem-solving approach to creativity, the problem finding theories e.g., (Jacob W. Getzels and Mihaly Csikszentmihalyi 1976; Runco and Chand 1995) propose that creative achievement results from the act of problem finding. Drawing on ideas from evolutionary biology, evolutionary theories of creativity e.g.,(Campbell 1960; D. K. Simonton 1988; D. K. Simonton, West, and Farr 1992), focus on "identifying dispositional and developmental idiosyncrasies associated to creative achievements"(Aaron Kozbelt, Ronald A. Beghetto, and Mark A. Runco 2010, 35). According to such theories, each individual starts with a different creative "potential". Through learning, a creative individual expands its potential and hence, increase its creative performance. Typological perspectives aim to understand individual variations among creators by creating typologies of creative personalities, working methods, etc e.g., (Galenson 2006; Aaron Kozbelt, Ronald A. Beghetto, and Mark A. Runco 2010). These theories consider that differences in creative performance are due to key individual differences between creators on both

macro- and micro level factors. Finally, the systems perspectives e.g.,(Gruber 1981; Csikszentmihalyi 1988; Sawyer 2006) consider that creativity emerge from a complex system with interacting components and that creative performance is conditioned by the socio-cultural environment in which the creator lives, aside from her personal characteristics. Such theories are very broad and take a qualitative contextual view on creativity (Aaron Kozbelt, Ronald A. Beghetto, and Mark A. Runco 2010) Summarizing the above, although the theoretical perspectives on creativity abound, none of them provides a single, widely accepted, explanation of the phenomenon. The field is characterized by a lack of a broad agreement on a single theory of creativity (Treffinger 1986). Over the decades, as it can be observed in the table, many scholars in fields so diverse such as psychology, sociology, anthropology, economics, organizational behavior or biology, have proposed theoretical models to explain and understand creativity. It is worth adding that the subject of creativity is also studied by neuroscience (Dietrich 2004; Nancy C. Andreasen 2005; Vartanian, Bristol, and Kaufman 2013) and psychiatry scholars as well (N. C. Andreasen 1987; N. C. Andreasen and Glick 1988; Ludwig, A.M. 1998). Yet, although the field is in continuous advancement, there are still many questions opened regarding what exactly creativity is or how to improve it.

3.4 Theories of organizational creativity:

Business organizations are also facing a fast paced and ever changing and turbulent environment to which they need to respond adequately in order to survive and succeed. As described by Ikujiro Nonaka, the renowned organizational theorist and knowledge management expert, today's business organizations are facing “an economy where the only certainty is uncertainty” and, in which “markets shift, technologies proliferate, competitors multiply, and products become obsolete almost overnight”. Under such conditions, “successful companies are those that consistently create new knowledge, disseminate it widely throughout the organization, and quickly embody it in the new technologies and products. These activities define the 'knowledge-creating' company, whose sole business is continuous innovation.”(Ikujiro Nonaka 2007, 162).

In addition to the external environment, there are also internal considerations that make creativity to be seen as the key to innovation in today's organizations. As explained in (Zha et al. 2006) in order to be successful organizations, need leaders with creative vision. In addition, given it is believed that about 70% of a product's cost is determined by design decisions (Douglas 1987; Sheldon et al. 1990), creative designs can lead to significant cost savings. Hence, the increased interest of organizations in building and/or acquiring a creative workforce and in increasing the creative abilities of their current employees. Given such interest, many training programs have been developed and are marketed to organizations' human research managers as effective tools aiming to enhance employees' creative abilities. Yet, although many of these programs are embraced by

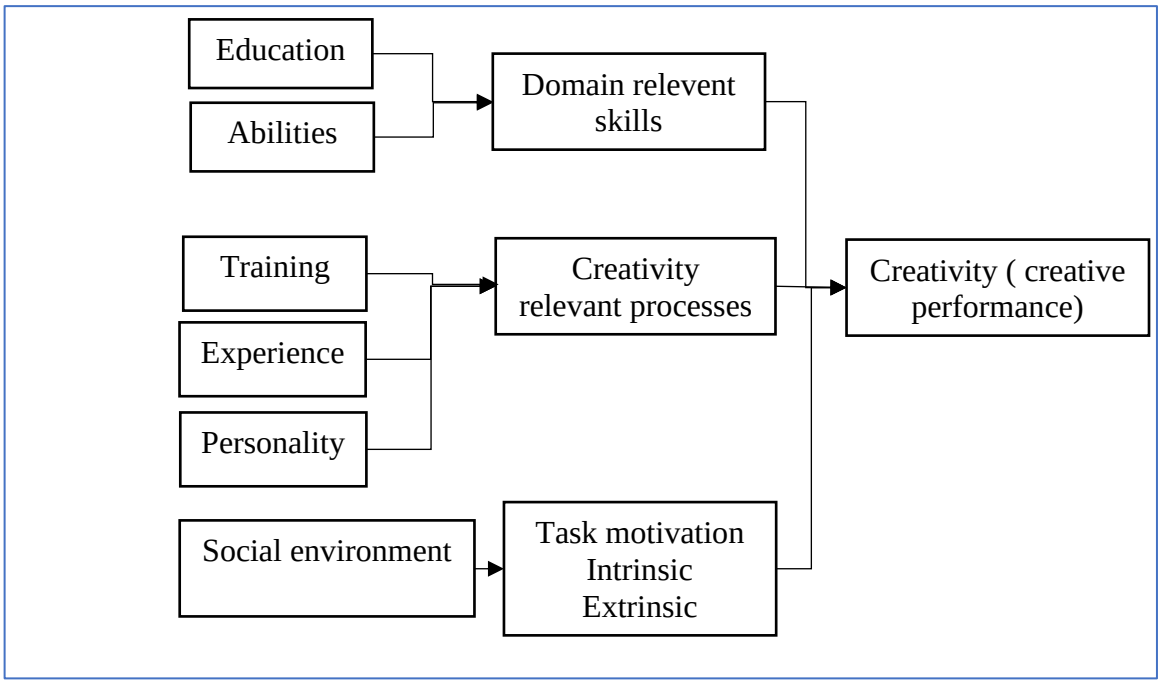
organizations worldwide as part of their human resource training policies, little evidence is available regarding their effectiveness and the extent to which they increase employee's creative performance, calling for further research and empirical evidence (Scott, Leritz, and Mumford 2004; Puccio et al. 2006).

Most attempts of theorizing on organizational creativity belong to the stage and componential approach to creativity (see the fourth raw in Table 3-2 above). The common feature of the theories and models grouped under this category is that they focus on how the creative process takes place within organizations by envisioning "the structure and nature of the creative process in terms of stages, which can be sequential or recursive, or underlying componential cognitive processes" (Aaron Kozbelt, Ronald A. Beghetto, and Mark A. Runco 2010, 30). Departing from Wallas's (1926) pioneering model, which depicted the creative process as a linear transition from one stage to another (i.e. preparation, incubation, illumination and verification) until the creative idea is generated and verified, more recent approaches e.g., (T. M. Amabile 1983; 1988; Teresa M. Amabile 1996; Teresa M. Amabile and Hennessey, B.A 1999; Richard W. Woodman, John E. Sawyer, and Ricky W. Griffin 1993), they have defined the creative process in terms of component mechanisms rather than stages (Aaron Kozbelt, Ronald A. Beghetto, and Mark A. Runco 2010). Such an approach moves beyond the linearity of Wallas's (1926) model to recognize the higher complexity of the creative process and of the factors that affect it (e.g. knowledge, information, motivation, social influences, etc.). Among the stage and componential approaches to creativity, the studies of (T. M. Amabile 1983; 1988; Teresa M. Amabile 1996; Collins and Amabile 1999) turn of the *componential theory of creativity*, however the studies (Richard W. Woodman, John E. Sawyer, and Ricky W. Griffin 1993) that turn around the *interactionist approach to creativity* are the most frequently cited in research studies that aim to explain different aspects of creativity in organizations and working settings. Given that creativity in work environments is the core topic of the current dissertation, more details about these two theoretical approaches are provided in the following sections.

3.4.1 The componential theory of organizational creativity:

The studies of Amabile's (T. M. Amabile 1983; 1988; Teresa M. Amabile 1996; Collins and Amabile 1999) componential theory of creativity, partially based on the componential model of the social psychology of creativity, is one of the most influential models concerning creativity in the workplace and represents one of the first comprehensive and grounded theories of employee creativity. The theory posits that there are three key components of creativity: domain-relevant skills, creativity relevant processes and task motivation. A graphical representation of the model is presented in Figure 3-1:

Figure 3-1: the componential model of creativity



source: edited by the student based on (Teresa M. Amabile 1996; 2012)

Domain relevant skills refer to factual knowledge and expertise in a given domain. They tend to be affected by formal and informal education, and individuals' perceptual, cognitive and motor abilities. Creativity relevant processes refer to explicit or tacit knowledge concerning the appropriate strategies for producing creative ideas, appropriate cognitive styles and work stiles for creative idea production. According to Amabile, creativity-relevant processes are likely to be positively affected by the level of training in creative skills and strategies for producing new ideas, by experiences in creative activities and by possessing certain personality characteristics.

Task motivation includes individuals' attitudes toward a task and their perceptions of his or her motivation for working on the task. In general, an individual's motivation can be intrinsic or extrinsic in nature. Intrinsic motivation is defined as “any motivation that arises from the individual's positive reaction to the qualities of the task itself; this reaction can be experienced as interest, involvement, curiosity, satisfaction, or positive challenge” (Teresa M. Amabile 1996, 115).

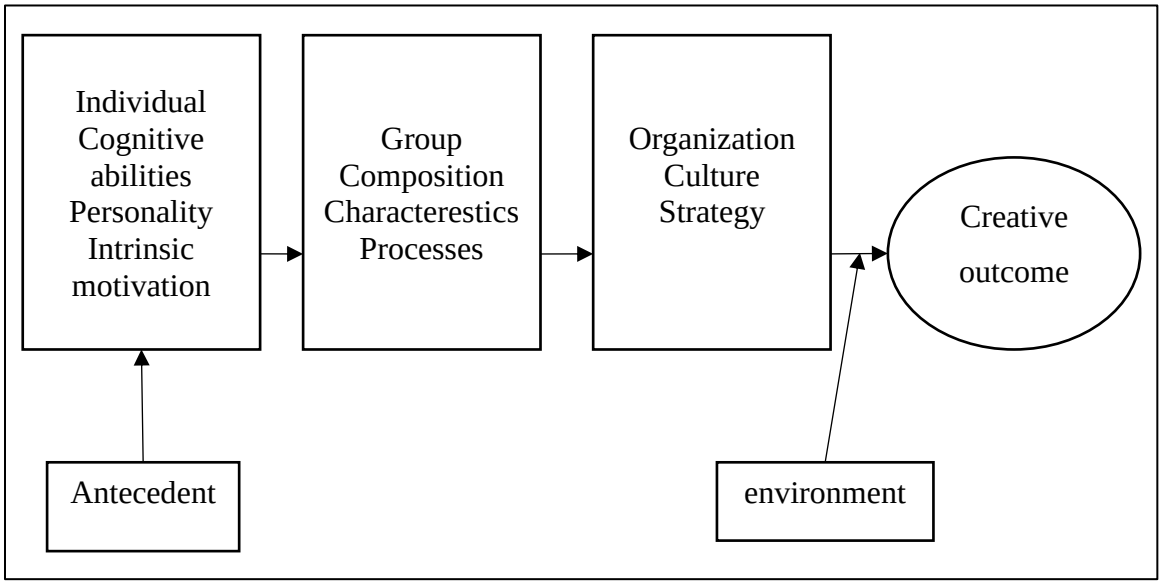
Extrinsic motivation can be defined as “any motivation that arises from sources outside of the task itself” (Teresa M. Amabile 1996, 115). Extrinsic motivation is driven by the desire to attain some goal that is apart from the work itself – such as achieving a promised reward or meeting a deadline or winning a competition. Although intrinsic and extrinsic motivation for doing a task may coexist, one is likely to be primary. Amabile proposed that a primarily intrinsic motivation will be more conducive to creativity than a primarily extrinsic motivation (Teresa M. Amabile 1996, 7). Summarizing, the *Componential Model* suggests that organizational creativity appears at the interplay between organizational components that are deemed necessary for overall innovation (such as,

organizational resources, management practices and organizational motivation) and components of individual/team creativity (i.e. creativity skills, task motivation and expertise). The model takes into account creativity training as an important factor that affect individual/team creativity, by affecting creativity-relevant processes which, in turn, affect creative performance. The creativity-relevant processes are a cognitive component of the model that refers to the cognitive style and the work style and can be influenced by training and experience in generating ideas. According to the model a positive relationship should be expected for the effect of training on creativity.

3.4.2 The interactionist approach

Similar to Amabile's componential theory of creativity (Richard W. Woodman, John E. Sawyer, and Ricky W. Griffin 1993) propose an *interactionist* model premised on the idea that creativity is an individual level phenomenon that can be affected by both dispositional and situational variables. A graphical representation of this model is presented in Figure 3-2 below:

Figure 3-2: the interactionist approach to creativity



Source: edited by the student based on (Richard W. Woodman, John E. Sawyer, and Ricky W. Griffin 1993)

Creative performance is more fully predicted by the interaction of individual's disposition and contextual factors. The model presented in the study (Richard W. Woodman, John E. Sawyer, and Ricky W. Griffin 1993) explicitly stresses the importance of the interaction between the person and the situation and is based on the theoretical base of interactional psychology.

According to the interactionist approach, creative performance in organizations is a function of individual, group and organizational characteristics that interact to enhance or constrain creativity. Important individual characteristics proposed by this approach are the cognitive abilities and style, personality, intrinsic motivation and knowledge. The group characteristics discussed includes norms,

cohesiveness, size, diversity, roles, task and problem-solving approaches. Organizational characteristics such as culture, resources, rewards, strategy, structure and technology are highlighted. The model proposes that creative persons, groups and organization are inputs that are transformed in some ways by the creative process and the creative situation, which includes enhancers and constraints for creative activities. The potential outcome of this transformation of the inputs is a creative product. Similarly, to the componential model, the interactionist approach also considers cognitive abilities as factor that affects creativity in individuals which in turn, affect the creativity of the group which, according to its composition, characteristics and processes, affect creativity at an organizational level and hence, the overall level of creative performance. This model does not specify the potential influence of training on creative performance directly. However, the authors rely on (T. M. Amabile 1988) argumentation regarding the importance to creativity of "creativity relevant skills" (Richard W. Woodman, John E. Sawyer, and Ricky W. Griffin 1993, 301). Knowledge, learning and experience, as parts of such skills relevant for creativity, are considered as having a positive impact on creative performance, although the authors also acknowledge Stein's (1989) assertion (Stein 1989) that in some situations previous experience or knowledge may lead to a "functional fixedness" that prevents individuals from producing creative solutions (Richard W. Woodman, John E. Sawyer, and Ricky W. Griffin 1993, 301) . As in the case of the componential model, the interactionist approach does not take into account the specific effect of the type of task (e.g. real-life or fictitious) may have on creative performance.

3.4.3 The componential interaction model – a unified view-:

As indicated in (Eder and Sawyer 2008) although the empirical research in organizational creativity has had a divergent history with the componential model in one direction (emphasizing major personal attributes and how they affect the creativity of individuals) and with the interactionist approach in the other direction (emphasizing the importance of individual as well as environmental and contextual variables, working together to influence creativity), the two theoretical perspectives on organizational creativity are, nevertheless, complementary. They both analyze creativity at an individual level and consider similar factors as being determinants of creative performance. In fact, both models consider creativity as the result of the interplay between individual characteristics (e.g. abilities, skills, cognition, personality, etc.) and the (working) context which has them involved in creative processes (e.g. organizational features, group characteristics, the support received, etc.). The main difference is that Woodman's model that it presented in (Richard W. Woodman, John E. Sawyer, and Ricky W. Griffin 1993) places more emphasis on the relationships developed within organizations (i.e. individual-group-organizations interaction that are conducive to creative performance) whereas Amabile's model is centered on identifying the components that work together

for the enhancement of creativity. According to (Eder and Sawyer 2008), the two models can be even integrated into a single "Componential Interaction" model. Under this approach, the proposed components of Amabile's model are interactive. Specifically, the combination of high intrinsic motivation, high domain-relevant skills, and high creativity relevant processes would encourage the greatest creativity on the job. Such determinants of creative performance in individuals, along with intergroup processes will determine the creative performance of groups. In addition, among the process specific factors that may affect creative performance we consider training delivery method and problem realism.

3.5 Different characteristics of innovation:

3.5.1 Levels of innovation:

There are three level of innovation:

1. New to the firm:

This level of innovation includes all new things such as procedures, technics …etc. These new things were in the market and in the other firms but new in our firms.

2. New to the market:

This level contains the new things for our market, but it was exit in the other market.

3. New to the world:

It is the most important level because it brings new things that did not exist before.

3.5.2 Kinds of innovation:

According to (Dodgson and Gann 2010), there are two kinds of innovation:

Incremental innovation:

The incremental innovation characterized in the new improvement that are coming from new ideas, to an existing product, service or even a process of execution.

The radical innovation:

We say that this is a Radical Innovation where the nature of the product service or the process was changed.

3.5.3 Types of innovation:

There are four types of innovation segmented to two different types:

3.5.3.1 Technological innovation:

According to (Krishnaswamy, Mathirajan, and Bala Subrahmanya 2014), the activities use technology according to its important in innovation. Because, there are the activities that it uses technology, so in this time we will find technological innovation, that is mean we use technology to innovate. Therefore, we will see touch this kind of innovation in two places, the product or service from a side and the process of producing the product or giving the service.

Starting with the technological innovation, there will be two types of innovation that they use technology:

1. The product innovation:

In the way of bringing innovation into the level of the product, the innovation in the product will be realized in following some important procedures(Cheng, Chang, and Li 2013):

In the first, we find that improving in technical specification as design, this kind of improvement need technology. To compare it with the kinds of innovation, we find that this is one of the incremental innovations because it keeps the characteristics of the product.

From the important ways of innovation that are used in the level of product is by improving the component and materials.

Using an incorporated software from the important technological innovation used in the level of the product for the result of innovating the product.

2. The process innovation:

In a hand, the process innovation characterized in the different procedures used to achieve the innovation in the process of the production (Ivanov and Avasilcăi 2014). From the second hand, the innovation did not focus just in the product, but for all the processes of the creation from the idea to the ways of selling the product or service, for example developing skills “that cannot be taught” is an important element in the innovation process (Martínez-Ros and Orfila-Sintes 2012)

In this point, we can find three important point of the process innovation as it shown in the figure:

a) Changes in techniques:

These techniques characterized in the different changes in the process, these technics may be will reduce from the consumption of the energy, reduce the time of the process pf production or distribution.

b) Changes in equipment:

With using new equipment for the procedure of innovation and these, equipment's will be of course equipment's with high technology.

c) Changes in software:

From the newest method of implementing innovation in the firm is following the technological development and changes and using new software that will facilitate any procedure that was take many times to be executed in a short time with less consumption of energy and raw material with a high quality and less level of wastes.

3.5.3.2 Non-technological innovation:

The second part are the activities that it do not use technology According to (Hyard 2013), so it is not technological innovation, and we will touch this kind of innovation in both of organizational and marketing innovation. Why? because it does need technology in the activity. From this point, we can suggest, there will be a clarification in the meaning of the innovation, where in the first, we think that innovation is always related with technology, se in the activities that it does not use technology machines or materials; we cannot think that it will be able to be innovated.

For the non-technological innovation, we found there are two other types of innovation that did not need technology to be innovated. These are:

1. <u>The marketing innovation:</u>

According to (Halpern 2010), Marketing is an important activity for the firms, according to its role from the creation of the product until selling it. IN addition, by using innovated method in different component of marketing (the four pillars of marketing), it will be an innovated activity or marketing innovation. Following (OECD 2005) , these innovated activities could be segmented through the four Ps as follows: for the product, the innovation could touch the design and packaging. However, for the price, the firms could use new pricing methods to market goods or services. For the place, the firms could change the types of the sales channels or use new design of the channels, where using promotional efforts made by the firms innovate also the promotion of the firm. In addition to use other new methods such as:

Implementing new marketing method,

Involving significant changes in products,

Involving changes in promotion, pricing … etc.

2. The organizational innovation:

According to the different exchanges between firms and organizations, the organizational innovation get an important role in the performance on the firm (Camisón and Villar-López 2014). According to (Laforet 2013), the organizational innovation has a greater impact on the small and medium sized firms.

3. The logistic innovation:

The distribution policy is one of the important policies followed by the firms to get the raw materials and distribute the product to the customers. Therefore, it is one of the important competitive advantage of the firm , that it leads the firms to increase the firm's market share (Daugherty, Stank, and Ellinger 1998; Mentzer, Flint, and Hult 2001). It is defined following the council of supply chain management professionals as "… the process of planning, implementing, and controlling procedures for the efficient and effective transportation and storage of goods including services, and related information from the point of origin to the point of consumption for the purpose of conforming to customer requirements". Following its important role in the firms, it is appeared as an important way to generate more competitive advantage through improving the logistics by reducing the cost for example or looking for new delivery solution following the customer needs. Therefore and Following the research of (Grawe 2009), the logistic innovation could see in different ways such as Containerization, cross-docking, EDI[1], RFID[2], and temperature-control technology.

3.6 Training and Innovation:

The rapidly changing environment of today's world in which human capital derived from formal education (schooling, vocational education) depreciates quickly, learning by doing, in the form of in-firm training, may be an additional way to continue to accumulate leading-edge knowledge. The reason is that trained workers who have leading-edge knowledge understand complex products and production processes and thus are more likely to come up with technological improvements. The argument further suggests that training is especially important in the case of so-called routine innovations, that is, those that involve significant improvements to existing products or processes, whereas the creation of something radically new might require additional skills such as creativity and inventive talent.

Starting training literature, (Becker 1964) initial contribution argues that firms will invest in training only if they can appropriate its future rent, that is, the workers' higher productivity.

[1] Electronic Data Interchange
[2] Radio Frequency Identification

Undoubtedly, human capital plays a central role in the inception, the implementation, and the interorganizational, national, and international diffusion of innovation (Soumitra Dutta, Bruno Lanvin, and Sacha Wunsch-Vincent 2014a).

From another side, Elena in her paper (Pelinescu 2015) the difficulty to believe that it is possible to achieve the goals of the EU 2020 without focusing on the education and the training system. This point for the important ones that push us to launch the research in the field of the training as policy to be innovator.

In the study of (Galia and Legros 2004), the authors tried by using the ALS method (asymptotic least square) to look for the results of the firm investments in R&D, innovation and training. They found in the first that the firms' probability to innovate is associated with the budgets of the higher research. From the other results, the technological innovation in the world raises the budget for the training investment in the firm. This latest (training) permits to diffuse innovation in the whole firm. From another side, they found also positive relationship between the R&D expenditure and the firm profitability, where there is not any relationship between the size of the firm and the R&D investment.

According to (Scott, Leritz, and Mumford 2004, 361), several approaches have been used to nurture and encourage innovation. Such approaches include:

- Providing the right incentives (Collins and Amabile 1999; Robert and Linda 2003);
- Acquiring the needed expertise (Ericsson and Charness 1994; Weisberg R. W. 1999);
- Effective structuring of group interactions (King Nigel and Anderson Neil 1992; Kurtzberg and Amabile 2001);
- Optimizing the climate and culture (Teresa M. Amabile and Gryskiewicz 1989; Anderson and West 1998; Ekvall and Ryhammar 1999);
- Identifying the necessary career development experiences (Feldman 1999) and
- Training to enhance innovation (Ellis Paul Torrance 2011; Cropley 2000; Nickerson, R.S. 1999).

Following these interventions, different researches such as (Scott, Leritz, and Mumford 2004, 361) argue that training has been preferred if not the favored approach to enhance innovation. Following the research of (Sawyer 2006, 296), there are two groups of researchers in the fields of training and innovation. The ability to innovate is trainable emerged in the beginning of 1950s, when a group of psychologists and innovation scholars such as J.P. Guilford, S. Parnes and P.E. Torrance disagreed with their colleagues who thought that innovation is a characteristic fixed at birth and which could not be increased deliberately.

However, following the researches (Guilford 1968; Ellis Paul Torrance 1962; 1974), they found that being innovator is a common characteristics between all people rather than being a trait reserved for few talented people. The authors proposed also that innovative abilities could be trainable and measurable through measuring such as originality and flexibility. As a result of the previous ideas, innovation training seen large diffusion, where it has become widespread and numerous training programs have been designed and deployed over the years.

The rationale is that if innovative abilities are trainable, just as right training helps to enhance any ability. Therefore, the improvement of training policies can help to improve the innovative performance. Following the research of (Runco 2006, 372), "virtually, all human behaviors are flexible. They each have a range of reactions. The range is genetically determined, and the skill or behavior is a reaction to the experience that influences that potential. Example of building muscles is depending on genetic potentials from a side in addition to the amount of exercises. Therefore, innovative talents depend also on the same two things based on programs and techniques. These latest very likely increase the likelihood that the individual will behave in a creative fashion"

In the study (Runco 2006, 371), the author argues that innovation can be enhanced in each individual in the micro-level through teaching and training all of tactics techniques and programs that are designed to improve the innovative thinking and enhancing the creative performance.

In addition to teaching that is one of the important techniques to improve the knowledge and the skills of the individual, encouragement rewards and models are also needed and important.

Therefore, teaching creative tactics and providing training in creative thinking techniques can be an important way of encouraging and enhancing innovation for both individuals and groups.

Also, different researches of the effect of training on creative performance has a big interest because it is based on the ability to provide the right understanding that is related with the techniques employed to improve the innovation in people. Comparing to other streams of innovation research (example: researches that are focusing on the individual differences between people showing different innovations, or the researches that are examining the personality characteristics and cognitive factors affecting innovation), so according to (Beth A. Hennessey and Teresa M. Amabile 2010), the examination of the factors that affect the effectiveness of training have been relatively scarce. Although, most empirical research on the training effectiveness indicates a positive relationship between receiving training and the subsequent creative performance. Some studies such as (Svensson, Norlander, and Archer 2002) shows the opposite of the relationship. Therefore, this latest indicates that the available evidence is still inconclusive.

Finally, although there is a multitude of programs designed to enhance creative thinking and innovation, just a few studies have been examined through rigorous academic studies regarding their effectiveness.

From the studies that analyze empirically the relationship between training and firm's propensity to innovate, Bauernschuster and others were interested in the effect of training on innovation, they applied simple probit and linear probability model in the study (Bauernschuster, Falck, and Heblich 2009). From the second side started the possibility of the causality to run in the other direction, it is very possible that innovation is driving the need for training (Bresnahan, Brynjolfsson, and Hitt 2002; Autor, Levy, and Murnane 2003).

In addition, the researchers are focusing on the effect of continuous training on innovation. That is the training offered constantly over the years instead of training at single point in time.

Therefor and following the research, (Bauernschuster, Falck, and Heblich 2009), the continuous training variable and the innovation variable are both binary. Therefore, different researchers might be tempted to use nonlinear models to analyze the determinants of a firm's propensity to innovate and to train continuously. Thus, continuous training could be the independent variable of the innovation probit model and the dependent variable of the second probit model; that is, continuous training is endogenized in this system of equations. A feasible way to handle this problem is to employ a recursive bivariate probit model in which the error terms of the two probit models are allowed to be correlated (Evans and Schwab 1995). In this seemingly unrelated bivariate probit model, the probit equations on training and innovation are estimated simultaneously, as described in the following equations:

Equation 3-1

$$IN = I(1|CT, S, A, BP, U, e_1)$$

Equation 3-2

$$CT = I(1|WC, S, A, BP, U, e_2)$$

Equation 3-3

$$COV(e_1, e_2) = \rho$$

where *I*(.) is the indicator function taking the value one if its argument is true and the value zero otherwise; IN stands for the innovation dummy; CT is a dummy indicating continuous training; S is establishment size; A is establishment age; BP represents a variable that captures the branch plant status; U is a dummy variable signifying whether the establishment is bound to a union contract; WC shows the existence of a works council in the establishment; and e_1, e_2 are the error terms of the specific equation. (Angrist and Krueger 2001) suggest estimating a linear IV two-stage least squares

regression even if the endogenous regressor is a dummy variable. Using probit or logit to generate first-stage predicted values is not necessary and may even do some harm. (Kelejian 1971) shows that consistency of second-stage estimates is not dependent on the functional form of the first stage being correct. What is more, computing predicted values in a nonlinear first stage, which are then plugged at the second stage, does not result in consistent estimates unless the nonlinear model happens to be exactly right (Angrist and Krueger 2001). To avoid problems arising from misspecification of the first stage, the authors prefer a linear IV specification in which innovation is used as a dependent variable and the endogenous variable, continuous training, is instrumented by the existence of a works council. As discussed above, we control for establishment size and age, branch plant status, and union contract.

The researchers do not assume homogeneous treatment effects; rather, what they estimate in the IV approach is a local average treatment effect (LATE). For IV to give LATE, they assume monotonicity (Imbens and Angrist 1994); that is, there is no establishments that have works councils and do not train but would conduct training in the absence of a works council. Note that causal inference is driven by the instrument works council whereas the variable of interest remains training. The result is thinking about a strategy as a causal chain in which a works council affects training, which in turn affects innovation. Put differently, they use only the variation in training that is induced by the exogenous variation in the presence of works councils. Consequently, they identify the causal effect of training for those firms that would have trained their workers in the presence of a works council and would not have done so without a works council (Imbens and Angrist 1994). Without further assumptions (e.g., constant causal effects), LATE cannot give information about causal effects for subpopulations other than this complier subpopulation (Angrist and Krueger 2001). Different valid instruments for the same causal relation may provide similar or different results depending on special characteristics of the exogenous variation in training employed, and they thus reiterate that they have a strong claim for internal validity, that is, for the causal effect of the kind of training that is induced by works councils. The result is that they solve the first-order problem of omitted variable bias for this well-defined subpopulation. However, the researchers do not claim the same degree of external validity. The existence of heterogeneous treatment effects calls for more IV approaches to estimate the effect of training on innovation.

3.7 Skills employed in innovation:

In the both second and third chapters of the report (Soumitra Dutta, Bruno Lanvin, and Sacha Wunsch-Vincent 2014a), the authors find that improving the skills of the employees form the most important ways to raise innovation, productivity, and economic growth and to improve social welfare

and equality. Also, (Yeung 2006) find that the impact of the employment skills on innovation depends on the employee training.

3.7.1 Human capital as inputs of innovation process:

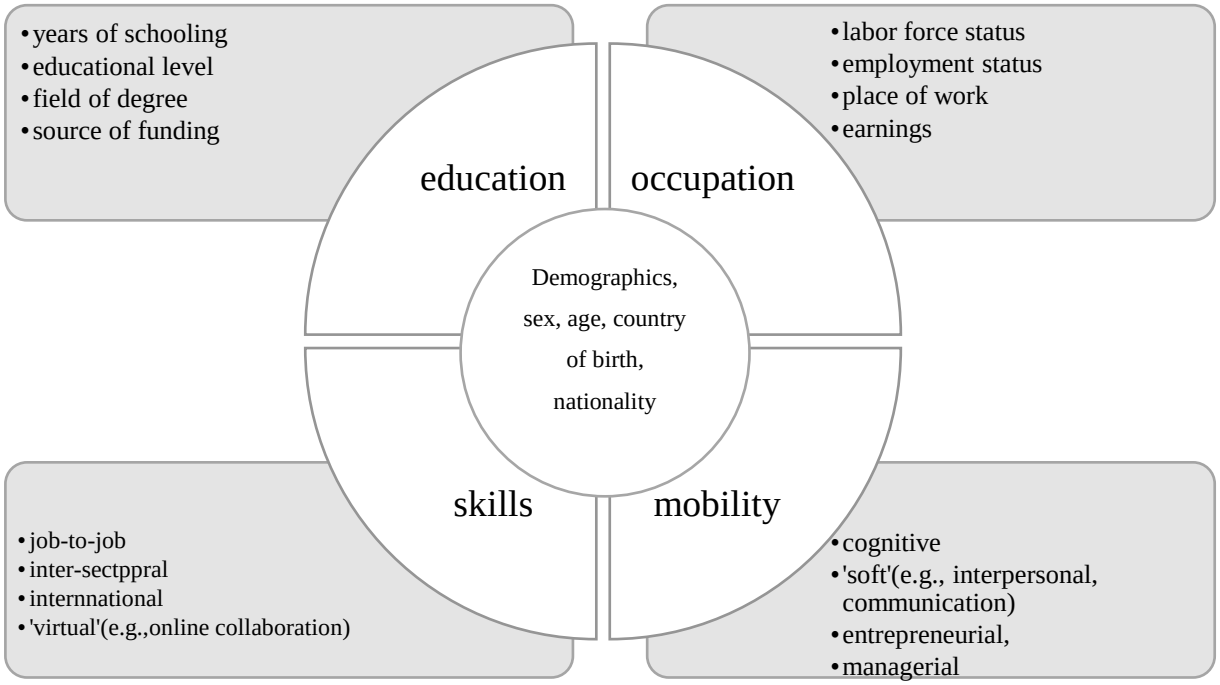
Human capital constitutes an intangible asset with the capacity to enhance or support productivity, innovation, and employability. It may be augmented or may decline or become redundant. It is formed through different influences and sources including organized learning activity in the form of education and training. Knowledge, skills, competences, and other attributes combine in different ways according to the individual and the context of use(OECD 1998, 9).

Following the results of the study of (Vila, Pérez, and Coll-Serrano 2014),"firms willing to foster their corporate capability for product innovation, knowledge innovation, or technological innovation should focus on recruiting or promoting employees who are strong in the appropriate competencies, as well as on helping employees already on the payroll raise their levels of such competencies, thereby encouraging an increase in propensity to contribute to innovative activities".

Innovation requires changes in the human capital to overcome the lack of skills (Martínez-Ros and Orfila-Sintes 2012). The modern growth theory (Acemoglu 2009) treats human capital formation as a central element and driver of the technical and innovation progress (Soumitra Dutta, Bruno Lanvin, and Sacha Wunsch-Vincent 2014b).

Following the OECD innovation strategy, the Figure 3-3 presents the fourth different dimension of the human capital that it could affect the innovation in the firm:

Figure 3-3: different dimensions of measurement of human capitals



Source: (Soumitra Dutta, Bruno Lanvin, and Sacha Wunsch-Vincent 2014a)

Measures based on these settings should address, inter alia, the dimensions of:

1- The role of each in producing human capital, quantitatively and qualitatively;
2- Efficiency measures of each, relating the different settings to cost considerations;
3- Measures of access and equity;
4- Investments currently made in these different settings, and by whom;
5- Returns to investments in human capital in these different settings, and for whom. The notion of "returns should include both economic and social returns.

According to (Soumitra Dutta, Bruno Lanvin, and Sacha Wunsch-Vincent 2014a) "the educated people make good innovators, thus educations speeds the process of the technological diffusion".

In the study of(Guisado-González, Vila-Alonso, and Guisado-Tato 2016) , the authors test the existence of the complementarity between the training and two types of innovation that are incremental innovation and radical innovation. From the results gathered, positive and significant impact of the training and radical innovation on labor productivity.

From the studies that focus in the role of the human capital in the innovation activities, Morrocu et al. found in their study (Marrocu, Paci, and Usai 2013) that all of human capital, R&D are essential for innovative activity by using the KPF model.

Following the study of Elena (Pelinescu 2015), the contribution of the human capital is the major for the EU's 2020 strategy. Using the MRW (Mankiw, Romer, and Weil 1992) model and by selecting the number of the schooling years as the proxy variable for the human capital. The results of the paper demonstrate positive relationship between the GDP per capita and innovative capacity of the human capital.

Following the results gathered from the study of (Negassi 2004), the human capital from the important factors that push for the success of the commercial innovation. From another side and according to (Galia and Legros 2004) , the major assets of the innovative firms are the employees, competencies and knowledge.

Following (Soumitra Dutta, Bruno Lanvin, and Sacha Wunsch-Vincent 2014a) , from the different possibilities, that it allow us to measure the ways affect the human capital, and pushing it to innovate. We found Adequate education and training. In addition, motivation in different places from the beginning of life such as: school, universities, to the places of works such as businesses, without forgetting the important role of the civil society and the government. From another way, the staff of

global innovation index in their studies that the human capital has an essential role in the design of policies that help promote economic development and richer innovation-prone environments locally(Soumitra Dutta, Bruno Lanvin, and Sacha Wunsch-Vincent 2014a).Youndt summarizes in a table the important administrative and Human-Capital-Enhancing Human Resources practices (Youndt et al. 1996):

Table 3-3: Summary of Administrative and Human-Capital-Enhancing Human Resource Practices

HR Practice	Administrative	Human-capital Enhancing
Staffing	Physical skills	Selective staffing
		Technical skills
		Problem-solving skills
Training	Policies	Comprehensive training
	Procedures	Technical skills
		Problem solving skills
Performance appraisal	Administrative	Developmental
	Results-based	Behavior-based
compensation	Hourly	Salary
	Individual incentives	Skill-based
	Internal equity	Group incentives
		External equity

Source: (Youndt et al. 1996)

In the study of (Laplagne and Bensted 1999), the authors looked for the role of the training and innovation in workplace performance. In the period of the study, there is an increase in the Australian labor productivity from a side that it faces an increase in the training and the innovation in the medium and large-sized workplace. From the important results gathered

From the important results founded following the study of (Kim 1980) is the positive relationship between the professional training is positively correlated with organizational innovation.

From the side of the employees, (Robert Eisenberger et al. 1986) stressed that the performance of the employees was found to be very high when they perceive benefits from attending a training program.

Following the studies of (Nazir et al. 2015), the training is for:

- Growing up the level of firm performance.
- Guaranteeing and increasing the plant production,

- Keeping the operation of the production safe

From another hand and following (Salas and Cannon-Bowers 2001), from the interesting results of the training:

- Improve the organizational performance,
- Increase productivity,
- Increase the profit and safety,
- Reduce errors,
- Enhance market share.

From the important roles of the training in the firm is playing a key role in enhancing the competitive sources such as human capital and organizational knowledge (Subramaniam and Youndt 2005). Also, according to (Dhar 2015),” the employee training plays a significant role in improving employee performance in terms of offering better quality services and, hence, helping an organization to obtain a competitive advantage”.

In addition to the benefits cited above, there are other researchers such as Acton and golden in their studies and Hayes and Ninemeier in (Acton and Golden 2003; Hayes and Ninemeier 2009) find other benefits of the training in different levels such as:

- Improve performance,
- Reduce operating costs,
- More satisfied guests,
- Reduce work stress,
- Increase the job advancement opportunities,
- Improve the staff relationships,
- More professional staff,
- Fewer operating problems: i.e. reduce the operating problems.
- Lower turnover rates,
- Increased the moral,
- Bring higher levels of work quality,
- Improve the ability to recruit new staff,
- Increase the profits.

The training could affect also the job satisfaction, according to (Choo and Bowley 2007); they recommended that job satisfaction of employees could be enhanced through the provision of effective training and development programs.

From another researches as (Sommerville 2007), the benefits of the training characterized in improving the ability to reach personal goals and become problem solver. Also, increasing self-confidence and self-development in addition to enhance the employee development. In the same side, the training increases the levels of productivity and sustaining positive attitudes toward customer service., without forgetting that through the training, the employee reduces the accident at work and even at life also.

However, following the study (Ravichandran et al. 2015) ,the participants felt that the training improves their peace of mind because they understood the job better, and felt more comfortable in the world place when they are starting the job.

For the benefits of the training, according to (Noe and Wilk 1993; Dhar 2015), the training program benefits can be looked at from three different perspectives:

- Personal benefits: improve the job performance of the employee, develop their network, attain personal growth for development.

- Job related benefits: this point leads to the development of better relationship with colleagues and managers a gives a break from the daily work routine.

- Career benefits: this could see as an output or an outcome of employee participation in training programs because it helps them to achieve their career objectives and pursue new paths to extend and develop their careers.

According to (Bartel 1994), to have qualified and flexible employees, the training from the important activities to get well-prepared employees.

(Sirilli and Evangelista 1998) argue that the training activities from the different processes used to grow up the firm's technological capabilities that lead to successful innovation.

Following the study of (Djeflat 2002), different innovation firms find that innovation and R&D are competitive tools. From the important source of the R&D activities , 80% of the firms (Djeflat 2002) find that training seminars are important sources.

According to (Leiponen 2005), the lack of skills from the major obstacles that it curb the innovation ability of the employee. Following the study of (Lopez-Cabrales, Valle, and Herrero 2006), the training results will be shown more in the high skilled employees who will make better use of new technologies in addition to the high ability of innovating. The training seminars also founded as important sources for technical information that played an important role in R&D activities (Djeflat 2002). Following (Martínez-Ros and Orfila-Sintes 2012), he tried to look for the effect of the training on the innovation decision and intensity

3.7.2 Skills and innovation in firm:

There are different activities that it affects the innovation propensity in the firms. According to the study of (Gazaniol 2012) where he apply the model of Crépon et al. (1998) (CDM model). He found in the first that the firms executing the imports and exports operation are more likely to invest in research and development activities rather than the firms that execute the international activities and are more likely to become innovators by introducing new products and /or new patents for their markets in the first. By time, there will contribute in producing knowledge

Following the study of (Amara et al. 2008), the investment of firms in training for employees increase the skills and enhance the innovative capacity of employees that has a positive effect on the performance of the firm. Starting from the studies of Robert Solow, the origins of the economic growth is pinpointed in innovation (Bosco and Mavilia 2014). To be innovative firms following the study of (Rolf Wüstenhagen et al. 2008), "to be innovative, means to provide organizational and technical improvements which can be sold successfully in the marketplace"

From another side and following the GII reports, the training has a positive impact in the IER (Innovation Efficiency Ratio) the one who make a point about its important. Following the PM[3] of Singapore (Tong 2000), "innovation is not just about creativity but also about implementation. Innovation need not be limited to the realms of the technical and scientific"

From another hand, the innovation plays an important role in shaping the growth and competitiveness of the firms, the countries and the regions (OECD 2009). Also, From the outputs of the innovation are increasing welfare, create new types of jobs and destroy older ones in addition to increasing the performance and the competitiveness of the firms.

Following the report of (European Commission 2010), the innovation is one of the keys to smart, sustainable and inclusive growth that is aimed at the whole continent. Following the studies of (Soumitra Dutta 2010), from the extraordinary capacities of the innovation for the economic growth in general, are facilitating the countries recovery, in addition to sustaining the national competitiveness in the short and long run.

This is in the macroeconomic sides where from the microeconomic ones and following the changing environment that face the different firms, it forces them to look for ways of improving quality and reputation, efficiency and increasing the market share. From the different approach to improve, the competitive advantage of the firm is innovation. According to (Yeung 2006; Martínez-

[3] The prime minister

Ros and Orfila-Sintes 2012), the innovation development is from the important strategic drivers to achieve the competitiveness and the productivity.

The innovation does not need to be developed by the firm itself, but can be acquired from other firms or institutions through the process of diffusion (OECD 2005).

The capacity to be innovator doesn't only apply in entrepreneurs or those who work in R.D activities. However, all workers are likely to become innovator by creating new knowledge in the performance of their daily tasks and responsibilities or using new knowledge that comes from other people in other jobs (Vila, Pérez, and Coll-Serrano 2014). From another side, the innovation touched from two angles following the study of (Djeflat and Kuznetsov 2014), where the first one is related to the engagement in R&D processes as well as linkages between various key institutions in the STI (Science Technology and innovation policy) style. The second one is related to the endogenous dynamics at the firm level where interactions among all workers and firms and daily practice help increase innovation and have an impact on economic performance in the DUI (earning by doing, using and interacting) style.

3.8 Innovation and labor markets changes:

3.8.1 Innovation and labor market flexibility:

Market flexibility is defined following the study (Atkinson 1984), as a "function of corporate strategy. It is divided into three different dimensions that are numerical, functional and financial or wage flexibility". Thereby, external and internal aspects of flexibility can be distinguished. External numerical flexibility refers to the mobility of employees between different companies, illustrating the extent to which the number of employees can be quickly adapted to economic requirements. However, functional flexibility describes how a company can use its employees for different tasks. The external solutions are possible through outsourcing or temporary employment, while internal functional flexibility refers to continued training that allows multi-skilled employees to fulfil a variety of tasks. Where, for the third dimension of labor market that is Wage flexibility, it can be defined as the flexibility of wages. A high wage flexibility is associated with a decentralized wage-setting where the wage level represents the equilibrium of supply and demand on the labor market.

Different Researchers such as (Grant 1991) argues that the capabilities of an organization cannot be completely utilized using short-term, temporary or part-time employment contracts. This results in a negative relationship between flexible work and innovation as empirically shown by e.g. (Michie and Sheehan 2003). In addition, the development of innovation is path dependent and therefore influenced by earlier investments as well as accumulated previous knowledge (Pavitt 1991). Temporary employment contracts might therefore under-mine training investments of a company

resulting in a loss of competitive advantage (Zhou, Dekker, and Kleinknecht 2011). Additionally, the likelihood of successful innovation depends on the commitment of a company's employees. As shown by (Acharya, Baghai, and Subramanian 2010), employees have an additional incentive to engage in risky innovation projects if their employment status provides them with security and stability. Following (Lorenz 1999), employment contracts that provide high employment security will increase the incentive of the employees to share their knowledge about labor saving innovations with their company. However, the relationship between external labor market flexibility and innovation is not necessarily negative. Following (Kodama 1996; Matusik and Hill 1998), not only internal resources are used for innovation. Instead, innovation depends much more on the effective utilization of technology and knowledge, even beyond internal capacities. According to(Teece 1986, 288–89), the use of external capacities can be seen as additional innovation input factors, especially in the case of open source projects. Following these studies (Bassanini and Ernst 2002; Tressel 2004), the authors emphasize that severe restrictions on terminations of labor contracts may limit the incentive to implement labor-saving process innovations. Following (Adams and Brock 2004), flexible employment also allows a larger labor turnover which introduces new knowledge and fresh ideas into a company and additionally allows an easier replacement of inefficient workers (Zhou, Dekker, and Kleinknecht 2011, 4). Finally, (Ichniowski, Shaw, and Crandall 1995) think that permanent employees may be disinclined to change in the form of innovation due to habit or so called lock-in effects. In this respect, flexible working arrangements such as outsourcing, temporary, or fixed-term contracts can fit exactly right with the innovation process.

3.8.2 Innovation and quality of labor:

Penrose was one of the first researchers to indicate the lack of management talent as the main limitation for organizational growth (Penrose 1959). Management capabilities refer to the capabilities with which managers construct, integrate, and reconfigure the organization's resources and competences (Adner and Helfat 2003). These capabilities enable top management teams to face their environment, improve organizational performance, and maintain and create competitive advantages (Carmeli and Tishler 2004). Firms need their managers to employ their capabilities to design organizational and strategic processes that lead the organizations to innovate and obtain more growth (Eisenhardt and Martin 2000). Some studies suggest that innovation processes require top management teams to use their management capabilities to assign and distribute the firm's resources and activities properly (Sascha Kraus, Rainer Harms, and Erich Schwarz 2008; Wolff and Pett 2006; Hoskisson, Hitt, and Hill 1993). Therefore, top management teams should use their management capabilities to detect, develop, and deploy new products (Yadav, Prabhu, and Chandy 2007). The educated people make good innovators, and thus education speeds the technological diffusion (Nelson

and Phelps 1966). As in the case of product innovation, the top management team plays a vital role in the success of process innovations (Murat Ar and Baki 2011). Process innovation requires that the management team have the capability to manage resources efficiently and capture synergies between resources located in different parts of the organization (Clayton, Driver, and Griffths 2000). All of these actions oriented to achieving results in process and product innovation depend on management capabilities. In the side of small firms, small firms make managers very close to work posts and to their employees. It is essential that they use their human capabilities to improve communication and trust and to achieve a work climate that encourages the exchange of knowledge and drives the development of innovative products (Prajogo and Ahmed 2006; Wilkinson 1999). From another side, the top managers can use their abilities to generate positive attitudes among their employees, reduce communication problems, and improve performance (Hoonsopon and Ruenrom 2012). In addition, they can implement techniques, programs, and systems that drive development of innovations in the organization's products and services, such as training programs or participatory systems that encourage proposing ideas and creating new products or services. Top managers can also improve development of successful innovative processes by using their technical abilities to design procedures that lead the organization to improve its performance. Implementing innovation in the organization's processes requires a high level of technical abilities that encourage and increase individuals' capability to generate new and improved procedures (Jack, Anderson, and Connolly 2014).

In the case of SMEs, which are characterized by their closeness to the market, managers have greater knowledge of the customer and can use their capabilities to respond rapidly to customers' needs (Holweg 2003). In this way, the managers' capabilities enable them to analyze what happens, perceive tendencies, anticipate changes, and recognize opportunities and potential threats (Martin 2010; Yukl 2002), as well as to establish processes that are useful for developing new products (Maggitti, Smith, and Katila 2013). From another side, recent research has shown that close to 75% of migrant inventors from low- and middle-income countries reside in the USA (Soumitra Dutta, Bruno Lanvin, and Sacha Wunsch-Vincent 2014a).

3.8.3 Innovation and gender diversity:

Different studies show that gender diversity in the top management team provides different types of abilities, knowledge, and ideas that generate benefits for the organization such as (Torchia, Calabrò, and Huse 2011; Ruigrok, Peck, and Tacheva 2007; Krishnan and Park, D. 2006). For example, based on critical mass theory, (Torchia, Calabrò, and Huse 2011) find that if a top management team composed of at least three women (size of the minority group),it will be more heterogeneous and have more interaction, permitting high-quality decision making and generation of more creativity, innovative solutions than homogeneous groups. Homogeneous groups usually have

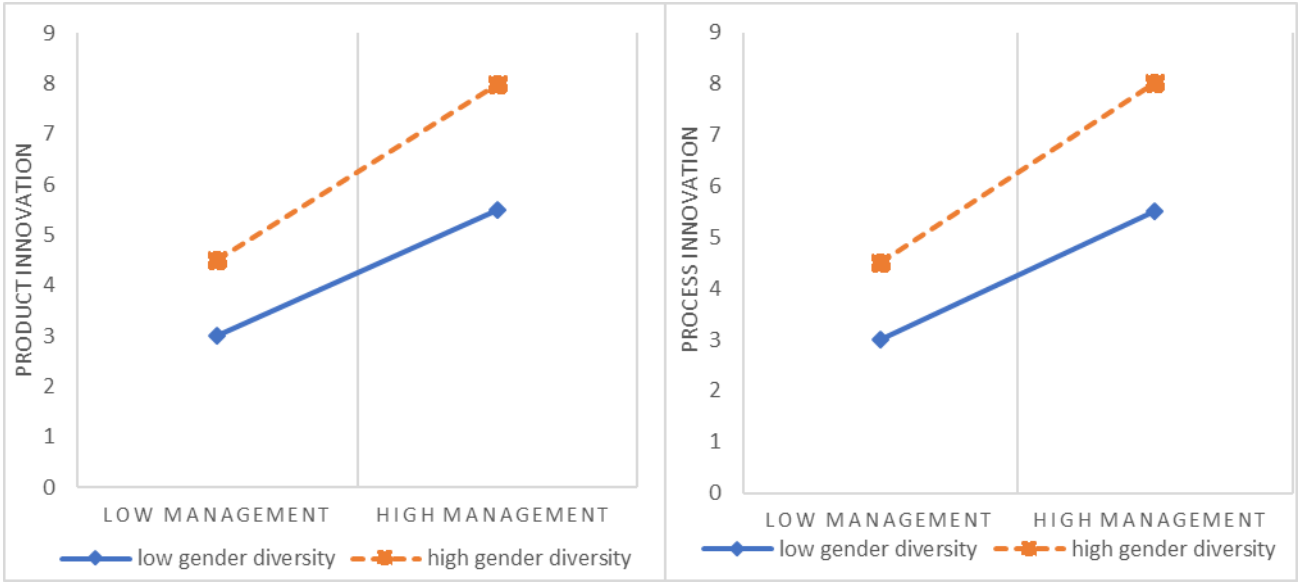
a lower range of abilities, ideas, and experience than heterogeneous groups. The study (Ruigrok, Peck, and Tacheva 2007) confirms that women in top management teams not only bring different perspectives, abilities and knowledge, but also contribute different values, norms, and understanding relevant to improving this team's functioning and the organization's results. According to (Østergaard, Timmermans, and Kristinsson 2011), gender diversity is related to improvement in problem solving, creativity, learning, flexibility, and variety of capabilities, which can increase the probability of introducing new products or services in the organization. Arguments from social cognitive and gender theory also suggest that men and women have different socialization experiences such as professional experience or affiliation with social networks----which shape different innovative strategic options (Manolova et al. 2007; Bandura and Bussey 2004). (Díaz-García, González-Moreno, and Sáez-Martínez 2013) indicate that gender diversity in the R&D team enables the team to be more innovative and adaptable, since individuals with different social experiences and professional trajectories can generate diverse perspectives, capabilities, and knowledge, which, when combined, can create new knowledge and encourage development of creativity and innovation. As (Miller and Triana 2009) suggest that gender diversity in the top management team provides the firm with different human and social capital that helps top management teams to produce new ideas, allocate resources properly, and detect research opportunities, actions that improve the firm's innovation. In contrast, top management teams with a majority presence of either men or women tend to take less advantage of the potential of gender diversity to enable management capabilities to encourage product and service innovation to a greater extent. Gender diversity in top management teams also contributes improvements in abilities such as conflict resolution, adaptation to change, and integration (Krishnan and Park, D. 2006). Further, the multiple roles that women perform in their personal life provide psychological benefits that enrich interpersonal and leadership abilities (Ruderman et al. 2002). With greater gender diversity, it is more likely that these abilities will facilitate implementation of management capabilities and generate a work atmosphere that facilitates communication, proposal of ideas, and employee participation, encouraging greater develop of product and process innovations. In fact, gender diversity in the top management team increases the possibility of connecting with each member of the organization and generating an open work environment (Nielsen and Huse 2010). Process innovations require changes in organizational structure, administrative systems, and production techniques employed (Ettlie and Reza 1992). These changes could imply variations in work relationships and the specifications of tasks to be performed, changes that require strong support from employees and a good work climate. In addition, since the presence of women on the top management team may be perceived as inclusion of different minority groups in the firm's highest level and thus as a positive sign for the rest of the

organization (Tidball 1980), it can improve workers' attitudes (Appold, Siengthai, and Kasarda 1998). Homogeneous top management teams can use their management capabilities to improve the work climate and their employees' attitude, but some members of the organization may feel excluded and have a negative attitude toward the top management team's ideas. Based on the foregoing, in situations of greater gender diversity in the top management team, we can expect the search for and allocation of resources that influence innovation to be performed with the contribution of new perspectives, knowledge, values, and socialization experiences that are less present in more homogeneous groups. The implement of management capabilities will translate into more novel, creative routines and procedures that can help the firm to find opportunities for development and change in products or processes. (Kor and Mesko 2013) explain these mechanisms through which management capabilities translate into organizational performance and term them management's dominant logic and the firm's dominant logic. The positive effects of gender diversity mentioned here and those derived from women's different cognitive and social bases will influence the dominant management logic created from management capabilities, which is merely the application of the mental models, knowledge, and abilities of the top management team to the specific context of the firm (Kor and Mesko 2013). According to (Kor and Mesko 2013), this logic guides the management team in its interpretation of the information relevant to the firm, decision making, allocation of resources, and establishment of expectations about the firm. We can expect top management teams with more gender diversity to develop a dominant management logic that reflects the knowledge, values, and socialization experiences of the women, taking into account their perceptions of the environment, way of interrelating with other members of the team, and expectations about their own performance and roles (Manolova et al. 2007). When top management teams are more diverse, management capabilities will translate into generation of a dominant management logic that incorporates women's perspective and that can take materialize in more novel and creative decisions, different configurations of resources, or a favorable, participatory climate that encourages product and process innovation. As indicated, gender diversity in the team permits organizations to take advantage of the team's different management abilities and to generate greater creativity and innovation (Bagshaw 2004; Dessler 2000). In contrast, top management teams with less diversity will contribute less to development of a dominant management logic with the above-mentioned characteristics inherent in gender diversity. Over time, with the putting into practice of the dominant management logic, this logic ends up becoming the dominant logic of the firm, understood as a system of expectations, beliefs, and properties that infuse the firm's routines, procedures, and commitments. This dominant logic informs and influences the organization's members in achieving their productive efforts and initiatives(Kor and Mesko 2013). With time, therefore, greater gender diversity can

encourage consolidation of a dominant logic in the firm with routines and procedures sustained by management and cultural styles that derive from this diversity and thus encourage achievement of better results in product and process innovation.

With a link between the gender diversity and management, the results of the study of (Ruiz-Jiménez and Fuentes-Fuentes 2016, 117) presented in figures below:

Figure 3-4:effect of gender diversity and management on innovation



source: (Ruiz-Jiménez and Fuentes-Fuentes 2016, 117)

Figure 3-4 indicates that the relationship between management capabilities and product and process innovation varies according to level of gender diversity in the top management team. As it presented in the figure, the positive relationship between management capabilities and product and process innovation is stronger with high levels of gender diversity than with low levels.

3.9 Chapter Conclusion:

Chapter three demonstrates the theoretical links between all of training, innovation and employment. At first, the chapter presents theoretical overview of innovation or creativity. The second part of this chapter touch the theoretical links of training on innovation.

The third part of this chapter is for the relationship between employment and innovation because it is considered as the second part of the research. In this part, there are different sides of employment have links with innovation because it is a part of human capital, that is has direct relationship with innovation. Among employment, labor market flexibility, quality of labor and gender diversity has relationships through characteristics of each factor.

CHAPTER FOUR

4 Chapter four: empirical research:

4.1 Chapter Introduction:

According to (Gary King, Robert O. Keohane, and Sidney Verba 1994, 9), the content of scientific research is the methods and rules of research. The importance of being aware of the most suitable method and be able to conduct it is therefore immense. This chapter will first account for my methodological choices, then proceed to cover the data used in the thesis. The final part of the chapter describes the measurement validity and operationalization of the variables. The current chapter starts with presenting the reality of training and innovation in MENA region. Also, it demonstrates also the National innovation system proposed by Professor Djeflat. Also, the chapter presents some examples of innovation in some MENA countries, in addition to the variables that have an effect directly or indirectly on it such as R&D expenditures, Training and education.

To elaborate the empirical study of the thesis, the chapter is organized as follows:

After the introduction and characteristics of the MENA region that it gives an overview of the innovation and training on the MENA countries. The next section presents the literature review about the phenomenon. The following section focuses on the theoretical presentation of the used models that are logit – probit models. After present the models, there are sections of presenting the variables and one of results and discussion. In the end, conclusion of the chapter.

4.2 Characteristic of MENA region:

As it mentioned in the first chapter that the brain grain is important factor for the knowledge spread and according to the report of (Soumitra Dutta, Bruno Lanvin, and Sacha Wunsch-Vincent 2014a), the number and the geographical spread of students, researchers and entrepreneurs could be a signs of innovation and can drive the innovation effectively.

First of all, in the field of the innovation of the national innovation system, three categories can be identified in the region of MENA due to the study of (Djeflat 2002). The table below shows the three categories and the countries of each category:

Table 4-1: categories of MENA countries

Cat	Characteristics	Countries	Driving vectors
1	Have made serious attempts to integrate science and technology into economic development.	Algeria Egypt	Engagement in both categories of programs scientific research (fundamental and applied), Massive transfer of up to-date technologies from various advanced countries and substantial investments in education and training locally and abroad.
2	More oriented towards market-driven growth and the contribution of foreign capital to industrialization	Morocco, Tunisia Jordan, Kuwait,	The technological decision was to a large extent in the hands of foreign firms. Industrial base of the countries was being laid down. The countries have managed to develop local industries of small and medium size type. The low level of the awareness of the fundamental role of science and technology in development
3	Lack a sufficient industrial base, small existing industrial base in the terms of population and markets.	Libya, Mauritania	Low integration of science and technology policies into economic policies. The current potential and infrastructure are unlikely to provide the basis for a national system of innovation.

Source: edited by the student based on (Djeflat 2002)

As it mentioned in Table 4-1, the first category contains both of Algeria and Egypt are characterized by their serious attempts to integrate science and technology into economic development (in hydrocarbon sector in the case of Algeria). However, the second one includes all of morocco, Tunisia, Jordan and Kuwait. These countries are more oriented towards market driven growth. Where, in the third category contains the countries with lack in sufficient industrial base such as both of Libya and Mauritania.

4.3 Characteristics of Innovation in MENA region:

4.3.1 National innovation system in MENA region:

Following the study of (Djeflat 2002), the MENA region faced serious challenges for the fragile components in the socio-economic system in the regions because of the enhanced competition such as the failure of old strategies, the emergence of new generations of decisions makers with a significant breakthrough of university graduate in addition to the prospect of the free trade zone with Europe by the year 2010. Also, the stringent intellectual property regimes and the dipper concern for the environment. These latest movement interest for major transitions that will be translated in promoting scientific and

technological innovation, a well-established market-driven competition, and a more efficient market in allocating resources enhanced with the supply of more and better information. This latest will automatically couple with the important role of the innovation entrepreneurs.

Following (B.-Å. Lundvall 1985), the integrate approach to the National innovation system putted and revised in the nineties for the least developed countries. There for, three spheres are identified:

- The productive sphere,
- The training and education sphere
- The research spheres.

The Figure 4-1below demonstrate all the three spheres:

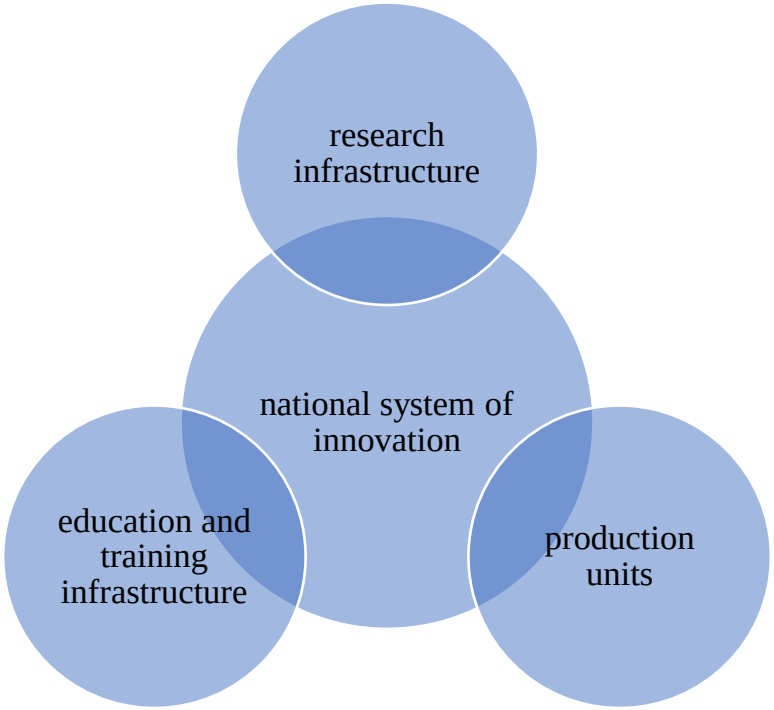
Figure 4-1: the three spheres of the NIS

Source: edited by the students

Following the previous explication, and according to the study of (B.-A. Lundvall et al. 2002; Djeflat 2002), the national system of innovation has an ex-post not ex-ante usage and it has been used mostly described systems with well-developed institutional and infrastructural support of innovation activities ex-post. It has not been applied to system building, whereas in the south, it needs to be shifted to system-construction in the wake of the globalization.

According to (Djeflat 2002), the national system of innovation contain three components as it presented in the figure below:

Figure 4-2: the three components of national system of innovation



source: edited by the student

The Figure 4-2 above shows the three components of national system in general. In the first, we find the research infrastructure that there represents the different infrastructure built by the government in the aim of fostering the research in the region. The second pillar of the national system of innovation is the education and training infrastructure. This latest contain different infrastructure for the both education and training in the region such as universities, high school and centers for Professional formation. Where the third pillar is the production units, that will focus in the firms or organization that produce.

4.3.1.1 Education and training in MENA region:

Higher education is singled out as the most relevant level to scientific research and development (Djeflat 2002). But the results gathered through the role of the higher education rests on the good education and training at primary and secondary level.

In 1980, the combined school gross enrolment in the region was 47% and it became 58% in 1995, that it represents a rose in this rate. In addition, the region of the Arab countries creates a reference related to countries to compare the rates of each level. For example, in 1992, the primary enrolment was 90% with 87% of the reference country, the secondary enrolment with 55% where the reference country was 51%.

In addition, the higher education is related in the first state with the number of the universities. The establishment of the universities seen an important movement in the Arab countries. In the first of 1950, the number of the universities was 10 university. In the end of 1995, the number of the universities was equal to 195, this establishment is following the important of the universities and their sensible role in the

research and development. In front of the universities, the university colleges also find an important rise from 29 colleges in 1960 to 177 colleges in 1996.

Focusing in the training of the levels up to master, the three countries of the Maghreb region (Morocco, Algeria and Tunisia) in addition to Egypt, Jordan and Lebanon offers this important training following the developed countries (Alain Alcouffe 1996).

4.3.1.2 Research institutes and centers:

Following the important role of the research institutes and centers, The MENA countries gave them an important interest by building an infrastructural base contain all types of S&T institutions in particular for research and development. In the first, there were 26 R&D institutes in 1960 and there rised with a rate of 8 institutes per year to be 322 institutes in 1996.

The most positive point in these institutions is the links between them with the academic research centers such as the laboratories in the universities and the links with the economic national plans.

4.3.1.3 Industry as production units:

The industry plays an important pillar of national system of innovation following its important role in implementing the ideas of the research institutes into the reality. In addition, following the R&D services in the industries, the decision makers are always looking in getting better in all sides. This latest push the productions units to look for new ideas and solution for actual problems. These new ideas need in many times technological services in addition to the know-how. On the top of that, the research unites, laboratories and research services within the productive sector were set up in some countries, where the interaction between the firms, branches and sectors of education system appeared as a core issue in the eyes of the policy makers. There for, the main objectives being to get science and technology research activities out of the education system and orient them towards the productive system. This latest initiated the contacts between the industry and the academic research where we found that some countries focus in this coordination such as Algeria, Jordan and Egypt (Djeflat 2002)

4.3.2 Innovation and training in MENA region:

The importance of the capacity building and infrastructure development in the acceleration of the internal and regional economic growth (Mokwunye 2012). Following (Mokwunye 2012), the world Bank spent nearly $10 billion between 1995 and 2004 in the capacity building that it concerns the improvements of the systems, processes and resources required for the public workforce to adequately provide public services to people and its private sector. However, the infrastructure has a key role in the economic growth, following a study of the AfDB and world Bank cited in (Mokwunye 2012), the current state of the infrastructure in African countries reduces economic growth by two percentages point and truncates

business productivity by 40%.With the existed infrastructures, the African countries would collectively requires $93 billion/year over ten years to build enough infrastructures to achieve the Millennium Development Goals MDGs by 2015 (Mokwunye 2012). The innovation faces different obstacles in the African countries characterized in the policy environment. According to the study of (Djeflat and Kuznetsov 2014), the lack of a stable and enforced policy limits competitiveness in the private sector and reduces incentives to invest in innovation.

4.3.2.1 Examples of innovation in MENA region

According to (Djeflat 2015), "the most key players and stakeholders of the innovation process in the GCC countries and Maghreb countries are either partially included or totally excluded from the innovation sphere".

In the MENA region, we discover scarce studies in the fields of innovation which revealed the existence of successful innovations in the regions especially in the agricultural research and well-focused industries (Djeflat 2002). However, the less studies to measure the effect of innovation on the economy in this region make as a barrier to touch the real effect. In Tunisia for example, only two innovative firms of 10 have tried to measure the effect of their innovation on their results by calculating their ration of R&D expenses. Without forgetting that the majority of the MENA countries are less developed countries (LDC); the innovation systems construction following the study (Abdelkader Djeflat 2016) takes place in a very specific environments with very little experience in the fields of R&D and innovation, and relatively weak industrial sector in terms of performances, suffering notably from high levels of obsolescence both in terms of human resources and equipment's.

4.3.2.1.1 Innovation in Tunisia:

Sector studies on innovation performances were conducted in recent years in the MENA region either by government agencies, private consultants, academics or international organization. Even though, they are relatively scarce and lack a strong information base, they can give an idea of the trends and orientation of innovation in the region. There for, the most important innovation sectors in Tunisia are in the chemical industry. The SERST of Tunisia examined 31 firms of the chemical sector. Where, 61% of the firms have an R&D unit and have done some incremental innovation of the products, 60% of the firms consider that the R&D units have increased the income. In addition, it is considering for other important improvement: 69% of the firms have process improvement, 46% of the firms have product improvement and 54% have the creation of new product.

From another side, other studies focus in other innovation companies in Tunisia in the different sectors. The results gathered show that all successful operation was conducted by the Research and Development department in the several operations. The results of these operation are as follows:

- 80% of the firm answer that the modification of the acquired technological process or product in order to improve their characteristics
- 80% answer that they develop and commercialize product,
- 60% answer that they develop product without commercializing them,

These results are from firms that:

- 60% of them has formal R&D department;
- 20% in the process of creating an R&D department;
- 20% without R&D department.

From this latest, we find that the R&D department has a great importance for innovation in the firm . In this point, 90% of the human resource mobilized are through training of personal on the newly introduced technologies (Djeflat 2002).

4.3.2.1.2 Innovation in Algeria:

In 2000, the SME's in Algeria are concentrated in five major sector that are as follows:

- 27.6% of the SME's in the sector of building and public works,
- 16.34% are for commerce,
- 8.7% of the SME's are for transport and communication,
- 8.59% for services and households,
- 7.29% for Agro-food industries.

The investments of these firms are increased with remarkable rates. In short time, the investments rise from 700 projects in 1994 to 12300 in 1999, i.e. the number is multiplied per 17. The innovative activities of this firms are found in product improvements with 48.5, capacity stretching, new product fabrication and replacement of old equipment.

From another side and following the study of (Djeflat 2015), the most key players of innovation appear to be excluded from the national innovation sphere such as foreign firms, professional bodies and the independent innovators. Where others are partially included like the universities, valorization agencies, private and public firms. In addition, few key players are included due to their origins of work that are policy makers, research centers and research funding agencies

4.3.2.1.3 Innovation in Kuwait:

Kuwait is appeared as one of the innovative countries in the region following their interest in building centers and institutions for innovation such as KIST (Djeflat 2002). The KIST is the Kuwait institute for scientific research, it has registered the good records in terms of successful innovation in all fields that will respect the characteristics of the regions such as de development of water resources, the plant tissue culture to support the agricultural sector in addition to the field of energy conservation in building.

According to (Djeflat 2002, 9), in the field of seawater desalination, Kuwait is considered as one of the first countries in the world who have used this method for fresh water supply and certainly the most experienced in the region using the MSF method (multistage flash).

4.3.2.2 Training in the developing countries:

The majority of the MENA countries are the developing countries, these latest defined as the countries which lag behind the transition from agricultural to industrial societies, and their economies (compared with the developed world) are not primarily based on knowledge (i.e. creation and diffusion) and usage of science and technology (Arocena and Sutz 2002). From the important characteristics of the developing countries is the low rates of all of the standard of living, the human development index and per capita income(Gaillard 2010).

Following (Djeflat 2015), " the most important keys to push the innovation in the GCC countries and Maghreb countries is to build an innovation system".

From another side, there are different variables that represent the inputs for the innovation process such as training (our principal variable), expenses of internal R&D, external R&D, acquisitions of equipment and software …etc. The outputs of these inputs could be characterized in different variables as innovation (seen in product, process), new product in the market, patents…etc. (Gazaniol 2012).

Following the study of (Bosco and Mavilia 2014), The utilization of the KAM (knowledge assessment methodology) in the study for the MENA regions provide important indicators such as R&D expenditures, Human capital, Patents, High tech employment, High-tech export.

The training plays an important role for the innovation. The table below contain the data of firm offering formal training for their employees:

Table 4-2 : training as rate of GDP in the MENA region

	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Algeria	31.84					17.3						
Egypt			13.41			21.4	21.7					
Iraq										22.2		
Israel												18.6
Jordan					23.9							3.4
Lebanon					67.8			52.4				26.6
Mauritania					25.5							
Morocco			33.51			24.7						
Oman		20.92										
Pakistan	11.09					6.7						
Syria		21.03						38.3				
Turkey	21.4		26.7	33.3			28.8					28.4
Palestine					26.5							11.2
Yemen									12.9			

Source: www.wdi.org

Data of table above represents expenditures of Mena countries on Training as a rate of GDP. Following data presented, there is a lack of training in MENA region in general though its importance. This latest is proved with the absence of data for all Mena countries in general. This is because the neglecting of the training role and importance in the economy and performance in general. From another side, with the available data, there is reduction in the expenditures of training in all of Algeria, Jordan, Lebanon, morocco Pakistan and Palestine. This reduction is because of the neglection of the training that is one of the important policies to improve the human capital capacities in a country.

Education:

Following different studies about the determinants of innovation, the education is the most important determinant of the innovation (Simone 1968; Ronaldo Mota and David Scott 2014; Baumol 2004). However, from the characteristics of the developing countries such as the MENA region is the lack level of education.

R&D in MENA region:

From the important indicators that affect the innovation in the world is the expenditures in R&D. It is defined following the Frascati manual of 2002 (OECD 2010) " research and experimental development

(R&D) comprise creative work undertaken on a systematic basis in order to increase the stock of knowledge, including knowledge of man, culture and society, and the use of this stock of knowledge to devise new applications".

The table below contains the growth of expenditures per GDP in some important countries from the MENA region from 1996 to 2012 following the World bank data:

Table 4-3: R&D expenditures in MENA region in the period

	Algeria	Egypt	Iran	Iraq	Israel	Jordan	Kuwait	Morocco	Pakistan	Saudi Arabia	Tunisia	Turkey
1996		0.2126			2.71121						0.30473	0.45159
1997		0.19756			2.96835		0.20539		0.15565		0.38748	0.49169
1998		0.1991			3.08146		0.25795	0.2856	0.10919		0.39029	0.37095
1999		0.18651			3.51993		0.19764		0.1159		0.39756	0.46767
2000		0.19247			4.16784		0.12543		0.12828		0.4145	0.47909
2001	0.23028		0.55195		4.45105		0.17882	0.63473	0.1667		0.48194	0.53779
2002	0.3664		0.54754		4.42864	0.33696	0.18001	0.54955	0.21977		0.57141	0.52594
2003	0.19623		0.67451		4.16508		0.14347	0.65909		0.06269	0.66152	0.48311
2004	0.16357	0.26994	0.58742		4.146		0.1301			0.05315	0.90117	0.51831
2005	0.06604	0.24141	0.73454		4.30688		0.10083		0.43689	0.0423	0.9171	0.59104
2006		0.25903	0.66814		4.22459		0.08478	0.63568		0.04245	0.95506	0.58016
2007		0.2551		0.04554	4.52323		0.08585		0.6325	0.04521	1.00472	0.72241
2008		0.27024	0.7488	0.03435	4.40296	0.4347	0.0855			0.04902	1.0341	0.72518
2009		0.23911		0.04562	4.16801		0.1122		0.44806	0.07338	1.10218	0.84902
2010		0.39781		0.03574	3.96501		0.09759	0.7338				0.84343
2011		0.42863		0.03378	3.97351		0.09494		0.32902			0.85952
2012					3.92627							

Source: www.wdi.org

4.3.3 The global innovation index of the MENA region:

Concerning the MENA countries, the Table 4-4 below summarizes the GII ranking of the MENA countries in the global innovation index in the period 2007-2017:

Table 4-4: the GII ranking of MENA countries in the period 2007-2017

Countries	2007	2008-2009	2009-2010	2011	2012	2013	2014	2015	2016	2017
Algeria	83	108	121	125	124	138	133	126	113	108
Bahrain	n.a	34	40	46	41	67	62	59	57	66
Egypt	74	76	74	87	103	108	99	100	107	105
Iran	n.a	n.a	n.a	95	104	113	120	106	78	75
Israel	18	23	23	14	17	14	15	22	21	17
Jordan	53	55	58	41	56	61	64	75	82	83
Kuwait	30	30	33	52	55	50	69	77	67	56

Lebanon	n.a	n.a	n.a	49	61	75	77	74	70	81
Morocco	76	82	94	94	88	92	84	78	72	72
Oman	n.a	52	65	57	47	80	75	69	73	77
Qatar	n.a	24	35	26	33	43	47	50	50	49
Saudi Arabia	n.a	32	54	54	48	42	38	43	49	55
Tunisia	41	46	62	66	59	70	78	76	77	74
Turkey	45	51	67	65	74	68	54	58	42	43
UAE	14	26	24	34	37	38	36	47	41	35
Yemen	n.a	n.a	n.a	123	139	142	141	137	128	127

Source: edited by the authors using data from GII reports

Note :

n.a. : data not available

From the table above, there is different fluctuation in the MENA region following the ranking of the global innovation index. These changes are the results of different changes (according to the different pillars cited above).

4.4 Innovation barriers:

According to research of (Abdul Waheed 2012), the micro level characteristics such as the lack of education (technical in the case of industrial workers and general in the case of the whole society) and knowledge bases which hinder the assimilation of new knowledge, the lack of technological, telecommunication, and other public infrastructures, a preference for the status quo and an unwillingness to accept industrial, institutional, and individual changes, a plethora of laws and institutions governing the launch of a new product which may slow the pace of innovation, political instability, insecurity, a lack of links between industries and universities (research centers), etc. are the main reasons of the lack of innovation in the developing countries. From another side, the environment does not enhance for the innovation in the developing countries starting from people to the government.

In addition, Following the study of (Szogs 2008), there is a lack of absorptive capacity in the developing countries because of the lack of applicability of technological knowledge to local condition, making collaboration with underdeveloped socio-economic structures virtually impossible in a non-system perspective. In addition, following the research of (Narula 2004), there are many factors cause the lack of the absorptive capacity in the developing countries. The most common factors are:

- weak or missing basic infrastructure (such as infrastructures of communication, electricity, health and basic education);

- Insufficient advanced infrastructure like universities, research centers and institutes, foreign affiliates for research and development facilities;

- Insufficient formal and informal institutions (intellectual property right regime, taxation, incentive system and partnership).

Following different studies, the innovation in the firm is hampered by different factors. According to (OECD 2005) the factors that hamper the innovation in the firm are:

Economic factors: such as high costs or lack of demand

Enterprise factors: lack of skilled persons or lack of knowledge.

Legal factors: regulations and tax rules.

From another side, the brain drain is the important hurdle in front of the innovativeness of the developing countries following (Aubert 2005) because it is the operation pf knowledge emigration to the developed countries. As a result, they will contribute in the advancement of the knowledge of the developed country, this latest has a negative effect on the knowledge on the original country.

According to (Oyelaran-Oyeyinka 2004), there are three fundamental problems face the innovation:

- The inability of local institutions to interact with productive entities,
- The difficulty in the building of local knowledge through the tacit knowledge of small structure in an unstable competitive environment
- The repetitive techniques of learning through imitation

4.5 Literature review:

Continuing to the previous chapter, there are different studies turn around the training, innovation and employment. To build our model of the study, it is necessary to make the bases that is literature review, therefor, the Table 4-5 below summarizes some important studies:

Table 4-5: literature review

Study	Authors and year	Results
Determinants of firm's innovation	(Alena Zemplinerová and	Through using **CDM model**, the decision to innovate and consequent innovation investment are separated. In addition, the innovation input is

	Eva Hromádková 2012)	linked to innovation outputs. Also, the productivity of the firms is related to its innovation activities.
Networks, Firm Size and Innovation	(Rogers 2004b)	Following the execution of **regression analysis and probit regression methods**, the small manufacturing firms exhibit a positive relation between networking and innovation. From another side, this relation is seen for the medium and large sized firms in non-manufacturing sector.
More labour market flexibility for more innovation? Evidence from employer–employee linked micro data	(Wachsen and Blind 2016)	The **panel probit regression** mentions that at first, the labor market flexibility does not influence innovation in an entrepreneurial innovation regime characterized by high competition, low market entry barriers and generally available knowledge. In contrast, labor market flexibility significantly reduces the likelihood of innovation in a routinised innovation regime leading innovators and high entry barriers
Determinants of firm's innovation in Nigeria	(Abdu and Jibir 2018)	Through using **Probit and Tobit regression model**, the firm's age and employee education have a negative effect on the possibility of the firm innovation. However, all of R&D investment, formal training, firm size, type and sector are significant determinants of all types of innovation.
Determinants of innovation capability in small electronics and software firms in southeast England	(Romijn and Albaladejo 2002)	Following the **regression tests**, the R&D play the key role in nurturing high-tech spin-off that will generate innovation.

Determinants of innovation in a small open economy: the case of Belgium	(Bernadette Biatour and Chantal Kegels 2008)	Through using the **dynamic panel model**, the technological has a direct effect on the growth of Bulgarian sectors. Also, the sigh skilled workers help to improve the multifactor productivity MFP.
Determinants of innovation in energy intensive industry and implications for energy policy	(Song and Oh 2015)	To test the determinants of innovation, the authors adopt **probit model.** They found that R&D personal ration has strong positive effect on product and process innovation. However, the R&D intensity has a positive effect just on process innovation.
Innovation in New Zealand: Issues of Firm Size, Local Market Size and Economic Geography	(Shangqin, McCann, and Oxley 2013)	Through using **logit and probit model**, the small sized firms are not able to innovate as large sized firms.
Determinants of Innovation	(Bhattacharya and Bloch 2004)	After adopting **probit model** to determine the important determinant of innovation, most variables such as size, R&D intensity, market structure has significant effect on the innovation.
Application of Logit Model in Innovation Adoption: a Study on Biotechnology Academic Researchers in Malaysia	(Hadi Farid, Abu Daud Silong, and S.K. Sarkar 2010)	Following the execution of **probit model**, the level of knowledge, transfer of and acceptance of technology influence the level of innovation adoption in the companies.

Source: edited by the student

Following the majority of these studies, the most used is the logistic model due to the nature of the data. The section below presents theoretically the essential of both logit and probit model that we will use in the study.

4.6 Econometric model: Logit & Probit model

The econometric model in the first is under the form below:

Equation 4-1:

$$y_i = \beta x_i + u_i$$

Where:

y_i: dependent variable (qualitative dichotomic variable) (innovation)

x_i: independent variable

β: parameter

u_i: error

4.6.1 Logit model:

Logistic regression is the standard way to model binary outcomes (that is, data yi that take on the values 0 or 1)(Gelman and Hill 2006, 79).

The logistic regression is characterized with representing one or more independent variables that determine a dependent variable or outcome. This outcome is measured or recoded via a binary variable; the independent variable(s) on the other hand can be classified as Continuous, Mixed of Continuous and Categorical. Logistic regression generates the coefficients (and its standard errors and significance levels) of a formula to predict a Logit transformation of the probability of presence of interest (Hadi Farid, Abu Daud Silong, and S.K. Sarkar 2010):

Equation 4-2:

$$\text{logit}(p_i) = \beta_0 + \beta_1 X_{1i} + \beta_2 X_{2i} + \beta_3 X_{3i} + \cdots + \beta_n X_{ni}$$

Where pi is the probability of presence of the characteristic of interest. The logit transformation is defined as the logged odds:

Equation 4-3:

$$odds = \frac{Pi}{1 - Pi}$$

And therefore, the logit (natural logs of odds), of the unknown binomial probabilities are modelled as a linear function of the Xi:

Equation 4-4:

$$\text{logit}(p_i) = Ln\left(\frac{Pi}{1 - Pi}\right) = \beta_0 + \sum_{j=1}^{n} \beta_j X_{ji}$$

The logit model assumes that underlying stimulus index $\text{logit}(p_i)$ is a random variable, which predicts the probability of innovation adoption (marketing, process, organizational, product or logistic innovation):

Equation 4-5:

$$chance\ of\ adoption = p_i = \left(\frac{1}{1 + e^{-logit(p_i)}}\right) = \left(\frac{e^{logit(p_i)}}{1 + e^{logit(p_i)}}\right)$$

The above formula has been used to calculate the probability of adoption of innovation that is to predict the possibility and chances for innovation to be adopted.

The dependent variables in this study are in two steps. At first, there is just innovation as global dependent variable. Where in second steps, there are five dependent variables that are the types of innovation. Thus, there are two equations to estimate. In either case, the dependent variables have a value of 1 when innovation exist. Otherwise, it has a value of zero.

Because this thesis sets up a binary variable, I analyze the effect of independent variables chosen on innovation using logit and probit

4.6.2 Probit model:

The probit model is described as the relationship between the explanatory variables and the dependent variable that has a value of 0 or 1. The following equation indicates that the existence of the innovation in a firm is used as the explanatory variable during a certain period of time. At this point, the dependent variable and the explanatory variable will have nonlinear relationship with each other.

Equation 4-6:

$$P(y = 1) = F(x\beta)P(y = 0) = 1 - F(x\beta)$$

Where:

*P:*is the probability,

*F:*is the probability distribution function,

y: is the dependent variable,

*x:*is the explanatory variable,

β:is the parameter.

In Equation 4-6, the probability of *y*=1; that is, the presence of innovation appears as a function of $x\beta$, so the equation is called the probit model when $f(\blacksquare)$ is a normal probability distribution function. β are the coefficients of explanatory variables (*x*) that determine the probability that innovation will occur.

Where $\emptyset(\blacksquare)$ is the standard normal probability distribution function and $\Phi(\blacksquare)$is the standard cumulative probability distribution function, thus the estimate of β can be obtained by maximizing the likelihood function of Equation 4-7:

Equation 4-7:

$$P(y=1)=\int_{-\infty}^{x\beta}\emptyset(t)dt=\Phi(x\beta)$$

In the case of the general linear model, $E(y/x)$ is $x\beta$, so β represent the marginal effect on the dependent variable x. However, in the probit model, the standard normal cumulative distribution function is an increasing function and $E\left(\frac{y}{x}\right)$is $F(x\beta)$, so that β itself no longer represents that marginal effect, the sign of β simply shows positive or negative effects on the probability that a company's innovation activity will take place.

Thus, the marginal effect should be measured separately in the empirical analysis using the probit model, which presents the change of the expected value of the dependent according to changes of the explanatory variables increase by one unit; hence, the differentiation of the expected value of the dependent variable (*y*) by the explanatory variables (*x)* can be measured as follows:

Equation 4-8:

$$\frac{\partial \mathrm{E(y/x)}}{\partial \mathrm{x}}=\emptyset(x\beta)\beta$$

Where $\emptyset$ is standard normal probability density function.

4.7 Testing econometric model:

To adjust the econometric model of the study, we have to calculate the likelihood function and P levels that is associated with the CHI-squared.

4.7.1 Likelihood test:

The maximum likelihood method is a general method to estimation the population parameters following the values that maximize the sample likelihood (L)(Breslow and Holubkov 1997; Johansen and Juselius 1990).

The likelihood (**L**) of a sample contain (**n**) observation $x_1, x_2, x_3 \dots x_n$ is the associated probability $p(x_1, x_2, x_3 \dots x_n)$ function where $x_1, x_2, x_3 \dots x_n$ are the discrete random variables. If $x_1, x_2, x_3 \dots x_n$ are continuous random variables, the likelihood (**L**) of a sample of (**n)** observation $x_1, x_2, x_3 \dots x_n$ will be the respective density function $f(x_1, x_2, x_3 \dots x_n)$.

The estimation of logistic regression and probit regression models is done using the loss function presented below:

Equation 4-9:

$$\mathrm{Log}(L_1)=\sum_{i=1}^{n}[y_i Log(P_i)+(1-y_i)Log(1-P_i)]$$

Where:

$\text{Log}(L_1)$: represents the Natural logarithm of the likelihood of the current model (logit or probit).

y_i: represents the observed value of observation i.

P_i: represents the adjusted or expected probability that is between 0 and 1.

The log-likelihood of the null model (L_0), i.e. the model is containing just the intercept that is calculated as it mentioned in Equation 4-10:

Equation 4-10:

$$Log(L_0) = n_0[Log\left(\frac{n_0}{n}\right) + n_1 Log\left(\frac{n_1}{n}\right)]$$

With:

n_0: represents the number of the observations with the null value (0)

n_1: represents the number of the observations with the value 1

n : represents the total number of observations.

4.7.2 P level:

After estimating the parameters of the regression models, it is necessary of the model to be appropriate. maximizing the likelihood function is equivalent to calculating the chi-square given by the following equation:

Equation 4-11: Chi-square

$$\chi^2 = -2[Log(L_0) - Log(L_1)]$$

The degrees of freedom for the chi-square are equal to the difference between the number of parameters of the null model and the adjusted model. So, the degrees of freedom will be equal to the number of independent variables in the logit or probit model.

If the **P level** associated with the Chi-square is significant, it means that we could say that the estimated model produces best and significative adjustment of the data comparing with the null model, it means also that the estimated parameters of the model are significative. the higher the p level, the less likely it is that the observed relationship between the variables in the sample is a good indicator of the relationship between the respective variables in the population.

More precisely, the **P level** represents the probability of error which is linked to the acceptance of a result observed as valid, i.e. as representative of the population.

For example, a **P level** of 5% indicates that there is a 5% probability that the relationship between the variables found in our sample is coincidental or due to chance.

Typically, in many scientific fields, the results with **P≤0.05** are considered statistically significative, even if they still imply a significant probability of error of 5%. Also, the results are significant at a level of **P≤0.01** are statistically significant. Also, for **P≤0.005** and **P≤0.001**, the results will be more significant at these levels of P value.

4.7.3 Interpretation of the parameter:

The numerical value of the estimated parameters is not really interesting in itself, since both models that are logit and probit correspond to the parameters of the equation of the latent variable only to a multiplicative constant. Therefore, the only and the really usable information is the sign of the parameters, indicating whether the associated variable influences the probability upward or downward.

4.8 Presentation of the variables:

Table 4-6 contain the description of the variables used in the study. For the dependent variables, there are six dependent variables that we would like to test. In the first step, we would like to test the Innovation in general. However, in the second step, we will test the different types of the innovation that are all of marketing innovation, logistic innovation, process innovation, organizational innovation and process innovation. All the dependent variables are dichotomous (i.e. take the value 1 if it exists and 0 if it does not exist). however, for the independent variables, we use in the study some variables that are related with the firm (that are sector of work and size of the firm). Some other variables related with the employment that are permanent employees, temporal employees and skilled employees in addition to the education level of employees. Also, we use the dichotomous variables that is the formal training program to look for the effect of training on innovation. Also, from the important variables that affect innovation is R&D, therefor we add the R&D expenditures.

The variables are selected using the Business Environment and Enterprise Performance Survey dataset. The modalities of the question selected are presented in the Table 4-6 bellow:

Table 4-6:Definition of the variables

	Variables	Description
Dependent	Innovation	Dichotomous variable 0= the firm is not innovative 1= the firm is innovative
	Marketing innovation	Dichotomous variable

		0= the firm did not have marketing innovation 1= the firm had marketing innovation Dichotomous variable
Independent variable	Logistic innovation	0= the firm did not have logistic innovation 1= the firm had logistic innovation Dichotomous variable
	Process innovation	0= the firm did not have process innovation 1= the firm had process innovation Dichotomous variable
	Organizational innovation	0= the firm did not have organizational innovation 1= the firm had organizational innovation Dichotomous variable
	Product innovation	0= the firm did not have product innovation 1= the firm had product innovation
	Sector of work	Categorical variable: 1= manufacturing 2= retail 3= services
	Size of the firm	Categorical variable 0= micro-sized firm 1= small-sized firm 2= medium-sized firm 3= large firm
	R&D expenditures	Continuous variable Dichotomous variable
	Formal training	0= the firm did not offer formal training 1= the firm offered formal training
	Permanent employees	Continuous variable
	Temporary employees	Continuous variable
	Skilled employees	Continuous variable
	Years of education	Continuous variable A continuous measure of years of education

Source: edited by the student

4.9 Results and discussion:

To elaborate the empirical part of the study, we based on the BEEPS data sets. The map 4-1 below presents the distribution of the firms in the MENA region. The sample of the study contain 6566 firms from the MENA region (using data of Beeps database).

The table below presents the distribution of the firms per region of activity:

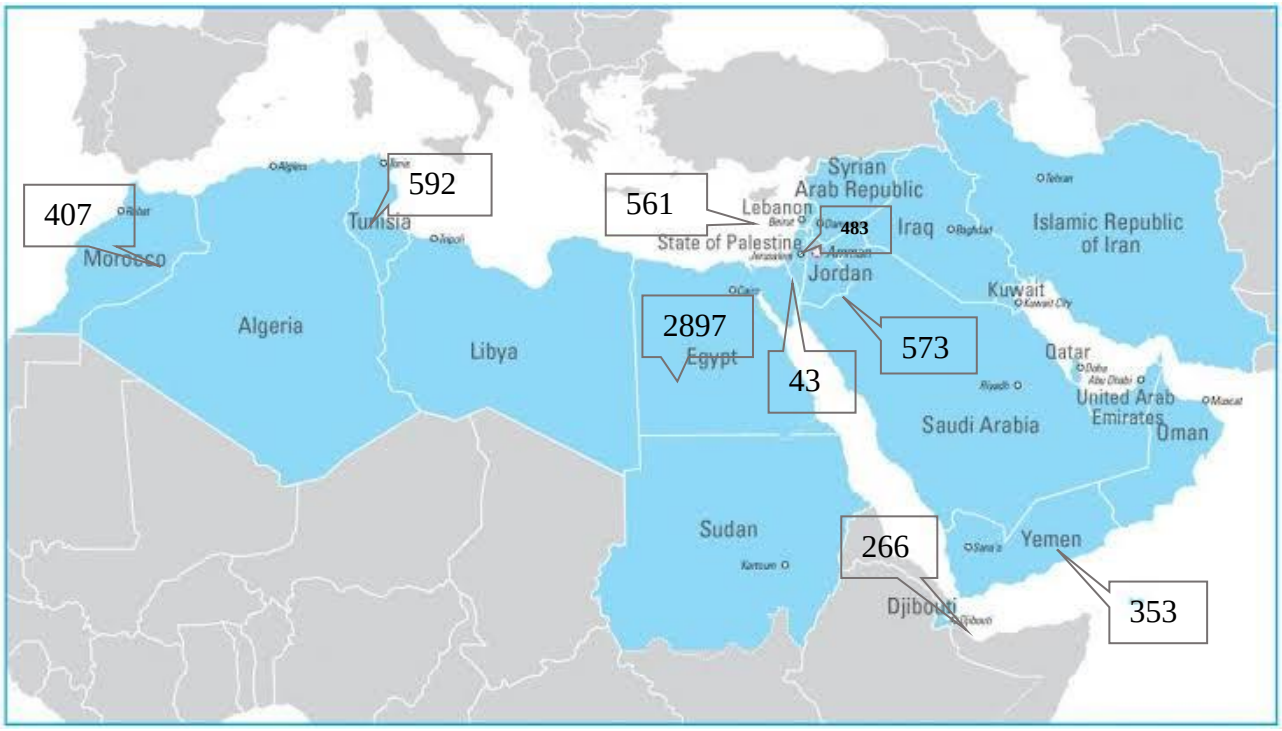
Table 4-7:distribution of the firms per countries

Characteristics	Category	Frequency	Percentage(N=6566)
Country	Palestine	434	6,6
	Morocco	407	6,2
	Egypt	2897	44,1
	Yemen	353	5,4
	Lebanon	561	8,5
	Djibouti	266	4,1
	Israel	483	7,4
	Tunisia	592	9,0
	Jordan	573	8,7
Total		6566	100%

Source: edited by the student using BEEPS dataset

In the sample, there is mixture of regions where maximum of firms situated in Egypt with 2897 firms (that it represent44.1% of the sample). The map 4-1 presents the distribution of the firms of sample per countries of MENA region. This result follows the willingness of the managers of the firms to share information in the aim of developing their firms following the feedback of information (that is the exploitation of the data from the scientist).

map 4-1: distribution of the firms on the map of MENA region



source: edited by the student using BEEPS dataset

For the dependent variables that are innovation or one types of innovation, there are different question with different modalities. Therefore, the tables below demonstrate the data of the dependent variables. Starting with the product innovation,

Table 4-8: number of improved or innovative product

Number	Frequency	Valid %	Cumulative %
from 1 to 10 products	1160	86.4%	86.4%
from 11 to 50 products	126	9.4%	95.8%
from 51 to 100 products	27	2.0%	97.8%
more than 100 products	29	2.2%	100%
Total	1342	100%	

Source: edited by the student

As it is mentioned in table above, maximum of the firms that improve product improve less than 10 products (86.4% of the firms). This rate is following the different obstacles faced in the firms to improve and innovate. There for, the high number of innovated firms is with the smaller number of improved products.

Table 4-9: level of newness of the product

Levels of innovation	N	%	% of Cases
The improved product was new to: this establishment's local market	1200	48,7%	89,4%
The improved product was new to country	927	37,6%	69,1%
The improved product was new to International market	337	13,7%	25,1%
Total	2464	100%	183,6%

Source: outputs of SPSS using BEEPS data

For the firms that launch innovation or product or service improvement presented in map 4-1, the big rate of innovation or product improvement is large in the local market (963 firm of 1269 firms innovate). As a first result, Table 4-9 shows that 89.4% of the innovative firms, innovate in the local market level (smallest circle).

However, 927 of innovative firms innovate in the country level (that it represents69.1% of the innovative firms). In addition to that, the innovative firms in the international level represent 25.1% of the innovative firms (337 firms of 1342). Following these data, the innovation in the local market take the first place because the innovation in the level of local market could be exist with new features on existing product with low investment and risk and low payoff. The innovation in the country level takes the second place due to some special characteristics in the innovation such as: advancement of existing product, medium investment and risks in addition to medium pay-off.

Where the innovation in the international level takes the third place (few firms could innovate in the international level). To get innovation in the international level, it is necessary for the product to be evolutionary (i.e. new to the international level). This latest necessitate large investment of the firms in addition to face big risks. To get innovation in the country level, it will be innovation in the firm level at first in addition to innovation in all the country. However, to get innovation or improved product in the international level, it will be innovation in the country level and firms' level in the same time. There for, there is deterioration in the number of innovations in the change of level to the biggest.

After the explication of innovation level, it is necessary to understand the source of the innovation. Therefore, Table 4-10 shows the different methods of the product innovation.

Table 4-10:different ways of innovation

Fields of innovation	N	%	% of Cases
New product has added new functions to an existing product	1001	20,0%	74,6%
New product has completely new functions compared to the existing product	823	16,4%	61,3%
New product uses new materials or components that enhance its performance	575	11,5%	42,9%

New product uses new technology	530	10,6%	39,5%
New product looks different from the existing product	627	12,5%	46,7%
New product is cheaper to produce compared to the existing product	284	5,7%	21,2%
New product is completely new to the establishment	840	16,8%	62,6%
New product/service: More efficient/easier to use	289	5,8%	21,5%
Other	46	0,9%	3,4%
Total	5015	100%	373,7%

Source: outputs of SPSS using BEEPS data

Following Table 4-10, there are different methods followed to improve the product or service (i.e. innovate). From the different methods applied to innovate, **adding new functions to the existing product** from the easiest and important methods to innovate (following to the facility of using) where 1001 firms of the innovated firms (that it represents 74.6% of the innovated firms). In the second place, the **New product is completely new to the establishment**, where 823 firms of 1342 innovated firms (that it represents 61.3%) innovate new product. In the production of a new product, there are different characteristics of these new product. There for, in making comparison between new product and an existing product, these characteristics play the first role because there are the factors to evaluate the product. **New product looks different from the existing product** 627 firms of 1342 (that it represents 46.7% of the innovated firms).

From the classical methods that lead to innovation is using new materials or component in an existing product to enhance its performance. For that, 575 firms of 1342 (that it represents 42.9%) find that **New product uses new materials or components that enhance its performance**.

Using new technology from the widely used methods to innovate (Ndesaulwa and Kikula 2017). For the firms of the MENA region, 530 firms' of 1342 innovative firms (that it represents 39.5%) are **using new technologies to produce the new product.**

From the followed methods to innovate is by improving the efficiency of the product in addition to ease the utilization of the product. For that, 289 firms' of 1342 firms find that the **New product or service is more efficient or easier to use in comparison with the existed product** (that it represents 21.5%)

From the characteristics of the product is the price. Therefore, from the procedures follows to innovate is to produce with low cost to achieve the goal of reduce the price of the product in the market. Following the data of our research, just 284 firms' of 1342 firms (that it represents 21.2%) find that **New product is cheaper to produce compared to the existing product**. This latest result shows that 72.2% of the innovated firms find that the new product is expensive compared to the existing product because of the new different investments to innovate.

Table 4-11 presents other side of innovation of the firms (that is the sources of the innovation).

Table 4-11:How the main **new or improved product** was introduced or developed

Source of innovation	Frequency	Valid %	Cumulative %
Developed or adapted by this firm	818	60.90%	60.90%
Developed in cooperation with suppliers from abroad	138	10.30%	71.20%
Developed in cooperation with domestic client firms	95	7.10%	78.30%
Licensed products or services from another firm	72	5.40%	83.70%
Developed in cooperation with domestic suppliers	72	5.40%	89.10%
Developed in cooperation with client firms from abroad	50	3.70%	92.80%
Introduced the establishment own version of a product or service	48	3.60%	96.40%
Developed in cooperation with external academic or research institute	15	1.10%	97.50%
Other	34	2.50%	100%
Total	1342	100%	

Source: outputs of SPSS using BEEPS data

For the innovative firms of our sample, there are different ways followed from the firms to innovate as it presented above in Table 4-11. We find that the majority of the new innovations (818 firms of 1342 that it represents 60.9%) are developed or adapted by the firms itself. This latest means that the firms are interested to use their own capacities to innovate without basing on the foreign capacities to keep the source of innovation inside the firm. However, the elements of the firm's environment play also important role in the innovation. Learning by exporting from important ways to innovate (as it explained in the second chapter) where it mentions the necessity of the supplier(Massimiliano Brat and Giulia Felice 2012). Therefore, the supplier in our empirical research takes the second place where 10.3% of the innovative firms develop their product in cooperation with suppliers from abroad (that is 138 firms). In the second side of the suppliers, the domestic clients are also source of innovation (by proving ideas following their desirous that will be transformed to innovation). Therefor, 7.1% of the firms (95 innovative firms) developed their products starting from the desirous of the client.

There different goals push the firms to innovate. Following the different types of innovation, the goals also will be multiplied. For the innovation product, there are different goals followed to innovate and especially in the product. Following Table 4-12, there are at least seven goals followed to innovate in the product. However, for the MENA region, the maximum innovative firms improve their product with the goal of improving the benefits of the firms in addition to survive against competitors. 1227 Innovative firms

that it represents 91.4% of all innovative firms improve their product to extend the range of products sold by this firms. However, 87.1% of the innovative firms improve their product with the goal of opening up new markets or increase the market share. Where 86.4% of the innovative firms of the MENA region improve their product to keep up with the competitors. For the other goals, the number of the firms is reduced especially for the goal of reducing the cost of production because the improvement at first require investment, the matter that it will be translated to costs. For that, just 25.3% of the innovative firm improve their product with the goal of reducing the cost of the production.

Table 4-12: Does any of the following describe why this firm introduced this new or **improved product**

Modalities	N	%	Rates of responses
To replace an old product sold by this establishment	486	8,3%	36,2%
To extend the range of products sold by this establishment	1227	21,0%	91,4%
To open up new markets or increase market share	1169	20,1%	87,1%
To lower the cost of production	339	5,8%	25,3%
To keep up with competition	1159	19,9%	86,4%
To comply with regulations or standards	753	12,9%	56,1%
To deal with a decrease in the demand for other products	696	11,9%	51,9%
Total	5829	100%	434,4%

Source: outputs of SPSS using BEEPS data

For the innovation process and following BEEPS dataset, there are different reasons that push the firms to improve their process. Table 4-13 contain the answer of the innovative firms in the different reasons that foster them to improve their innovative process.

Table 4-13: Does any of the following describe why this firm introduced **the new or improved process**?

The aim through innovation	N	%	% of Cases
To raise the volume of products sold or services offered	1014	14,5%	88,2%
To keep up with competition	1009	14,4%	87,7%
To raise the quality of products sold or services offered by this firm	980	14,0%	85,2%
To open up new markets or increase market share	925	13,2%	80,4%
To raise the flexibility or speed of selling products or offering services	907	13,0%	78,9%
To extend the range of products sold or services offered by this firm	891	12,8%	77,5%
To comply with regulations or standards	737	10,5%	64,1%
To lower the cost of offering services	526	7,5%	45,7%

Total	6989	100%	607,7%

Source: outputs of SPSS using BEEPS data

Augmenting the capital through the raise of the volume of the products sold or services offered is the first reason that it pushes the firms to improve their innovative process where 88.2% (1014) of the firms improve their process for it. In the second place, competing against the competitors is the second reason to improve the innovative process where 1009 firms (that it represents 87.7%) improve their innovative process for it.

Improving the quality of the product is also from the important reason followed by the firm to improve their innovative process where 980 innovative firms improve to raise the quality of product sold or services offered. In addition to that, opening up a new market, raising he flexibility or speeding up the sold product or offered services; or extending the range of product sold or services offered are also from the important reasons followed by the firms to improve their innovative process where 925, 907 and 891 firms respectively follow these reasons to improve their innovative process.

Where just 526 firms (that it represents 45.7% of the innovative firms) improve their process to low the cost of offering services. From another side and following the continuous changes in the regulations and standards, some changes touch the products such as pharmaceutical product or services. Therefore, it is important for the firm to comply with these regulations. From another side, Regulatory framework conditions have been identified as important factors influencing the innovation activities of companies, industries and whole economies (Blind, Petersen, and Riillo 2017; Blind 2016; Firth and Mellor 1999; Grabowski 1979). Therefor, 64.1% of the firms (737 innovative firms) that improve their process are improving their process to comply with regulation and standards of the state. These latest shows that just few firms think to innovate by reducing the cost of the production.

After understanding the reasons that push the firms to improve their innovative process, Table 4-14 present data of the improvement goals.

Table 4-14: In what aspects is this main new or improved process different from the original?

Aim of process innovation	N	%	% of Cases
It automates manual processes partially or fully	610	20,8%	53,0%
It lowers costs compared to the old process	643	21,9%	55,9%
It complements new machinery	586	20,0%	51,0%
It is faster than the old process	983	33,5%	85,5%
Other aspects	112	3,8%	9,7%
Total	2934	100%	255,1%

Source: outputs of SPSS using BEEPS data

As it presented above, the majority of the firms improve their process with the goal to make it faster in the operation (983 of the innovative firms that it represents 85.5%) because the old one was slow that bring negative results for the firms. Therefore, the first improvement established by the firm is to improve the process to speed up the operation and make it faster. By speeding up the process, the sold product or offered services will be more in the new process comparing with the old process. These latest lead us to more production with the same employment cost that will reduce the cost of the unity production comparing with the old process. Therefor, 21.9% of the innovative firms (that are 643 firms) improve their process because they found that the new process lowers the costs compared to the old process. Also, 610 firms are improving their process by using new technologies, where they automating (partially or fully) the old manual process. In addition to this latest, 586 innovative firms (that it represents 20% of the innovative firms) improving their process to complement new machinery installed in the firm.

Table 4-15: in which area did this firm introduce new or improved **organizational methods**?

Area of organizational innovation	N	%	% of Cases
New systems to better use or exchange information, knowledge, skills	727	19,2%	65,6%
Introduction of management systems for general production or supply operations	675	17,8%	60,9%
New methods for distributing responsibilities & decision making among employees	849	22,4%	76,6%
A significant change to the management structure	706	18,6%	63,7%
New types of collaborations	435	11,5%	39,3%
Outsourcing or subcontracting of business activities	393	10,4%	35,5%
Total	3785	100%	341,6%

Source: outputs of SPSS using BEEPS data

As it mentioned in Table 4-15, there are six important areas of innovation for the organization. In the first, 76.6% of the innovative firms (849 firms) introduce new organization methods for distributing responsibilities and decision making among employees. Where in the second place, 727 firms (that it represents 65.6% of the innovative firms) improve new organizational methods with the goal of creating new systems to better use or exchange information, knowledge and skills. Following these information's, the majority of the innovative firms are using new organizational method with the goal of improving the human capital capacities with the aim of growing up the productivity of the firms. In addition to the human capital side of the firm, the management systems for general production or supply operation and management structure also have its role in the firms. There for, they have also their parts of organizational

innovation where 675 and 706 firms respectively are improving them following the implementation of new organizational methods.

To touch the main difference between the new and previous used method, the widely used method is to compare between the new and previous used methods. Therefore, by making comparison between the new and the previous utilized production or delivery method, Table 4-16 shows that 77,1% of the firms (1035 innovative firms) mention that the changes required are in the machinery and equipment. This latest means that the important changes required is by using new machinery and equipment (basing on high technology) to improve the characteristics of the product. In front of the side of using machinery and equipment, techniques of production have also important role. Therefor, 958 firms find that the old production necessitate changes in techniques to survive again the new changes. In the second side of machinery and equipment, there is the software used in the high-tech equipment in addition to the software of different operation such as accountability and others. For that, the changes in the software has its role in the firms. In the comparison between the old and new improved product, 672 innovative firms require significant changes in the software's. Where 639 find that the firms are requires significant changes in the management to improve product.

Table 4-16: Did the old product require significant changes in?

Changes required in	N	%	% of Cases
Did it require significant changes in Techniques	958	29,0%	71,4%
Did it require significant changes in Machinery and equipment	1035	31,3%	77,1%
Did it require significant changes in Software	672	20,3%	50,1%
Did it require significant changes in Management	639	19,3%	47,6%
Total	3304	100%	246,2%

Source: outputs of SPSS using BEEPS data

In addition to the previous types of innovation, the marketing innovation from the important new marketing appears in the last time following its improvements (Gupta et al. 2016; Sinapuelas, Wang, and Bohlmann 2015). The innovation in the marketing is basing on the pillars marketing mix that are price, place, product and promotion.

In the MENA region, there are also some firms that introduce new or significantly improved marketing methods, where these improvements are basing especially in the elements of marketing that are presented in Table 4-17. Advertising or product promotion from the important methods followed for the marketing innovation where 1012 firms of the innovative firms of the MENA region (that it presents 70.5% of the sample) innovate in marketing following the introduction of new methods of advertising or product promotion. For the pricing pillar, 906 innovative firms (that present 63.1% of all the innovative firms) introduce new pricing strategies to market. The innovation in the place pillar takes the third place following

the data gathered of our sample, where 845 innovative firms (that it presents 58.8% of all innovative firms) introduce new methods of product placement or sales channels. However, 715 firms introduce significant changes in the product appearance.

Table 4-17: Did the firm introduce new or **improved marketing methods** in the following areas?

Modalities	N	%	% of Cases
Significant changes in the product's appearance	715	20,6%	49,8%
Introduction of a new method of advertising or product promotion	1012	29,1%	70,5%
Introduction of a new method of product placement or sales channels	845	24,3%	58,8%
New pricing strategies to market the establishment's goods or services	906	26,1%	63,1%
Total	3478	100%	242,2%

Source: outputs of SPSS using BEEPS data

The production is the important operation in the firm, because it represents the operation that englobe different resources and transform them into product to sell. For the innovation, it could be also the source to implement innovation into the firm.

Table 4-18 depicts the distribution of firms per innovation based on the DEEPS dataset. The survey covered 6566 firms and 44.0% (2889) of them were innovative firm. Table 4-18 shows that majority of the innovative firms in MENA region are interested in marketing innovation with 21.9% of the whole interviewed firms. In the second place, product innovation takes the second place with 20.4% followed by the process innovation with 17.5% of the sample. In the fourth place, we found the firms that interest in organizational with 16.9% followed by logistic innovation in the last place with 13.4%.

Table 4-18: Descriptive statistics of dependent variable

Variable	categories	Frequencies	%
Innovation	1 (innovative)	2889	44.0
	0 (non-innovative)	3677	56.0
	1 (innovative)	1342	20.4
Product innovation	0 (non-innovative)	5224	79.6
	1 (innovative)	1108	16.9
Organizational innovation	0 (non-innovative)	5458	83.1
	1 (innovative)	1150	17.5
Process innovation	0 (non-innovative)	5416	82.5
	1 (innovative)	1436	21.9
Marketing innovation	0 (non-innovative)	5130	78.1
Logistic innovation	1 (innovative)	878	13.4

0 (non-innovative)	5688	86.6

Source: edited by the student

Table 4-19 presents the quantitative independent variables used in our study that are R&D expenditures, years of education of the employees, number of the permanent employees, number of temporary employees in addition to the number of skilled of employees.

Table 4-19: descriptive statistics of independent variables

Variable	Observations	Minimum	Maximum	Mean	Std. Dev.
R&D expenditures $	6566	0,00	1500000000,00	722996,852	21471303,016
years_education (emplo)	6566	0	36	10,658	3,266
Employment	6566	1	21000	102,812	466,480
Tempr employ	6566	0	1300	8,182	46,391
skill_worker	6566	00	18500	35,382	273,463

Source: edited by the student

Table 4-20 depicts the distribution of the independent variables that are dichotomous or categorical for all the sample. For the formal training programs, just 17.256% (1133) of the firms offer formal training programs for their employees. these firms are distributed between three sectors of activities that are manufacturing, retail and services. 3795 firms that it represents 57.798% of the sample exercise in the manufacturing sector. In the second-rate, firms in services with 28.511% (1872 firms). However, firms in retails take the third place with 899 firms (that it represents 13.692% of the sample. Table 4-20 presents also the distribution of the firms by their size based on DEEPS dataset. 0.426% of the total firms operated at the micro-scale, whereas 47.594 and 34.389 percent (3125 and 2258, respectively) of the total firms surveyed were small and medium-scale respectively. However, large firms represent 17.591% with 1155 firms.

Table 4-20: descriptive statistics of independent variables (dichotomous or categorical variables)

Variable	categories	Response	Frequencies	%
Formal training	1	Yes	1133	17,256
	2	No	5433	82,744
sector	1	Manufacturing	3795	57,798
	2	Retail	899	13,692
	3	Services	1872	28,511
Size	0	Micro	28	0,426
	1	Small	3125	47,594

	2	Medium	2258	34,389
	3	Large	1155	17,591

Source: edited by the student using software Xlstat 2016

The third characteristics presented in the table is the size of the firms. The data shows the mixture of the sizes of firms (all sizes of firms mentioned) but with different rates. In the first, small[§] sized firms with 3122 firms (that it represents 47.5% of the sample).

Where In the second rate, we find medium[**] sized firms take second rates with 2258 (that it represents 34.4% of the sample). The large[††] sized firms take the thirds place in the sample with 1155 large firms (that it represents 17.6% of the sample). However, the micro[‡‡] sized firms represent just 0.4% of the sample of the study. These data show that the entrepreneurs of the MENA region are more interested in creating small sized firms. This latest is following the entrepreneurial procedures and facilities offered to individuals to create their own firms such as financial mechanisms created in Algeria to foster entrepreneurship and curb unemployment (Bourouaha and Maliki 2014, 2005–12)

Table 4-21 reveals the incidence of innovation by firm type, sector and formal training program offered by the firm as well as the distribution of the sampled firms who were undertaking innovation in product, process, organizational, marketing and logistics. Table 4-18 shows that firms that innovate in marketing strategies were the largest (1436 that it represents 21.9% of the total sample) followed by product innovative firms with 20.4% of the sample, then process innovative firms with 17.5% and organizational innovative firms with 16.9% and lastly logistic innovative firms with 13.4% of the sample.

For Table 4-21 and starting with innovation, only 429 of 1342 (31.96 %) product innovative firms offer formal training for their employees. However, 441 of organizational innovative firms offer formal training program for their employees. Also, Table 4-21 presents the distribution of the innovative firms per sector of work and per size. Again, this table indicates that small and medium-scale firms where the most innovative followed by the lard and at last micro-scale firm. In term of firm sector, manufacturing firms were the most innovative followed by service firms and lastly retailing firms.

Table 4-21: cross table of dependent variables and categorical independent variables

		Formal training		sector			size			
		no	yes	manufacturing	retail	services	micro	small	medium	large
Product innovation	no	4520	704	2873	757	1594	24	2643	1741	816
	yes	913	429	922	142	278	4	482	517	339

[§] Small sized firms: firms with less than 20 employees
[**] Medium sized firms: firms with less than 100 employees
[††] Large sized firms: firms with more than 100 employees
[‡‡] Micro sized firms: firms with less than 5 employees

Organizational innovation	no	4766	692	3204	728	1526	26	2732	1844	856
	yes	667	441	591	171	346	2	393	414	299
Marketing innovation	no	4511	619	2984	690	1456	24	2577	1729	800
	yes	922	514	811	209	416	4	548	529	355
Logistic Innovation	no	4867	821	3295	760	1633	25	2796	1940	927
	yes	566	312	500	139	239	3	329	318	228
Process Innovation	no	4731	685	3144	736	1536	23	2701	1822	870
	yes	702	448	651	163	336	5	424	436	285
Innovation	no	3361	316	2032	526	1119	19	1957	1209	492
	yes	2072	817	1763	373	753	9	1168	1049	663

Source: edited by the student using SPSS 25.0

4.9.1 Logit and probit estimation for innovation:

Table 4-22 contains the estimated effects of the logit and probit models on the determinants of innovation. The logit model of innovation showed that the significant determinants of a firm's chances of innovating were all of training, R&D expenditures, sector of the firms, size of the firms, temporary employment, years of education and skilled workers. More precisely, the training has a positive important effect on the innovativeness of the firms with 1.34 with a significative probability less than 1%. In the second place, the size of the firms has a positive effect with 18.26 percent on the innovation with a significative probability that is less than 1%. However, employment has not a significative effect (Prob. is more than 10%). For the probit model, all the independent variables have significative effect on innovation except employment where the Probability is more than 10%.

Table 4-22: Logit & Probit regression of innovation

Variable	Logit		Probit	
	Estimation	Prob.	Estimation	Prob.
Intercept	-0.400034	0.0003	-0.255174	0.0002
employment	-5.89E-05	0.4835	-3.79E-05	0.4713
Formal training	1.346958	0.0000	0.833541	0.0000
R&D expenditures	9.92E-08	0.0032	3.65E-08	0.0001
Sector of the firm	-0.139773	0.0000	-0.085916	0.0000
Size of the firm	0.182680	0.0000	0.114937	0.0000
Temporary employment	0.003654	0.0003	0.001998	0.0001
Years of education	-0.019297	0.0207	-0.011463	0.0260
Skilled workers	0.000968	0.0023	0.000570	0.0018

Nbr obs.	6566	6566
chi2	614.55	609.64
Prob > chi2	0.0000	0.0000

Source: edited with the student (see Appendix 0-3and Appendix 0-6)

Both Equation 4-14 and Equation 4-15 represent the models of logit and probit of innovation.

Equation 4-12: logit model of innovation

INNOVATION = 1-@CLOGISTIC(-(-0.400033885819 - 5.89088253919e-05*EMPLOYMENT + 1.34695835493*FORMAL_TRAINING + 9.91874764488e-08*RDEXPENDITURES - 0.139773347592*SECTOR + 0.182679901663*SIZE + 0.00365367418867*TEMPR_EMPLOY - 0.0192967563583*YEARS_EDUCATION + 0.000968135929457*SKILL_WORKER))

Equation 4-13: probit model of innovation

INNOVATION = 1-@CNORM(-(-0.255174068028 - 3.79232553589e-05*EMPLOYMENT + 0.833541336248*FORMAL_TRAINING + 3.65426657647e-08*RDEXPENDITURES - 0.0859159038405*SECTOR + 0.114937051104*SIZE + 0.00199840204057*TEMPR_EMPLOY - 0.0114629142627*YEARS_EDUCATION + 0.000569994656172*SKILL_WORKER))

Table 4-23 contains the estimated effects of the logit and probit models on the determinants of innovation.

Table 4-23: Logit and probit estimation of innovation

Variable	Logistic regression		Probit regression
	Estimation	Odds ratio	Estimation
Intercept	0.759		0.472
R&D expenditures	0.000	1.000	0.000
years of education	-0.020	0.980	-0.012
Employment	0.000	1.000	0.000
Temporal employment	0.004	1.004	0.002
Skilled worker	0.001	1.001	0.001
Formal training (yes)	0.000		0.000
Formal training (no)	-1.350	0.259	-0.836
sector-1 (manufacturing)	0.000		0.000
sector-2 (retail)	-0.110	0.896	-0.068
sector-3 (services)	-0.279	0.757	-0.171
size-0 (micro)	0.000		0.000
size-1 (small)	0.216	1.241	0.126

size-2 (medium)	0.458	1.580	0.277
size-3 (large)	0.542	1.719	0.332
Nbr obs.	6566		6566
chi2	616.47		611.55
Prob > chi2	0.0000		0.0000

Source: edited by the student (see Appendix 0-4 and Appendix 0-7)

Following Table 4-23, for the logit model estimation parameters of the independent variables and starting with formal training, and using the category of offering formal training as reference, the estimated parameter is -1.35 that is means that firms that does not offer formal training are less likely to innovate than the firms that offer formal training for their employees. For firm's sector of activity and using manufacturing as reference, firms in services are more inappropriate rather than firms in retailing that is also inappropriate to innovate than firms in manufacturing (estimated parameters are -0.279 and -0.110 respectively). These results are justified also with the Odds ratio, for the formal training, odds ratio of the firms that does not offer formal training for their employees is less than 1, this latest means that this firms are less likely to innovate comparing with the firms that offer formal training for their employees. For the sector of the activity, the odds parameter of firms in services is less than the odds ratio of firms in retailing that is less than 1 (0.757 and 0.896), these latest confirm that firms in these sectors are less likely to innovate than firms in manufacturing. For the firms-size and using the micro-scale as reference, the estimation parameters of all of three other sizes (small, medium and large) are more than 0 (0.261, 0.458 and 0.548 respectively) with odds ration more than 1 (1.241, 1.580 and 1.719 respectively that is there is increase of 24.1% in the odds of small sized firms, 58% in the odds of medium firms and 71.9% in the odds of marge firms). These latest results mention that the firms in these three sizes are more able to innovate than micro-sized firms. these results are also justified with the probit model. In addition, the probability of chi-squared is under than 1%, therefore, we could say that the results are good. The Equation 4-14 and Equation 4-15 present the logit and probit model of innovation:

Equation 4-14: logit model of innovation

Pred(innovation) = 1 / (1 + exp(-(-0,759476331599904-9,87215027308635E-08*RDexpenditures+1,97157598429928E-02*years_education+4,37732453040443E-05*Employment-3,69069947724714E-03*tempr_employ-1,03371695196937E-03*skill_worker+1,35027039546632*formal_training-2+0,110260863460464*sector-2+0,278952138433601*sector-3-0,215918241017048*size-1-0,457709882630569*size-2-0,541692702279334*size-3)))

Equation 4-15: probit innovation of innovation

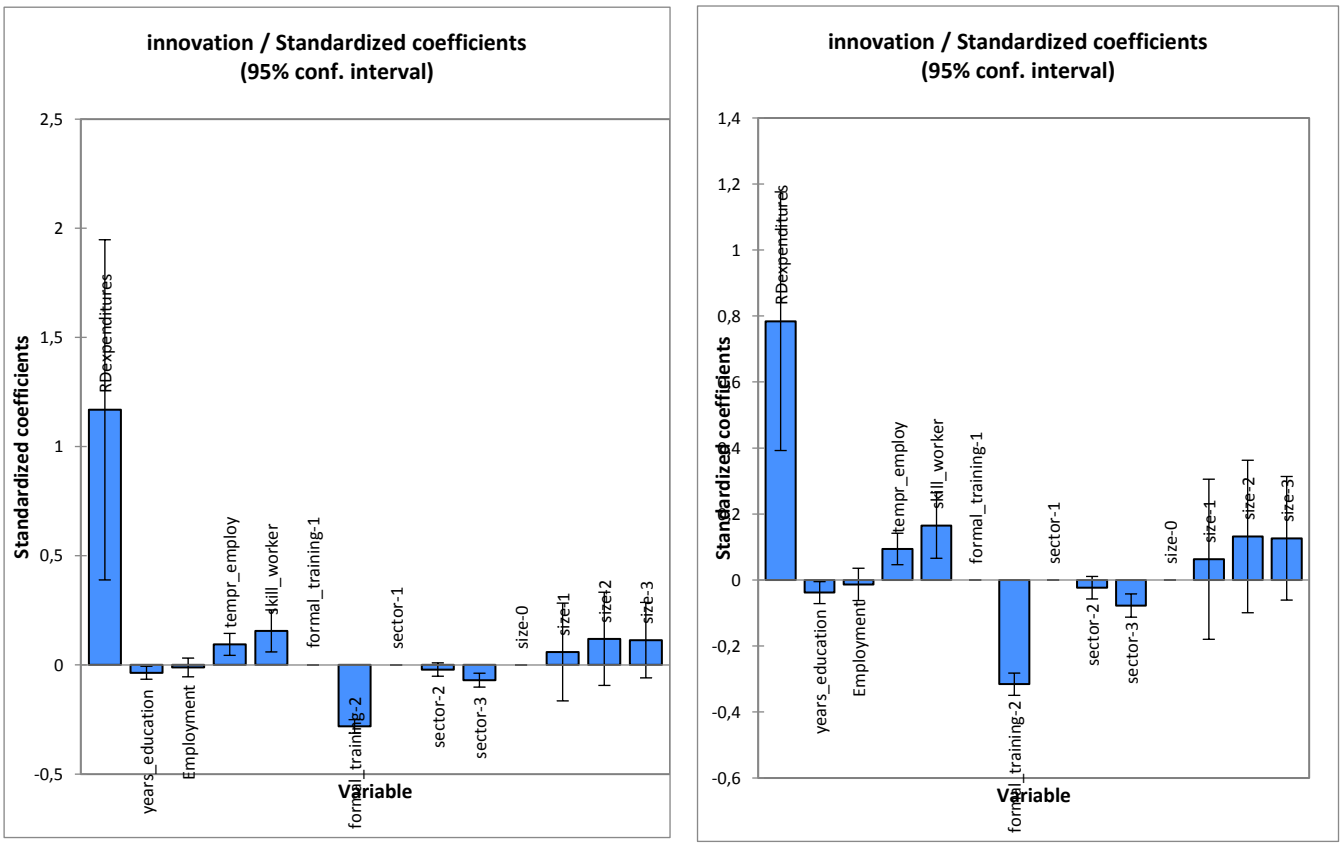
Pred(innovation) = XLSTAT_CDFNormal(-0,47247056712531-3,65191588142668E-08*RDexpenditures+0,011709484127054*years_education+2,84385605327081E-05*Employment-2,02667137317551E-03*tempr_employ-6,03625122099999E-04*skill_worker+0,835592389345324*formal_training-2+0,067986232769131*sector-2+0,17147843472778*sector-3-0,125983289765484*size-1-0,277468345257759*size-2-0,332128210146099*size-3)

Moreover and following (Menard 2011), "In presenting results for variables such as innovation , with no natural metric, only the standardized coefficients convey much information. When the objective is to compare the relative strengths of relationships involving variables measured in different metrics, however, it is the standardized coefficients that provide an appropriate and intuitively meaningful basis of comparison. Only with a standardized coefficient can we determine whether a dichotomous predictor (e.g., training) or categorical (such as size of the firm), are more or less strongly related to the outcome than ordered discrete or continuous predictors (innovation) in the same model, and it is in this sense that a standardized coefficient makes sense even for a dichotomous predictor.

Figure 4-3 shows that firms without formal training has negative standardized coefficient with the reference of offering formal training. For the sector of activity also, both of retailing and services has negative standardized coefficient with reference of manufacturing. This latest confirm that the manufacturing firms are more likely to innovate than firms in the other sectors. For the size of the firm and using micro-size as reference; the three size that are small, medium and large have positive standardized coefficient, i.e. the micro-sized firms are less likely to innovate comparing with the other firms in the other sizes.

Figure 4-3: standardized coefficient of logit model for innovation

Logit	Probit



Source: edited by the student using XLSTAT 2016 (see Appendix 0-5 and Appendix 0-8)

4.9.2 Logit and probit estimation for Product innovation:

Table 4-24 contains the estimated effects of the logit and probit models on the determinants of product innovation. The logit models indicate that both formal training and size of the firms have a significant positive effect on the product innovation at 1% (1.107 and 0.212 respectively). Where, the sector of the activity has a negative significant effect with 0.34 at 1%. however, the employment has non-significative effect on product innovation. From another side, the probit model confirms also the positive significant effect of formal training and size of the firm at 1%, and negative significant effect of sector at 1% in addition to the small positive significant effect of temporal employment at 5%.

Table 4-24: Logit and Probit product innovation

Variable	Logit regression		Probit regression	
	Estimation	Prob.	Estimation	Prob.
Intercept	-1.243802	0.0000	-0.762616	0.0000
Employment	-0.000113	0.2510	-6.71E-05	0.2189
Formal training	1.107424	0.0000	0.649577	0.0000
R&D expenditures	2.05E-09	0.3212	1.22E-09	0.2404
Sector	-0.341161	0.0000	-0.191164	0.0000
Size	0.212657	0.0000	0.123427	0.0000
Temporal employment	0.001244	0.0338	0.000798	0.0265
Years of education	-0.017960	0.0600	-0.010432	0.0617
Skilled workers	0.000411	0.0617	0.000256	0.0550
Nbr obs.		6566		6566
chi2		388.53		389.19
Prob > chi2		0.0000		0.0000

Source: edited by the student (Appendix 0-9 and Appendix 0-12)

Both Equation 4-16 and Equation 4-17 presents the logit and probit model of product innovation:

Equation 4-16: logistic regression model for product innovation

PRODUCT_INNOVATION = 1-@CLOGISTIC(-(-1.243802314 – 0.000113419161375*EMPLOYMENT + 1.10742373293*FORMAL_TRAINING + 2.04707646419e-09*RDEXPENDITURES – 0.341161421703*SECTOR + 0.212657483946*SIZE + 0.00124390866289*TEMPR_EMPLOY – 0.0179598990032*YEARS_EDUCATION + 0.0004111765352*SKILL_WORKER))

Equation 4-17: probit regression model for product innovation

PRODUCT_INNOVATION = 1-@CNORM(-(-0.762615555524 – 6.70973974347e-05*EMPLOYMENT + 0.64957672623*FORMAL_TRAINING + 1.22226696789e-09*RDEXPENDITURES – 0.191163772834*SECTOR + 0.123426587625*SIZE + 0.000797909887063*TEMPR_EMPLOY – 0.0104324884572*YEARS_EDUCATION + 0.000255544516157*SKILL_WORKER))

Table 4-25 contains the estimated effects of the logit and probit models on the determinants of innovation and product innovation as dependent variable. Starting with formal training and taking the first category as reference, the estimation parameter of the firms that does not offer formal training program for their employees is -1.117(that is less than 0) with and odds ratio less than 1 (0.327). These results explain

that this firms are less likely to innovate in production comparing with the firm firms that offer formal training for their employees. As a first result, the formal training has in important effect on the product innovation. For the sector of the firms and using manufacturing as reference, the estimation parameters of both retails and services are negative (-0.479 and -0.665 respectively) with odds ratio that are less than 1 (0.620 and 0.514 respectively). These results mention that firms in manufacturing are more likely to innovate in production rather than firms in retail or services. For the size of the firms and using micro-sized firms as reference, the micro-sized firms are less likely to innovate in the production in comparing with the firms in the other sizes. The previous explication is justified by the positive estimation parameters of the three level (0.079 , 0.410 and 0.440 of small, medium and large firms respectively) followed by odds ratio that are superior than 1. This results also justified by the estimation parameters of probit model. For the chi-square, the P value is less than 1% i.e. the logit-probit estimation of innovation product is good.

Table 4-25: logit and probit estimation of product innovation

Variable	Logistic regression		Probit regression
	Estimation	Odds ratio	Estimation
Intercept	-0.377		-0.234
R&D expenditures	0.000	1.000	0.000
Years of education	-0.016	0.984	-0.009
Employment	0.000	1.000	0.000
Temporary employment	0.001	1.001	0.001
Skilled workers	0.000	1.000	0.000
Formal training (yes)	0.000		0.000
Formal training (no)	-1.117	0.327	-0.656
sector-1 (manufacturing)	0.000		0.000
sector-2 (retail)	-0.479	0.620	-0.277
sector-3 (services)	-0.665	0.514	-0.373
size-0 (micro)	0.000		0.000
size-1 (small)	0.079	1.082	0.036
size-2 (medium)	0.410	1.507	0.224
size-3 (large)	0.440	1.552	0.243
Nbr obs.	6566		6566
chi2	395.61		396.45
Prob > chi2	0.0000		0.0000

Source: edited by the student (see Appendix 0-10 and Appendix 0-13)

Both Equation 4-18 and Equation 4-19 represent the both estimation models logit and probit of product innovation.

Equation 4-18: logistic regression model for product innovation

Préd(product innovation) = 1 / (1 + exp(-(0,377296133465404-2,08806260702138E-09*RDexpenditures+1,62667053322843E-02*years_education+8,07260574810856E-05*Employment-1,2887129193965E-03*tempr_employ-4,33420554873446E-04*skill_worker+1,11730922438631*formal_training-2+0,478815162025898*sector-2+0,664777746632078*sector-3-7,89664164040499E-02*size-1-0,410260971685641*size-2-0,439756015138249*size-3)))

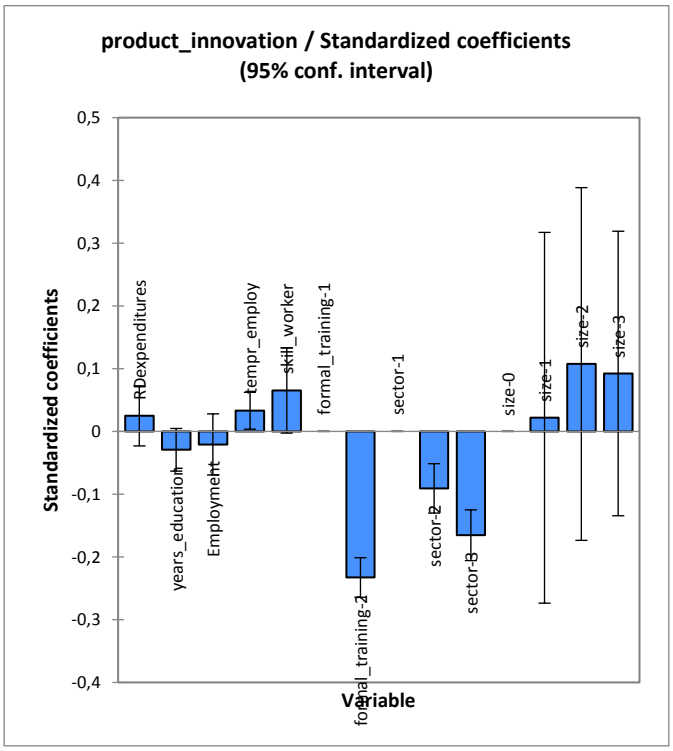
Equation 4-19: probit regression model for product innovation

Pred(product innovation) = XLSTAT_CDFNormal(-0,234288266024381+1,24676737126192E-09*RDexpenditures-9,30677512039644E-03*years_education-4,95282953287723E-05*Employment+8,23692569067359E-04*tempr_employ+2,70872038787777E-04*skill_worker-0,6556160418121*formal_training-2-0,277010658479358*sector-2-0,373152519280095*sector-3+3,64868345030048E-02*size-1+0,223858060194521*size-2+0,242907259032511*size-3)

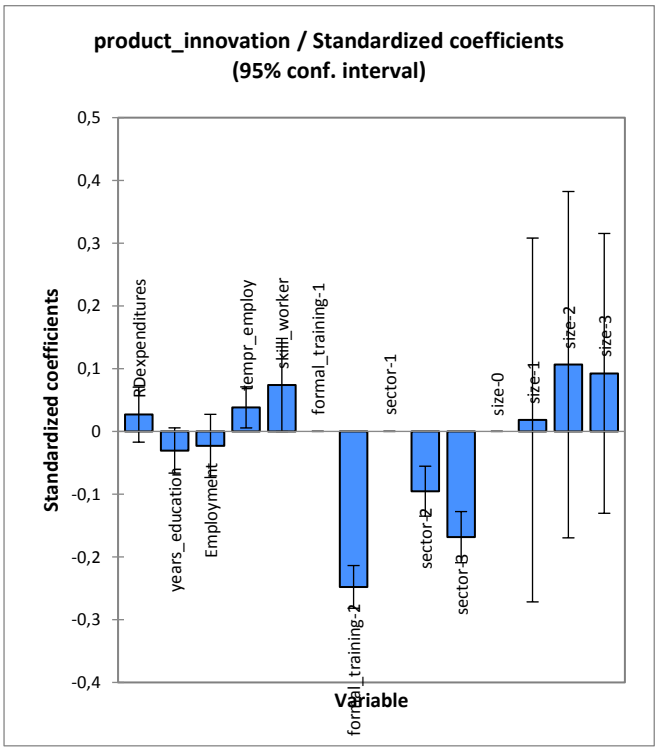
Figure 4-4 presents the standardized coefficient of both logit and probit models for product innovation. For the formal training programs and using offering formal training as reference, the standardized coefficient of not-offering formal training is negative, that is mean the firms without formal training programs are not likely to innovate in the product. For the sector of work and using manufacturing as reference, the negative standardized coefficient of both retailing and services demonstrates that the manufacturing firms ae more likely to innovate their product more than the firms in the other sectors of works that are retails and services. For the size of the firms, the micro-sized firms are less likely than the other firms to innovate in the production.

Figure 4-4: standardized coefficient for product innovation

Logit



Probit



Source: edited by the student using XLSTAT 2016 (see Appendix 0-11 and Appendix 0-32)

4.9.3 Logit and probit estimation for organizational innovation:

Table 4-26 contains the estimated effects of the logit and probit models on the determinants of organizational innovation. Both logit and probit model show that formal training, size of the firms and the sector of activity have significant positive effect on the organizational innovation at 1% (probability is less than 1%). Also, the Research and development expenditures have a small positive significant effect on the organizational innovation in addition to temporary employment and skill workers. where, the years of education of the employees does not have significative effect on organizational innovation (Probability is more than 10%). Both Equation 4-20 and Equation 4-21 present the logit and probit models of organizational innovation:

Table 4-26: logit and probit estimation of organizational innovation

Variable	Logit regression		Probit regression	
	Estimation	Prob.	Estimation	Prob.
Intercept	-2.455046	0.0000	-1.441028	0.0000
Employment	-0.000230	0.0779	-0.000134	0.0631
Formal training	1.357523	0.0000	0.788050	0.0000
R&D expenditures	1.87E-08	0.0009	1.13E-08	0.0007

Sector	0.113822	0.0068	0.064794	0.0056
Size	0.257384	0.0000	0.148257	0.0000
Temporary employment	0.001785	0.0035	0.001083	0.0030
Years of education	-0.015252	0.1779	-0.008834	0.1523
Skill worker	0.000890	0.0025	0.000527	0.0019
Nbr obs.		6566		6566
chi2		480.64		484.03
Prob > chi2		0.0000		0.0000

Source: edited by the student using eviews10.0(see Appendix 0-33 and Appendix 0-14)

Equation 4-20: logit estimation of organizational innovation

ORGANIZATIONAL_INNOVATION = 1-@CLOGISTIC(-(-2.45504568845 - 0.000229748496549*EMPLOYMENT + 1.3575230647*FORMAL_TRAINING + 1.87028805693e-08*RDEXPENDITURES + 0.113821649729*SECTOR + 0.257384195994*SIZE + 0.00178488669605*TEMPR_EMPLOY - 0.0152516705341*YEARS_EDUCATION + 0.000889824364917*SKILL_WORKER))

Equation 4-21: probit estimation of organizational innovation

ORGANIZATIONAL_INNOVATION = 1-@CNORM(-(-1.44102802566 - 0.000133561380293*EMPLOYMENT + 0.788050186446*FORMAL_TRAINING + 1.12875138288e-08*RDEXPENDITURES + 0.0647935861962*SECTOR + 0.148256663938*SIZE + 0.00108256933616*TEMPR_EMPLOY - 0.00883437119965*YEARS_EDUCATION + 0.000526557982807*SKILL_WORKER)).

Table 4-27 contains the estimated effects of the logit and probit models on the determinants of organizational innovation. Basing on the estimation parameters of logit model and using the category offering formal training as reference , the firms that are offering formal training are more likely to innovate in organization rather than the firms that does not offer formal training program for their employees (negative logit estimation parameter that is -1.358, and negative probit estimation parameter that is -0.789 with odds ratio 0.257 that is less than 1). However, the firms in manufacturing are less likely to innovate in the organization than firms in the other sector of activity that are retailing and services following the positive estimation parameters of logit and probit test of the two sectors, in addition to the odds ratio more than 1. This means that the organizational innovation is seen in retailing and services more than manufacturing firms. Table 4-27 also reveals that the micro-sized firms are less likely to get the organizational innovation comparing with the other sized firms following the positive estimation parameters (0.627, 0.996 and 1.134

of logit for small, medium and large size respectively, and 0.262, 0.470 and 0.549 for probit estimation respectively).

Table 4-27:logit and probit estimation of organizational innovation

Variable	Logistic regression		Probit regression
	Estimation	Odds ratio	Estimation
Intercept	-1.391		-0.720
R&D expenditures	0.000	1.000	0.000
Years of education	-0.020	0.981	-0.011
Employment	0.000	1.000	0.000
Temporary employment	0.002	1.002	0.001
Skilled worker	0.001	1.001	0.001
Formal training (yes)	0.000		0.000
Formal training (no)	-1.358	0.257	-0.789
sector-1 (manufacturing)	0.000		0.000
sector-2 (retail)	0.402	1.494	0.219
sector-3 (services)	0.223	1.250	0.126
size-0 (micro)	0.000		0.000
size-1 (small)	0.627	1.873	0.262
size-2 (medium)	0.996	2.708	0.470
size-3 (large)	1.134	3.107	0.549
Nbr obs.	6566		6566
chi2	491.62		494.25
Prob > chi2	0.0000		0.0000

Source: edited by the student (see Appendix 0-15 and Appendix 0-34)

In addition to Table 4-27, Equation 4-22 and Equation 4-23 represent the logit and probit model of organizational innovation:

Equation 4-22: logit model (Variable organizational innovation) :

Pred(organizational innovation) = 1 / (1 + exp(-(-1,39067377754559+1,90506076301785E-08*RDexpenditures-1,96320389348192E-02*years_education-2,06721251764059E-04*Employment+1,84587246983966E-03*tempr_employ+9,5596913979375E-04*skill_worker-1,35795632883793*formal_training-2+0,401564878377043*sector-2+0,223480143978627*sector-3+0,62743770953636*size-1+0,996109704052214*size-2+1,1335467398745*size-3)))

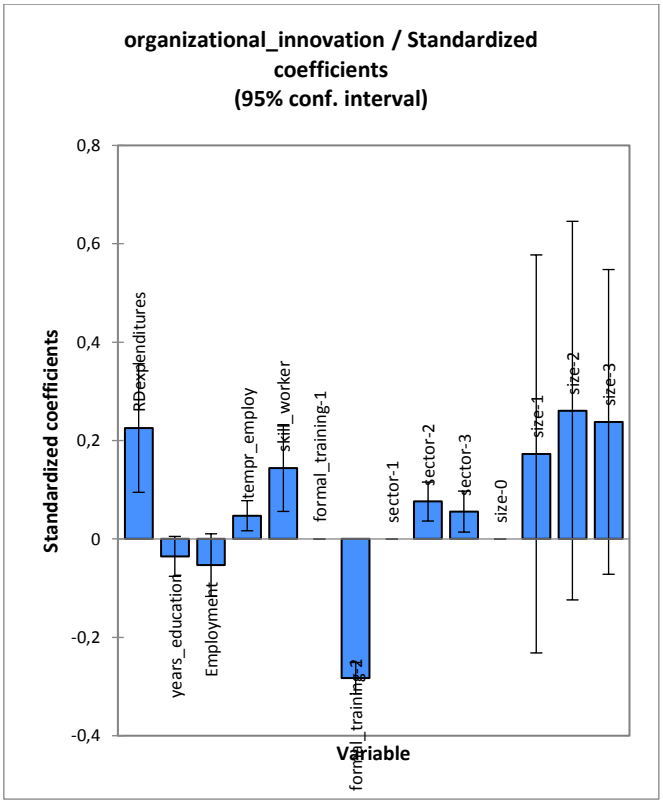
Equation 4-23: probit model (Variable organizational innovation)

Pred(organizational innovation) = XLSTAT_CDFNormal(-0,720263160885685+1,14570575455735E-08*RDexpenditures-0,011160218504762*years_education-1,20575773476462E-04*Employment+1,11793172643866E-03*tempr_employ+5,65462047802236E-04*skill_worker-0,788710476182153*formal_training-2+0,219471340315072*sector-2+0,12611921801573*sector-3+0,26212184236655*size-1+0,470156841715816*size-2+0,548788083499348*size-3)

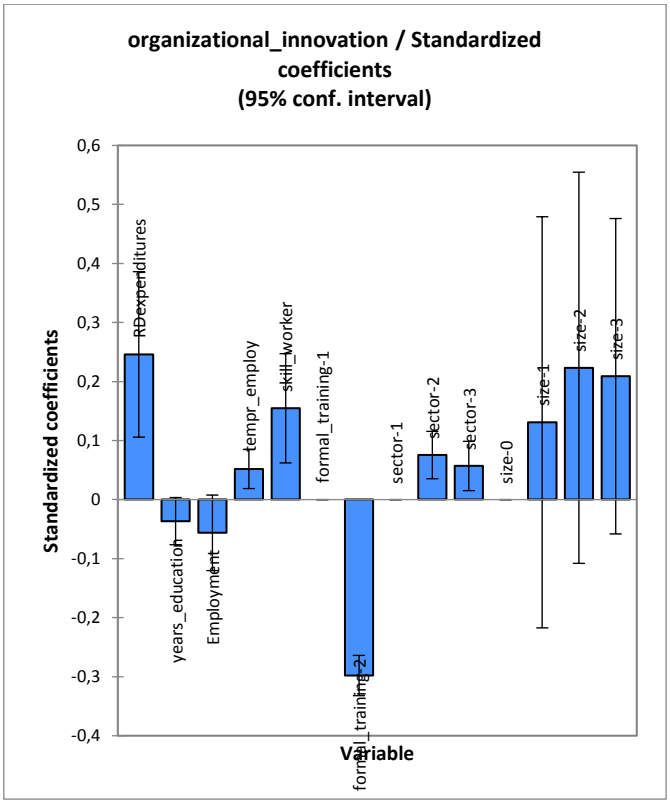
To confirm the previous estimation in Table 4-27, Figure 4-5 shows the standardized coefficients of both logit and probit for organizational innovation. as it appeared in the figure, the negative standardized coefficient of the firms that does not offer formal training for their employees comparing (the reference is offering formal training). This latest result confirms the necessity of the formal training to innovate in the organization. However, for the sector of the activity and using manufacturing as reference, the firms in the other sector are more likely to have organizational innovation than manufacturing. For the size of the firm, the standardized coefficient presented in Figure 4-5 confirm the logit and probit estimation of organizational innovation and showing that with using micro-sized firms as reference, the firms in the three other levels are more likely to have organizational innovation than micro-sized firms.

Figure 4-5: standardized coefficients of organizational innovation

Logit



Probit



Source: edited by the student using Xlstat 2016 (see Appendix 0-16 and Appendix 0-35)

4.9.4 Logit and Probit estimation for marketing innovation:

Table 4-28 contains the estimated effects of the logit and probit models on the determinants of marketing innovation. Both logit and probit model shows that all of employment, R&D expenditures and sector of work have not significative effect on marketing innovation (all probability values are more than 10%). From the other side, all of formal training and size of the firm have significant positive effect on the marketing innovation at 1%, where the years of education of employees has significant negative effect on marketing innovation (-0.02).

Table 4-28: logit and probit estimation of marketing innovation

Variable	Logit regression		Probit regression	
	Estimation	Prob.	Estimation	Prob.
Intercept	-1.664632	0.0000	-1.005522	0.0000
Employment	-1.30E-05	0.8762	-8.49E-06	0.8682
Formal training	1.314958	0.0000	0.786532	0.0000
R&D expenditures	-7.14E-10	0.5833	-3.91E-10	0.6270
Sector	0.025596	0.5044	0.014803	0.5006
Size	0.173149	0.0001	0.102652	0.0001
Temporary employment	0.000977	0.0941	0.000600	0.0940
Years of education	-0.026069	0.0083	-0.014948	0.0084
Skill worker	0.000553	0.0296	0.000329	0.0253
Nbr obs.		6566		6566
chi2		433.15		434.86
Prob > chi2		0.0000		0.0000

Source: edited by the student using Eviews 10.0(Appendix 0-20 and appendix 0-17)

The Equation 4-24 presents the logit model of marketing innovation where Equation 4-25 present the probit model of marketing innovation.

Equation 4-24: Logit model for marketing innovation

MARKETING_INNOVATION = 1-@CLOGISTIC(-(-1.66463209508 - 1.30441180198e-05*EMPLOYMENT + 1.31495788206*FORMAL_TRAINING - 7.14423491842e-10*RDEXPENDITURES + 0.0255958215003*SECTOR + 0.173149440539*SIZE + 0.00097681399782*TEMPR_EMPLOY - 0.0260693434241*YEARS_EDUCATION + 0.0005530826049*SKILL_WORKER))

Equation 4-25: probit model for marketing innovation

MARKETING_INNOVATION = 1-@CNORM(-(-1.00552186994 - 8.49371805704e-06*EMPLOYMENT + 0.78653208618*FORMAL_TRAINING - 3.91076590671e-10*RDEXPENDITURES + 0.0148030449057*SECTOR + 0.102652329648*SIZE + 0.000599776363807*TEMPR_EMPLOY - 0.0149484999449*YEARS_EDUCATION + 0.000329328079007*SKILL_WORKER))

Table 4-29 contains the estimated effects of the logit and probit models on the determinants of marketing innovation. Following the two types of innovation (organization and product) and innovation in general, the firms offering formal training for their employees are more likely to innovation in marketing than the firms that did not offer formal training. This is justified by the negative estimation parameter with the odds ration less than one for the logit test (-1.317 and 0.268 respectively) in addition to the negative estimation parameter of probit model (-0.788). These results confirm that the training has a positive effect on the marketing innovation. Also, the firms in retailing and services are more able to innovation in marketing than manufacturing firms following the positive estimation parameters of logit and probit (0.222 and 0.045 for logit and 0.120 and 0.026 for probit estimation respectively). Also, the odds ratio confirms the logit estimation with 1.248 and 1.046 that are both more than 1. These ratios mention that both sectors are more likely thank manufacturing. For the size of the firms, the micro-sized firms are less likely to innovate in marketing comparing with the other firms in the other sizes following the positive estimation parameters of logit and probit test and the odds ration more than 1.

Table 4-29:logit and probit estimation of marketing innovation

Variable	Logistic regression		Probit regression
	Estimation	Odds ratio	Estimation
Intercept	-0.416		-0.220
R&D expenditures	0.000	1.000	0.000
Years of education	-0.029	0.971	-0.016
Employment	0.000	1.000	0.000
Temporary employment	0.001	1.001	0.001
Skilled worker	0.001	1.001	0.000
Formal training (yes)	0.000		0.000
Formal training (no)	-1.317	0.268	-0.788
sector-1 (manufacturing)	0.000		0.000
sector-2 (retail)	0.222	1.248	0.120
sector-3 (services)	0.045	1.046	0.026

size-0 (micro)	0.000		0.000
size-1 (small)	0.236	1.267	0.103
size-2 (medium)	0.506	1.659	0.257
size-3 (large)	0.565	1.759	0.295
Nbr obs.	6556		6566
chi2	440.20		441.09
Prob > chi2	0.0000		0.0000

Source: edited by the student using Xlstat 2016 (see Appendix 0-21 and Appendix 0-18)

Both Equation 4-26 and Equation 4-27 represent the logit and probit model of marketing innovation:

Equation 4-26: the logit model of marketing innovation

Pred(marketing innovation) = 1 / (1 + exp(-(-0,416346431417218-6,53048208403876E-10*RDexpenditures-2,89332650479266E-02*years_education-1,63024415176628E-06*Employment+1,03833676668797E-03*tempr_employ+6,20641240456413E-04*skill_worker-1,31669401509269*formal_training-2+0,221813713698146*sector-2+4,49938837154954E-02*sector-3+0,236379144008609*size-1+0,506094206164985*size-2+0,564596848915358*size-3)))

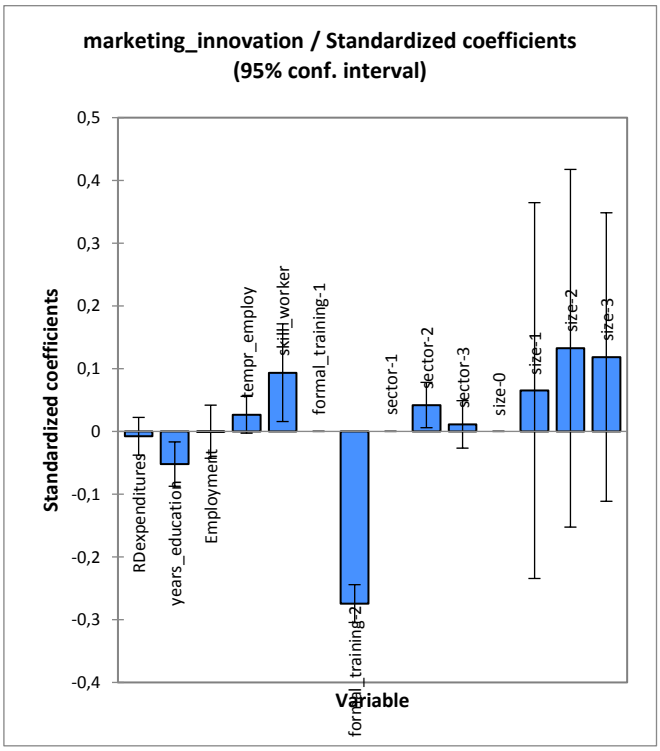
Equation 4-27: the probit model of marketing innovation

Pred(marketing innovation) = XLSTAT_CDFNormal(-0,219665508788497-3,55779001099716E-10*RDexpenditures-1,64121959903628E-02*years_education-1,22332973365791E-06*Employment+6,3378477582506E-04*tempr_employ+3,64054621680512E-04*skill_worker-0,787572244180325*formal_training-2+0,120331614153153*sector-2+2,58703250948518E-02*sector-3+0,102834922943368*size-1+0,257367471246537*size-2+0,294788667190314*size-3)

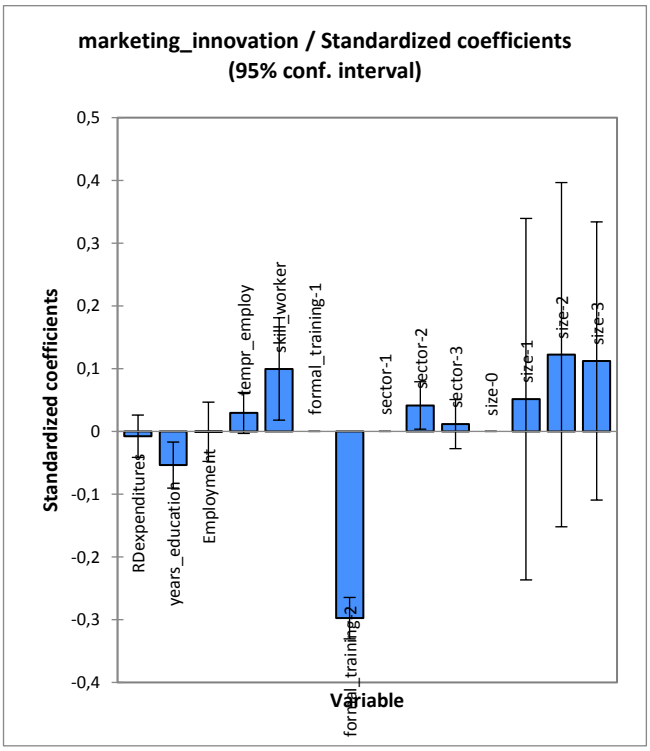
Following the Table 4-29, the training has an important effect on the marketing innovation. this effect is confirmed also with the standardized coefficient, where the firms with no normal training programs has a negative coefficient comparing with the firms that are offering formal training program.

Figure 4-6: standardizes coefficients of marketing innovation models

Logit



Probit



Source: edited by the student using Xlstat (see Appendix 0-19 and Appendix 0-22)

4.9.5 Logit and probit estimation for logistic innovation:

Table 4-30 contains the estimated effects of the logit and probit models on the determinants of logistic innovation. Starting with logit regression model, training have positive significant effect on the logistic innovation with 1.101 with 1% of probability. In addition, the size of the firms also has significant positive effect on logistic innovation. These determinants are justified also with the probit model. However, all of employment, R&D expenditures, sector of work, temporary employment and skill workers are not significative for marketing innovation. These models are presented in both Equation 4-28 and Equation 4-29.

Table 4-30: logit and probit estimation of logistic innovation

Variable	Logit regression		Probit regression	
	Estimation	Prob.	Estimation	Prob.
Intercept	-2.158635	0.0000	-1.266433	0.0000
Employment	-0.000108	0.3503	-6.49E-05	0.3237
Formal training	1.101328	0.0000	0.615918	0.0000
R&D expenditures	1.52E-09	0.2810	9.83E-10	0.2600
Sector	0.003948	0.9313	0.005684	0.8176

Size	0.213515	0.0000	0.117411	0.0000
Temporary employment	0.000907	0.1371	0.000567	0.1193
Years of education	-0.034266	0.0029	-0.018975	0.0024
Skill worker	0.000184	0.2578	0.000117	0.2071
Nbr obs.		6566		6566
chi2		235.75		237.20
Prob > chi2		0.0000		0.0000

Source: edited by the student using Eviews 10.0 (see appendix 0-23 and Appendix 0-26)

Equation 4-28: probit model for logistic innovation

LOGISTIC INNOVATION = 1-@CNORM(-(-1.26643261055 - 6.49128974298e-05*EMPLOYMENT + 0.6159175243*FORMAL_TRAINING + 9.82777508704e-10*RDEXPENDITURES + 0.00568380178819*SECTOR + 0.117411284903*SIZE + 0.000566642213877*TEMPR_EMPLOY - 0.0189752727208*YEARS_EDUCATION + 0.000117435752993*SKILL_WORKER))

Equation 4-29: logit model for logistic innovation

LOGISTIC_INNOVATION = 1-@CLOGISTIC(-(-2.15863508408 - 0.000108349042843*EMPLOYMENT + 1.10132806071*FORMAL_TRAINING + 1.5202539396e-09*RDEXPENDITURES + 0.00394765025966*SECTOR + 0.213514627347*SIZE + 0.000906582821443*TEMPR_EMPLOY - 0.0342655276519*YEARS_EDUCATION + 0.00018357201966*SKILL_WORKER))

Table 4-31 contains the estimated effects of the logit and probit models on the determinants of logistic innovation. Starting with the formal training program, following the negative estimation parameters of both logit and probit model (-1.096 and -0.613 respectively) and odds ratio less than 1 (0.334), the firms that are offering formal training programs are more likely to innovate in logistics than the firms that are not. However, for the sector of activity, the firms in retailing are more likely to innovate than manufacturing following the positive estimation parameter of logit and probit (0.336 and 0.169 respectively). However, the firms in services sector are less likely to innovate in logistic than manufacturing firms (negative estimation parameters of logit that is -0.008) and odds ratio less than 1 (0.992).

Also, Table 4-31 contains the estimation parameters for the size of the firms also. By using micro-sized firms as reference, the small-sized are less likely to innovate than the micro sized firms (negative estimation parameter of logit and probit that are -0.056 of logit with 0.946 of adds ration and -0.042 of probit estimation parameter). However, the medium and large sized firms are more likely to innovate in logistic than micro-sized firms (positive estimation parameters of logit and probit test and odds ratio more than 1)

Table 4-31:logit and probit estimation of logistic innovation

Variable	Logistic regression		Probit regression
	Estimation	Odds ratio	Estimation
Intercept	-0.804		-0.494
R&D expenditures	0.000	1.000	0.000
Years of education	-0.039	0.961	-0.021
Employment	0.000	1.000	0.000
Temporary employment	0.001	1.001	0.001
Skilled worker	0.000	1.000	0.000
Formal training (yes)	0.000		0.000
Formal training (no)	-1.096	0.334	-0.613
sector-1 (manufacturing)	0.000		0.000
sector-2 (retail)	0.336	1.399	0.169
sector-3 (services)	-0.008	0.992	0.003
size-0 (micro)	0.000		0.000
size-1 (small)	-0.056	0.946	-0.042
size-2 (medium)	0.203	1.225	0.094
size-3 (large)	0.414	1.513	0.211
Nbr obs.	6566		6566
chi2	245.79		245.58
Prob > chi2	0.0000		0.0000

Source: edited by the student using Xlstat 2016 (see Appendix 0-27 and Appendix 0-24)

The Equation 4-30 and Equation 4-31 presents the logit and probit estimation models of logistic innovation:

Equation 4-30: The logit model of logistic innovation

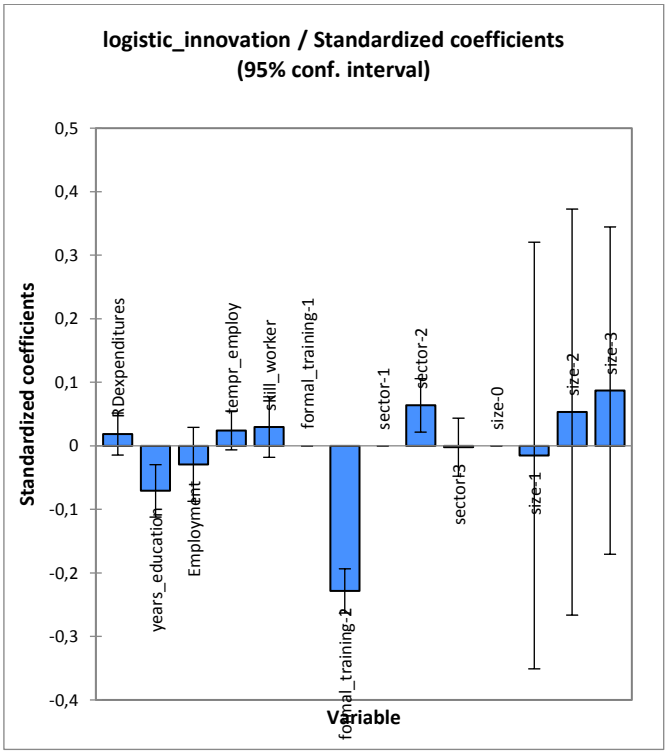
Pred(logistic innovation) = 1 / (1 + exp(-(-0,804081009857006+1,56828145275331E-09*RDexpenditures-3,93971556284773E-02*years_education-1,13361911583486E-04*Employment+9,46226794270507E-04*tempr_employ+1,95542516461687E-04*skill_worker-1,09623619510878*formal_training-2+0,335759148717674*sector-2-8,45893827266946E-03*sector-3-5,55119637581657E-02*size-1+0,202906970204663*size-2+0,413999755614473*size-3)))

Equation 4-31: probit model of logistic innovation

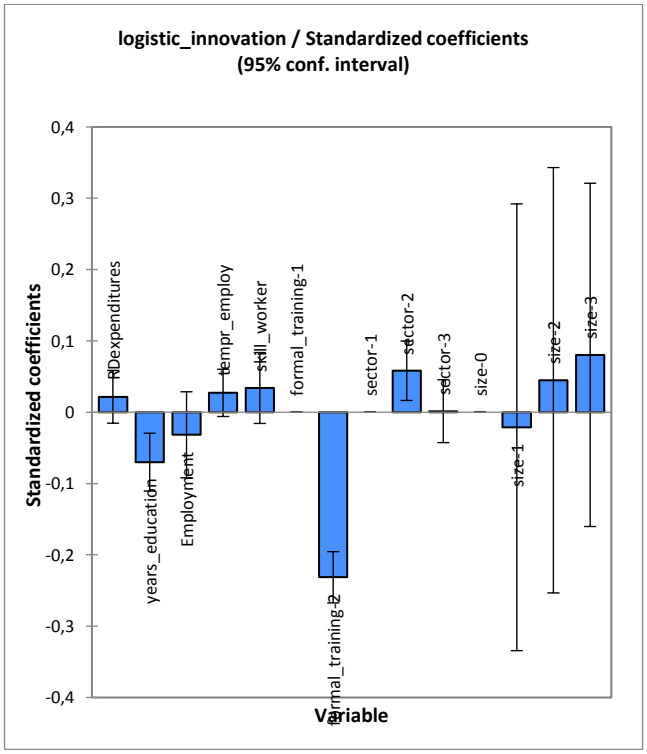
Pred(logistic innovation) = XLSTAT_CDFNormal(-0,4942198191192+1,00768002798414E-09*RDexpenditures-2,14095031757733E-02*years_education-6,7993194456451E-05*Employment+5,85424418428485E-04*tempr_employ+1,24291943982314E-04*skill_worker-0,612538180542861*formal_training-2+0,169208746265132*sector-2+3,22906015591765E-03*sector-3-4,22923988889755E-02*size-1+9,43344810671445E-02*size-2+0,211245739106412*size-3)

Figure 4-7: standardized coefficient for logistic innovation

Logit



Probit



Source: edited by the student using Xlstat 2016 (see Appendix 0-25 and Appendix 0-28)

4.9.6 Logit and probit estimation for process innovation:

Table 4-32 contains the estimated effects of the logit and probit models on the determinants of process innovation. Following the different types of innovation, the formal training has significant positive effect on process innovation using logit and probit estimation at 1% (1.39 and 0.80 respectively). In addition, the size of the firm has also significant positive effect on process innovation at 1%. However, all of employment, R&D expenditures, sector of activity and skill worker does not have significant effect on the process innovation.

Table 4-32: logit and probit estimation of process innovation

Variable	Logit regression		Probit regression	
	Estimation	Prob.	Estimation	Prob.
Intercept	-1.946495	0.0000	-1.158662	0.0000
Employment	8.14E-05	0.3366	4.86E-05	0.3431
Formal training	1.390492	0.0000	0.809338	0.0000
R&D expenditures	1.97E-09	0.3046	1.19E-09	0.2345
Sector	0.007921	0.8491	0.005717	0.8055
Size	0.132127	0.0059	0.077455	0.0041
Temporary employment	0.001411	0.0171	0.000852	0.0145
Years of education	-0.020965	0.0522	-0.011908	0.0471
Skill worker	0.000344	0.1420	0.000204	0.1382
Nbr obs.		6566		6566
chi2		428.15		429.74
Prob > chi2		0.0000		0.0000

Source: edited by the student using Eviews 10.0 (see appendix 0-29 and Appendix 0-36)

The Equation 4-32 and Equation 4-33 presents both logit and probit model respectively of process innovation

Equation 4-32: Logit model of process innovation

PROCESS_INNOVATION = 1-@CLOGISTIC(-(-1.94649530417 + 8.13600952776e-05*EMPLOYMENT + 1.39049201295*FORMAL_TRAINING + 1.97223670363e-09*RDEXPENDITURES + 0.0079214549419*SECTOR + 0.132126617989*SIZE + 0.00141064141579*TEMPR_EMPLOY - 0.020964906115*YEARS_EDUCATION + 0.000343611668312*SKILL_WORKER))

Equation 4-33: probit model of process innovation

PROCESS_INNOVATION = 1-@CNORM(-(-1.15866221402 + 4.86336512188e-05*EMPLOYMENT + 0.809337687272*FORMAL_TRAINING + 1.19033843906e-09*RDEXPENDITURES + 0.00571739026835*SECTOR + 0.0774546649124*SIZE + 0.00085244503091*TEMPR_EMPLOY - 0.0119075091771*YEARS_EDUCATION + 0.000204255257686*SKILL_WORKER))

Table 4-33 contains the estimated effects of the logit and probit models on the determinants of process innovation. The firms that are offering formal training are more likely to innovate their process than the firms that are not offering formal training for their employees (negative estimation parameter of logit and

probit estimation that are -1.396 and -0.813 respectively with odds ratio less than 1 that is 0.248). For the second categorical variables that is sector, manufacturing firms are less likely to innovate their process comparing with retailing and services (positive estimation parameters of logit and probit estimation that are 0.148 and 0.013 respectively for logit estimation and 0.082 and 0.011 respectively for probit estimation) in addition to odds ratio that are more than one for both retailing and services sectors (1.159 and 1.013 respectively). However, the size of the firms also has its effect on process innovation. Following the data presented in Table 4-33, the micro-sized firms are more likely to innovate the process than the other sized firms, this is due to the negative estimation parameters of logit and probit estimation of the three firms' level (-0.357, -0.053 and -0.131 respectively for logit, and -0.221, -0.050 and -0.092 respectively for probit) in addition to odds ratio less than 1 (0.700, 0.949 and 0.877 respectively).

Table 4-33:logit and probit estimation of process innovation

Variable	Logistic regression		Probit regression
	Estimation	Odds ratio	Estimation
Intercept	-0.118		-0.075
R&D expenditures	0.000	1.000	0.000
Years of education	-0.023	0.977	-0.013
Employment	0.000	1.000	0.000
Temporary employment	0.002	1.002	0.001
Skilled worker	0.000	1.000	0.000
Formal training (yes)	0.000		0.000
Formal training (no)	-1.396	0.248	-0.813
sector-1 (manufacturing)	0.000		0.000
sector-2 (retail)	0.148	1.159	0.082
sector-3 (services)	0.013	1.013	0.011
size-0 (micro)	0.000		0.000
size-1 (small)	-0.357	0.700	-0.221
size-2 (medium)	-0.053	0.949	-0.050
size-3 (large)	-0.131	0.877	-0.092
Nbr obs.	6566		6566
chi2	437.47		439.01
Prob > chi2	0.0000		0.0000

Source: edited by the student using Xlstat 2016 (see Appendix 0-37 and Appendix 0-30)

Both Equation 4-34 and Equation 4-35 presents the logit and probit model of the process innovation:

Equation 4-34: logistic model process innovation

Pred(process_innovation) = 1 / (1 + exp(-(-0,117530099228067+2,08279182519776E-09*RDexpenditures-2,27625700400671E-02*years_education+1,05244564409493E-04*Employment+1,50192878071774E-03*tempr_employ+4,11489903779555E-04*skill_worker-1,39554601512361*formal_training-2+0,147842787744228*sector-2+1,29430392047294E-02*sector-3-0,357319930912505*size-1-5,28306631974527E-02*size-2-0,131252256966415*size-3)))

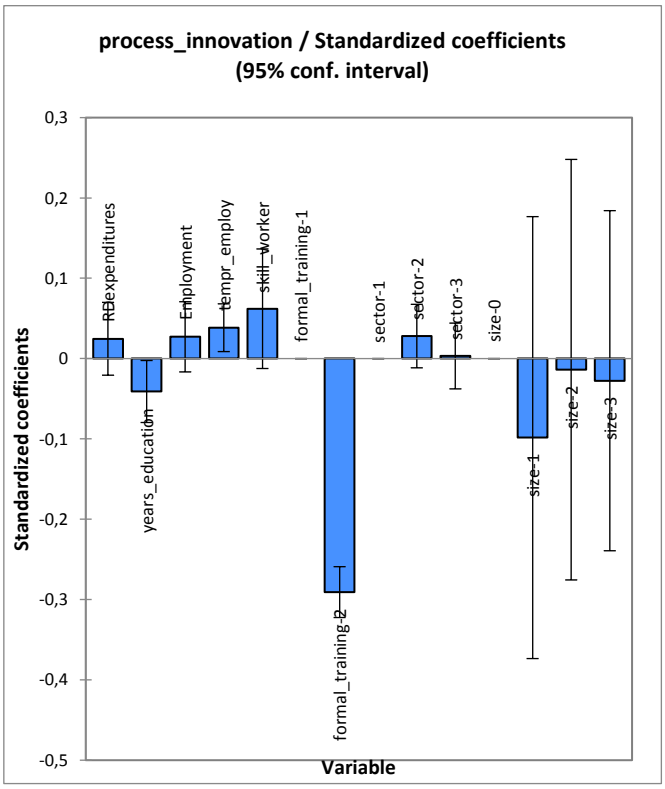
Equation 4-35: probit model of process innovation

Pred(process_innovation) = XLSTAT_CDFNormal(-7,54264037786863E-02+1,25247480999068E-09*RDexpenditures-1,29356810651561E-02*years_education+6,32464086878167E-05*Employment+9,0101957597474E-04*tempr_employ+2,41854916819802E-04*skill_worker-0,812770636430846*formal_training-2+8,15901599847241E-02*sector-2+0,010894257441532*sector-3-0,220859036383775*size-1-4,97638858031646E-02*size-2-9,22926941988152E-02*size-3)

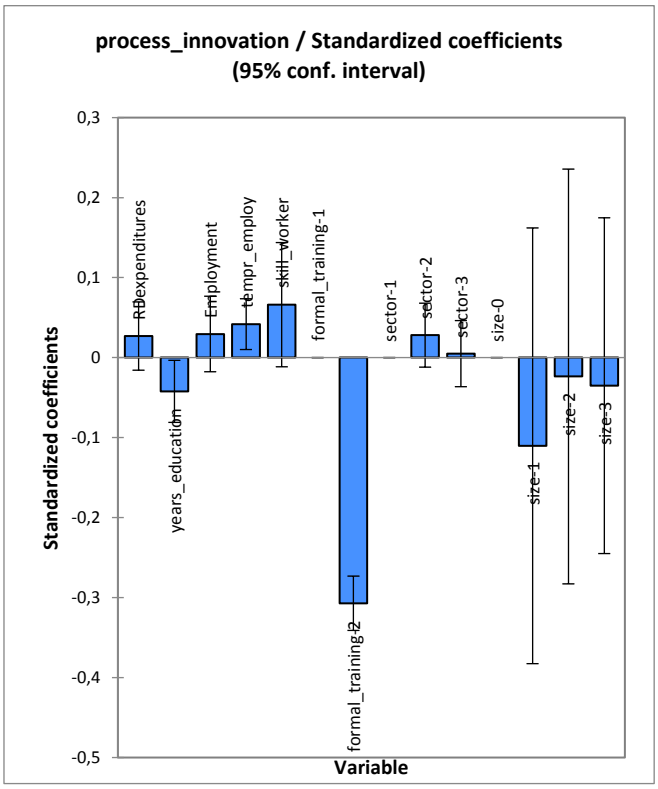
The Figure 4-8 below reveals also the standardized coefficient of the independent variables in the both model logit and probit for process innovation. The Figure 4-8 shows that do not offering formal training programs has negative standardized coefficient on both logit and probit estimation (using offering formal training program as reference). These confirms that the firms with formal training programs are more likely to innovate their process rather than the firms that did not offer formal training programs.

Figure 4-8: standardized coefficient of logit-probit model for process innovation

Logit



Probit



Source: edited by the student using Xlstat 2016(Source: outputs of the software Xlstat 2016

Appendix 0-31 and Appendix 0-38)

Also, the sector of work has its effect on the process innovation. using the manufacturing as reference, the retailing and services are a bit more likely to innovate their process rather than manufacturing firms. also, the micro-firms are more likely to have process innovation than the firms of the other sizes.

4.10 Chapter Conclusion:

The principal objectives of this chapter were the examination of the major determinants of firm's innovation basing on the training and employment as determinants in the first step, and on the types of the innovation in the second step using the Beeps dataset.

Starting with exploratory study of training and innovation in MENA region, following the data presented, the countries of this region are not interested in innovation. This latest influence their ranking in GII where the countries of MENA region ranked in the latest lists. From another side, the inexistence of the data obliged us to look for another source of data. To realize the objectives of this chapter, the study

based on the BEEPS, and the econometric techniques of binary logit and probit regression models were used. The chapter produced some stylized facts regarding innovation in the MENA region's firms. The firms of the sample distributed in three sectors where the first rate is for manufacturing followed by services in the second rate and retailing in the last rates. Most of these firms are small firms, followed by medium sized firms, and the large firms take the third place followed by micro-sized firms in the fourth place. Following the descriptive statistic, under than 20% of the surveyed firms do not interest in training.

First, it established that less than the half (44%) of the firms interviewed are innovative. For the innovative firms, there were innovative at least in one of the five types selected above (product, process, organizational, marketing and logistic).

In the first, marketing innovative firm, followed by product innovative firms in the second rates. The third place for the process innovation, and after the organizational innovation firms and firms in logistic innovation. Therefore, it established that the major determinants of innovation were training, firms' sector of activity, firm's size, temporary and skilled employees in addition to the years of education of the employees. Surprisingly, employment was found to be not significative in determining innovation. More precisely, years of education is a negative determinant of innovation of the firms. However, training has an important role in the innovation. also, the manufacturing firms were found more likely to innovate than the firms in the other sectors. Where, the micro-sized firms are less likely to innovate than the other firms. More precisely, formal training program is an important determinant for all of product, process, organizational, marketing and logistic innovation. Again, microenterprises were more likely to be innovative just in process innovation than small, medium and large firms. However, medium and large firms are more likely to be innovative in all of logistic, organizational, marketing and product innovation than micro-sized firms. Also, small-sized firms are less likely also to be innovative in logistic than medium and large firms. While, manufacturing firms are less likely to innovate in logistic, organizational, marketing and process innovation. However, there were more likely to innovate in product than retail and services firms. However, retail firms are more like to innovate in logistic innovation than both of manufacturing and services firms.

GENERAL CONCLUSION

General Conclusion:

This thesis focuses on revealing the effect of both training and employment on the innovativeness of the firms in MENA region using BEEPS dataset. Firstly, through the indicator analysis and secondly by investigating the validity of the effect of training and employment on Innovation in the firms of MENA region using logit and probit model. Several conclusions were drawn and they are as follows:

For the theoretical parts that it includes all of three first chapters, and starting with the first chapter that is turn around the importance of human capital in the economic growth, the presented models in the chapter shows that the human capital plays an important role in the economic growth. In addition, the human capital is a sensible factor that is related with the individual. Therefore, there are different variables that affect human capital such as education, migration and even the gender. Also, the training is an important factor that affect human capital. Therefore, the second chapter focus on this factor.

The second chapter focuses on the training because it is one of the factors that affect human capital from a side, and it is considered as an important process of creativity and solving problem. Also, the training could see in different sector following its necessity to generate client satisfaction especially in the service sector such as tourism, hospitality and restauration. Also, it is considered as source of solving problems. After using training to develop the human capital, it could arrive to the step of creativity and innovation following the generation of innovative ideas.

Therefore, the third chapter is focused on the innovation as the developed steps after economic growth. This chapter allows us to understand that the innovation and its relation especially in the side of the employees and how could the human capital affect the innovation in the firms.

For the empirical parts that it includes the fourth chapter that will answers the questions of our thesis, the first section mentions the lack in the training and Research and development that are two important determinants of innovation. However, following the Global Innovation Index, the MENA countries ranked among the last countries. This means that these firms are fare from the innovative countries.

For the empirical results using BEEPS dataset of the world bank, the descriptive analysis presents that just few firms of the MENA region are interested in Innovation. However, the majority of the firms are not-innovative firms. This result invalidates the first hypothesis that the majority of the firms in the MENA region are interested in innovation. Where, the majority of the innovative firms are in the local market, that are concentrated also in marketing types of innovation followed by the product innovation in the second rates.

For the formal training programs, the results mention that the majority of the firms in the MENA region are not interested in this program. This latest will invalidates also the second hypothesis that the firms in the MENA region are interested in the formal training programs for their employees.

For the results of the econometric study, there training has a significant positive effect on the innovation of the firms in the MENA region. Also, the formal training programs has positive effect on all types of innovation (marketing, process, product, organizational and logistic). These results validate the third hypothesis of the thesis.

However, the permanent employment has non-significative effect on innovation. Also, the permanent employment has non-significative effect on all types of innovation except organizational innovation, it has a negative effect on it. These results show invalidated the fourth hypothesis of our study. Where, from another side, the temporary and skilled employees have a positive significative effect on innovation in all types of innovation except the non-significative effect of skilled employees on both process innovation and logistic innovation.

Policy recommendation:

The policy implications of the thesis are that any firms desired to be innovative in any of the following types that are product, process, organizational, marketing or logistic should pay attention to formal training program, sector of activity and size of the firm. Specifically, for the firms that want to strengthen all of organizational innovation, they should engage also in research and development.

Any public policy intending to encourage firm's innovative behavior should also be directed to small, medium and large firms as well as to manufacturing in the product innovation, and to retail and service in all of organizational, marketing and process innovation.

From the side of the states, the BEEPS data set does not have any response from the Algerian firms. These latest opened different questions because the proposition of Algeria is existing. This latest means that the Algerian firms did not give response about this study. This behavior of neglection do not allow us to study these firms from a side, and to find solutions for their problems from another, and even propose ways for the innovation.

Suggestion for future studies:

This research opens various new horizons for other future further research about both of training and innovation and the links between them. Accordingly, several new subjects are proposed such as:

The training effect on the firm's innovativeness of underdeveloped countries

The education and innovation: what's a relation?

The effect of training sustainability on the economic growth of the country.

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Appendixes

Appendix 0-1: Kirkpatrick's four levels of training evaluation in detail

Level	Evaluation type (what is measured)	Evaluation description and characteristics	Examples of evaluation tools and methods	relevance and practicability
1	Reaction	Reaction evaluation is how the delegates felt about the training or learning experience	'Happy sheets' feedback forms. Verbal reaction post-training surveys or questionnaires.	Quick and very easy to obtain. Not expensive to gather or to analyze.
2	Learning	Learning evaluation is the measurement of the increase in knowledge-before and after.	Typically, assessments or tests before and after the training. Interview or observation can also be used.	Relatively simple to set up; clear-cut for quantifiable skills. Less easy for complex learning.
3	Behavior	Behavior evaluation is the extent of applied learning back on the job-implementation.	Observation and interview over time are required to assess change, relevance of change, and sustainability of change.	Measurement of behavior change typically requires cooperation and skill of line-managers.
4	Results	Results evaluation is the effect on the business or environment by the trainee.	Measures are already in place via normal management systems and reporting the challenge is to relate to the trainee.	Individually not difficult; unlike whole organization. Process must attribute clear accountabilities.

Source : http://www.businessballs.com/kirkpatricklearningevaluationmodel.htm

To get more details about the Kirkpatrick's four levels of the training evaluation, the table below could demonstrate it with more details:

Appendix 0-2: Kirkpatrick's four levels of training evaluation in detail

Evaluation level and type	Evaluation description and characteristics	Examples of evaluation tools and methods	Relevance and practicability
Reaction	Reaction evaluation is how the delegates felt, and their personal reactions to the training or learning experience. For example: Did the trainees like and enjoy the training? Did they consider the training relevant? Was it a good use of their time? Did they like the venue, the style, timing, domestics, etc.? Level of participation. Ease and comfort of experience. Level of effort required to make the most of the learning. Perceive practicability and potential applying the learning.	Typically, 'happy sheets'. Feedback forms based on subjective personal reaction to the training experience. Verbal reaction which can be noted and analyzed. Post-training Survey or questionnaires. Online evaluation or grading by delegates. Subsequent verbal or written reports given by delegates to managers back at their jobs.	Can be done immediately the training ends. Very easy to obtain reaction feedback. Feedback is not expensive to gather or to analyze for groups. Important to know that people were not upset or disappointed. Important to know that people were not upset or disappointed. Important that people give a positive impression when relating their experience to others who might be deciding whether to experience same.
Learning	Learning evaluation is the measurement of the increase in knowledge or	Typically, assessments or tests before and after the training.	Relatively simple to set up, but more investment and thought required than reaction evaluation.

	intellectual capability from before to after the learning experience: Did the trainees learn what intended to be taught? Did the trainee experience what was intended for them to experience? What is the extent of advancement or change in the trainees after the training, in the direction or area that was intended?	Interview or observation can be used before and after although this time-consuming and can be inconsistent. Methods of assessment need to be closely related to the aims of the learning. Measurement and analysis is possible and easy on a group scale. Reliable, clear scoring and measurements need to be established, so as to limit the risk of inconsistent assessment. Hard copy, electronic, online or interview style assessments are all possible.	Highly relevant and clear-cut for certain training such as quantifiable or technical skills. Less easy for more complex learning such as attitudinal development, which is famously difficult to assess. Cost escalates if systems are poorly designed, which increases work required to measure and analyze.
Behavior	Behavior evaluation is the extent to which the trainees applied the learning and changed their behavior, and this can be immediately and several months after the training, depending on the situation: Did the trainees put their learning into effect when back on the job?	Observation and interview over time are required to assess change, relevance of change, and sustainability of change. Arbitrary snapshot assessments are not reliable because people change in different ways at different times.	Measurement of behavior change is less easy to quantify and interpret than reaction and learning evaluation. Simple quick response systems unlikely to be adequate.

	Were the relevant skills and knowledge used Was there noticeable and measurable change in the activity and performance of the trainees when back in their roles? Was the change in behavior and new level of knowledge sustained? Would the trainee be able to transfer their learning to another person? Is the trainee aware of their change in behavior, knowledge, skill level?	Assessments need to be subtle and ongoing, and then transferred to a suitable analysis tool. Assessments need to be designed to reduce subjective judgement of the observer or interviewer, which is a variable factor that can affect reliability and consistency of measurements. The opinion of the trainee, which is a relevant indicator, is also subjective and unreliable, and so needs to be measured in a consistent defined way. 360-degree feedback is useful method and need not be used before training, because respondents can make a judgement as to change after training, and this can be analyzed for groups of respondents and trainees. Assessments can be designed around relevant performance scenarios, and	Cooperation and skill of observers, typically line-managers, are important factors, and difficult to control. Management and analysis of ongoing subtle assessments are difficult, and virtually impossible without a well-designed system from the beginning. Evaluation of implementation and application is an extremely important assessment - there is little point in a good reaction and good increase in capability if nothing changes back in the job, therefore evaluation in this area is vital, albeit challenging. Behavior change evaluation is possible given good support and involvement from line managers or trainees, so it is helpful to involve them from the start, and to identify benefits for them, which links to the level 4 evaluation below.

		specific key performance indicators or criteria. Online and electronic assessments are more difficult to incorporate - assessments tend to be more successful when integrated within existing management and coaching protocols. Self-assessment can be useful, using carefully designed criteria and measurements.

Appendix 0-3: Logistic regression of innovation

Dependent Variable : INNOVATION

Method: ML - Binary Logit (Newton-Raphson / Marquardt steps)

Date : 02/07/19 Time : 17:41

Sample: 1 6566

Included observations : 6566

Convergence achieved after 9 iterations

Coefficient covariance computed using observed Hessian

Variable	Coefficient	Std. Error	z-Statistic	Prob.
C	-0.400034	0.110702	-3.613621	0.0003
EMPLOYMENT	-5.89E-05	8.41E-05	-0.700672	0.4835
FORMAL_TRAINING	1.346958	0.075552	17.82832	0.0000
RDEXPENDITURES	9.92E-08	3.36E-08	2.949929	0.0032
SECTOR	-0.139773	0.032452	-4.307128	0.0000
SIZE	0.182680	0.038578	4.735288	0.0000
TEMPR_EMPLOY	0.003654	0.001001	3.650498	0.0003
YEARS_EDUCATION	-0.019297	0.008343	-2.312881	0.0207
SKILL_WORKER	0.000968	0.000318	3.046383	0.0023

McFadden R-squared	0.068226	Mean dependent var	0.439994
S.D. dependent var	0.496424	S.E. of regression	0.473456
Akaike info criterion	1.281002	Sum squared resid	1469.823
Schwarz criterion	1.290309	Log likelihood	-4196.530
Hannan-Quinn criter.	1.284219	Deviance	8393.059
Restr. Deviance	9007.611	Restr. log likelihood	-4503.805
LR statistic	614.5516	Avg. log likelihood	-0.639130
Prob(LR statistic)	0.000000		

Obs with Dep=0	3677	Total obs	6566
Obs with Dep=1	2889		

Source: Outputs of Eviews 10

Appendix 0-4: logistic Model parameters for innovation

Source	Value	Standard error	Wald Chi-Square	Pr > Chi²	Wald Lower bound (95%)	Wald Upper bound (95%)	Odds ratio	Odds ratio Lower bound (95%)	Odds ratio Upper bound (95%)
Intercept	0.759	0.428	3.145	0.076	-0.080	1.599			
RDexpenditures	0.000	0.000	8.641	0.003	0.000	0.000	1.000	1.000	1.000
years_education	-0.020	0.008	5.483	0.019	-0.036	-0.003	0.980	0.964	0.997
Employment	0.000	0.000	0.263	0.608	0.000	0.000	1.000	1.000	1.000
tempr_employ	0.004	0.001	13.559	0.000	0.002	0.006	1.004	1.002	1.006
skill_worker	0.001	0.000	10.087	0.001	0.000	0.002	1.001	1.000	1.002
formal_training-1	0.000	0.000							
formal_training-2	-1.350	0.076	318.598	< 0,0001	-1.499	-1.202	0.259	0.223	0.301
sector-1	0.000	0.000							
sector-2	-0.110	0.082	1.792	0.181	-0.272	0.051	0.896	0.762	1.053
sector-3	-0.279	0.065	18.337	< 0,0001	-0.407	-0.151	0.757	0.666	0.860
size-0	0.000	0.000							
size-1	0.216	0.415	0.270	0.603	-0.598	1.030	1.241	0.550	2.800
size-2	0.458	0.416	1.212	0.271	-0.357	1.273	1.580	0.700	3.570
size-3	0.542	0.420	1.662	0.197	-0.282	1.365	1.719	0.754	3.917

Source: outputs of the software xlstat 2016

Appendix 0-5: Standardized coefficients of logit model for innovation

Source	Value	Standard error	Wald Chi-Square	Pr > Chi²	Wald Lower bound (95%)	Wald Upper bound (95%)
RDexpenditures	1.169	0.398	8.641	0.003	0.389	1.948
years_education	-0.035	0.015	5.483	0.019	-0.065	-0.006
Employment	-0.011	0.022	0.263	0.608	-0.054	0.032
tempr_employ	0.094	0.026	13.559	0.000	0.044	0.145
skill_worker	0.156	0.049	10.087	0.001	0.060	0.252

formal_training-1	0.000	0.000				
formal_training-2	-0.281	0.016	318.598	< 0,0001	-0.312	-0.250
sector-1	0.000	0.000				
sector-2	-0.021	0.016	1.792	0.181	-0.051	0.010
sector-3	-0.069	0.016	18.337	< 0,0001	-0.101	-0.038
size-0	0.000	0.000				
size-1	0.059	0.114	0.270	0.603	-0.165	0.284
size-2	0.120	0.109	1.212	0.271	-0.094	0.333
size-3	0.114	0.088	1.662	0.197	-0.059	0.287

Source: outputs of the software xlstat 2016

Appendix 0-6: probit regression for innovation

Dependent Variable: INNOVATION

Method: ML - Binary Probit (Newton-Raphson / Marquardt steps)

Date: 02/07/19 Time: 17:53

Sample: 1 6566

Included observations: 6566

Convergence achieved after 7 iterations

Coefficient covariance computed using observed Hessian

Variable	Coefficient	Std. Error	z-Statistic	Prob.
C	-0.255174	0.068276	-3.737387	0.0002
EMPLOYMENT	-3.79E-05	5.26E-05	-0.720406	0.4713
FORMAL_TRAINING	0.833541	0.045507	18.31684	0.0000
RDEXPENDITURES	3.65E-08	9.33E-09	3.917026	0.0001
SECTOR	-0.085916	0.019795	-4.340209	0.0000
SIZE	0.114937	0.023628	4.864432	0.0000
TEMPR_EMPLOY	0.001998	0.000523	3.823246	0.0001
YEARS_EDUCATION	-0.011463	0.005150	-2.225766	0.0260
SKILL_WORKER	0.000570	0.000183	3.122079	0.0018

McFadden R-squared	0.067681	Mean dependent var	0.439994
S.D. dependent var	0.496424	S.E. of regression	0.473755
Akaike info criterion	1.281750	Sum squared resid	1471.677

Schwarz criterion	1.291057	Log likelihood	-4198.986
Hannan-Quinn criter.	1.284967	Deviance	8397.971
Restr. Deviance	9007.611	Restr. log likelihood	-4503.805
LR statistic	609.6397	Avg. log likelihood	-0.639504
Prob(LR statistic)	0.000000		
Obs with Dep=0	3677	Total obs	6566
Obs with Dep=1	2889		

Source: outputs of the Eviews 10.0

Appendix 0-7:probit Model parameters for innovation

Source	Value	Standard error	Wald Chi-Square	Pr > Chi²	Wald Lower bound (95%)	Wald Upper bound (95%)
Intercept	0.472	0.256	3.400	0.065	-0.030	0.975
RDexpenditures	0.000	0.000	15.386	< 0,0001	0.000	0.000
years_education	-0.012	0.005	5.079	0.024	-0.022	-0.002
Employment	0.000	0.000	0.282	0.595	0.000	0.000
tempr_employ	0.002	0.001	14.934	0.000	0.001	0.003
skill_worker	0.001	0.000	10.621	0.001	0.000	0.001
formal_training-1	0.000	0.000				
formal_training-2	-0.836	0.046	336.387	< 0,0001	-0.925	-0.746
sector-1	0.000	0.000				
sector-2	-0.068	0.051	1.801	0.180	-0.167	0.031
sector-3	-0.171	0.040	18.654	< 0,0001	-0.249	-0.094
size-0	0.000	0.000				
size-1	0.126	0.248	0.258	0.611	-0.360	0.612
size-2	0.277	0.248	1.250	0.264	-0.209	0.764
size-3	0.332	0.251	1.752	0.186	-0.160	0.824

Source: outputs of the software Xlstat 2016

Appendix 0-8: Standardized coefficients of probit model for innovation

Source	Value	Standard error	Wald Chi-Square	Pr > Chi²	Wald Lower bound (95%)	Wald Upper bound (95%)
RDexpenditures	0.784	0.200	15.386	< 0,0001	0.392	1.176

years_education	-0.038	0.017	5.079	0.024	-0.071	-0.005
Employment	-0.013	0.025	0.282	0.595	-0.062	0.036
tempr_employ	0.094	0.024	14.934	0.000	0.046	0.142
skill_worker	0.165	0.051	10.621	0.001	0.066	0.264
formal_training-1	0.000	0.000				
formal_training-2	-0.316	0.017	336.387	< 0,0001	-0.349	-0.282
sector-1	0.000	0.000				
sector-2	-0.023	0.017	1.801	0.180	-0.058	0.011
sector-3	-0.077	0.018	18.654	< 0,0001	-0.113	-0.042
size-0	0.000	0.000				
size-1	0.063	0.124	0.258	0.611	-0.180	0.305
size-2	0.132	0.118	1.250	0.264	-0.099	0.363
size-3	0.126	0.096	1.752	0.186	-0.061	0.314

Source: outputs of the software xlstat 2016

Appendix 0-9: logit regression for product innovation

Dependent Variable: PRODUCT_INNOVATION

Method: ML - Binary Logit (Newton-Raphson / Marquardt steps)

Date: 02/07/19 Time: 18:10

Sample: 1 6566

Included observations: 6566

Convergence achieved after 4 iterations

Coefficient covariance computed using observed Hessian

Variable	Coefficient	Std. Error	z-Statistic	Prob.
C	-1.243802	0.131284	-9.474117	0.0000
EMPLOYMENT	-0.000113	9.88E-05	-1.147849	0.2510
FORMAL_TRAINING	1.107424	0.076970	14.38781	0.0000
RDEXPENDITURES	2.05E-09	2.06E-09	0.991911	0.3212
SECTOR	-0.341161	0.041376	-8.245404	0.0000
SIZE	0.212657	0.044906	4.735572	0.0000
TEMPR_EMPLOY	0.001244	0.000586	2.122681	0.0338
YEARS_EDUCATION	-0.017960	0.009550	-1.880550	0.0600
SKILL_WORKER	0.000411	0.000220	1.868151	0.0617

McFadden R-squared	0.058423	Mean dependent var	0.204386
S.D. dependent var	0.403283	S.E. of regression	0.390428
Akaike info criterion	0.956415	Sum squared resid	999.5120
Schwarz criterion	0.965721	Log likelihood	-3130.910
Hannan-Quinn criter.	0.959632	Deviance	6261.819
Restr. Deviance	6650.350	Restr. log likelihood	-3325.175
LR statistic	388.5308	Avg. log likelihood	-0.476837
Prob(LR statistic)	0.000000		
Obs with Dep=0	5224	Total obs	6566
Obs with Dep=1	1342		

Source: outputs of the software Eviews 10.0

Appendix 0-10: Model parameters of logit for product innovation

Source	Value	Standard error	Wald Chi-Square	Pr > Chi²	Wald Lower bound (95%)	Wald Upper bound (95%)	Odds ratio	Odds ratio Lower bound (95%)	Odds ratio Upper bound (95%)
Intercept	-0.377	0.558	0.457	0.499	-1.471	0.717			
RDexpenditures	0.000	0.000	1.024	0.312	0.000	0.000	1.000	1.000	1.000
years_education	-0.016	0.010	2.858	0.091	-0.035	0.003	0.984	0.965	1.003
Employment	0.000	0.000	0.700	0.403	0.000	0.000	1.000	1.000	1.000
tempr_employ	0.001	0.001	4.852	0.028	0.000	0.002	1.001	1.000	1.002
skill_worker	0.000	0.000	3.556	0.059	0.000	0.001	1.000	1.000	1.001
formal_training-1	0.000	0.000							
formal_training-2	-1.117	0.077	209.915	< 0,0001	-1.268	-0.966	0.327	0.281	0.381
sector-1	0.000	0.000							
sector-2	-0.479	0.106	20.443	< 0,0001	-0.686	-0.271	0.620	0.503	0.762
sector-3	-0.665	0.083	64.374	< 0,0001	-0.827	-0.502	0.514	0.437	0.605
size-0	0.000	0.000							
size-1	0.079	0.547	0.021	0.885	-0.994	1.152	1.082	0.370	3.164

size-2	0.410	0.548	0.561	0.454	-0.663	1.483	1.507	0.515	4.408
size-3	0.440	0.551	0.637	0.425	-0.640	1.520	1.552	0.527	4.571

Source: outputs of the software xlstat 2016

Appendix 0-11: Standardized coefficients of logit for product innovation

Source	Value	Standard error	Wald Chi-Square	Pr > Chi²	Wald Lower bound (95%)	Wald Upper bound (95%)
RDexpenditures	0.025	0.024	1.024	0.312	-0.023	0.073
years_education	-0.029	0.017	2.858	0.091	-0.063	0.005
Employment	-0.021	0.025	0.700	0.403	-0.069	0.028
tempr_employ	0.033	0.015	4.852	0.028	0.004	0.062
skill_worker	0.065	0.035	3.556	0.059	-0.003	0.133
formal_training-1	0.000	0.000				
formal_training-2	-0.233	0.016	209.915	< 0,0001	-0.264	-0.201
sector-1	0.000	0.000				
sector-2	-0.091	0.020	20.443	< 0,0001	-0.130	-0.051
sector-3	-0.165	0.021	64.374	< 0,0001	-0.206	-0.125
size-0	0.000	0.000				
size-1	0.022	0.151	0.021	0.885	-0.274	0.317
size-2	0.107	0.143	0.561	0.454	-0.174	0.388
size-3	0.092	0.116	0.637	0.425	-0.134	0.319

Source: outputs of the software xlstat 2016

Appendix 0-12: probit regression for product innovation

Dependent Variable: PRODUCT_INNOVATION

Method: ML - Binary Probit (Newton-Raphson / Marquardt steps)

Date: 02/09/19 Time: 13:58

Sample: 1 6566

Included observations: 6566

Convergence achieved after 5 iterations

Coefficient covariance computed using observed Hessian

Variable	Coefficient	Std. Error	z-Statistic	Prob.
C	-0.762616	0.075739	-10.06901	0.0000

EMPLOYMENT	-6.71E-05	5.46E-05	-1.229465	0.2189
FORMAL_TRAINING	0.649577	0.045853	14.16663	0.0000
RDEXPENDITURES	1.22E-09	1.04E-09	1.174105	0.2404
SECTOR	-0.191164	0.022964	-8.324473	0.0000
SIZE	0.123427	0.025844	4.775876	0.0000
TEMPR_EMPLOY	0.000798	0.000360	2.218798	0.0265
YEARS_EDUCATION	-0.010432	0.005583	-1.868496	0.0617
SKILL_WORKER	0.000256	0.000133	1.918601	0.0550

McFadden R-squared	0.058521	Mean dependent var	0.204386
S.D. dependent var	0.403283	S.E. of regression	0.390411
Akaike info criterion	0.956315	Sum squared resid	999.4234
Schwarz criterion	0.965621	Log likelihood	-3130.581
Hannan-Quinn criter.	0.959532	Deviance	6261.162
Restr. deviance	6650.350	Restr. log likelihood	-3325.175
LR statistic	389.1877	Avg. log likelihood	-0.476787
Prob(LR statistic)	0.000000		

Obs with Dep=0	5224	Total obs	6566
Obs with Dep=1	1342		

Source: outputs of the Eviews 10.0

Appendix 0-13: probit Model parameters for product innovation

Source	Value	Standard error	Wald Chi-Square	Pr > Chi²	Wald Lower bound (95%)	Wald Upper bound (95%)
Intercept	-0.234	0.303	0.596	0.440	-0.829	0.361
RDexpenditures	0.000	0.000	1.431	0.232	0.000	0.000
years_education	-0.009	0.006	2.737	0.098	-0.020	0.002
Employment	0.000	0.000	0.810	0.368	0.000	0.000
tempr_employ	0.001	0.000	5.246	0.022	0.000	0.002
skill_worker	0.000	0.000	3.838	0.050	0.000	0.001
formal_training-1	0.000	0.000				
formal_training-2	-0.656	0.046	203.856	< 0,0001	-0.746	-0.566
sector-1	0.000	0.000				

sector-2	-0.277	0.059	21.969	< 0,0001	-0.393	-0.161
sector-3	-0.373	0.046	65.668	< 0,0001	-0.463	-0.283
size-0	0.000	0.000				
size-1	0.036	0.296	0.015	0.902	-0.544	0.617
size-2	0.224	0.296	0.570	0.450	-0.357	0.805
size-3	0.243	0.299	0.661	0.416	-0.343	0.828

Source: outputs of the software xlstat 2016

Appendix 0-14: logistic regression for organizational innovation

Dependent Variable: ORGANIZATIONAL_INNOVATION

Method: ML - Binary Logit (Newton-Raphson / Marquardt steps)

Date: 02/07/19 Time: 18:56

Sample: 1 6566

Included observations: 6566

Convergence achieved after 5 iterations

Coefficient covariance computed using observed Hessian

Variable	Coefficient	Std. Error	z-Statistic	Prob.
C	-2.455046	0.152436	-16.10539	0.0000
EMPLOYMENT	-0.000230	0.000130	-1.763033	0.0779
FORMAL_TRAINING	1.357523	0.077951	17.41508	0.0000
RDEXPENDITURES	1.87E-08	5.62E-09	3.328699	0.0009
SECTOR	0.113822	0.042048	2.706928	0.0068
SIZE	0.257384	0.049430	5.207028	0.0000
TEMPR_EMPLOY	0.001785	0.000611	2.921924	0.0035
YEARS_EDUCATION	-0.015252	0.011320	-1.347364	0.1779
SKILL_WORKER	0.000890	0.000294	3.022515	0.0025

McFadden R-squared	0.080637	Mean dependent var	0.168748
S.D. dependent var	0.374558	S.E. of regression	0.358568
Akaike info criterion	0.837331	Sum squared resid	843.0380
Schwarz criterion	0.846638	Log likelihood	-2739.958
Hannan-Quinn criter.	0.840548	Deviance	5479.917
Restr. deviance	5960.557	Restr. log likelihood	-2980.278

LR statistic	480.6403	Avg. log likelihood	-0.417295
Prob(LR statistic)	0.000000		
Obs with Dep=0	5458	Total obs	6566
Obs with Dep=1	1108		

Source: outputs of the software Eviews 10.0

Appendix 0-15: logit Model Parameters for organizational innovation

Source	Value	Standard error	Wald Chi-Square	Pr > Chi²	Wald Lower bound (95%)	Wald Upper bound (95%)	Odds ratio	Odds ratio Lower bound (95%)	Odds ratio Upper bound (95%)
Intercept	-1.391	0.759	3.361	0.067	-2.877	0.096			
RDexpenditures	0.000	0.000	11.430	0.001	0.000	0.000	1.000	1.000	1.000
years_education	-0.020	0.011	2.918	0.088	-0.042	0.003	0.981	0.959	1.003
Employment	0.000	0.000	2.682	0.101	0.000	0.000	1.000	1.000	1.000
tempr_employ	0.002	0.001	9.130	0.003	0.001	0.003	1.002	1.001	1.003
skill_worker	0.001	0.000	10.270	0.001	0.000	0.002	1.001	1.000	1.002
formal_training-1	0.000	0.000							
formal_training-2	-1.358	0.078	302.506	< 0,0001	-1.511	-1.205	0.257	0.221	0.300
sector-1	0.000	0.000							
sector-2	0.402	0.107	14.179	0.000	0.193	0.611	1.494	1.212	1.842
sector-3	0.223	0.085	6.855	0.009	0.056	0.391	1.250	1.058	1.478
size-0	0.000	0.000							
size-1	0.627	0.750	0.701	0.403	-0.842	2.097	1.873	0.431	8.139
size-2	0.996	0.750	1.765	0.184	-0.473	2.466	2.708	0.623	11.772
size-3	1.134	0.753	2.268	0.132	-0.342	2.609	3.107	0.710	13.585

Source: outputs of the software Xlstat 2016

Appendix 0-16: Standardized coefficients of logit for organizational innovation

Source	Value	Standard error	Wald Chi-Square	Pr > Chi²	Wald Lower bound (95%)	Wald Upper bound (95%)
RDexpenditures	0.225	0.067	11.430	0.001	0.095	0.356
years_education	-0.035	0.021	2.918	0.088	-0.076	0.005
Employment	-0.053	0.032	2.682	0.101	-0.117	0.010
tempr_employ	0.047	0.016	9.130	0.003	0.017	0.078
skill_worker	0.144	0.045	10.270	0.001	0.056	0.232
formal_training-1	0.000	0.000				
formal_training-2	-0.283	0.016	302.506	< 0,0001	-0.315	-0.251
sector-1	0.000	0.000				
sector-2	0.076	0.020	14.179	0.000	0.036	0.116
sector-3	0.056	0.021	6.855	0.009	0.014	0.097
size-0	0.000	0.000				
size-1	0.173	0.206	0.701	0.403	-0.232	0.577
size-2	0.261	0.196	1.765	0.184	-0.124	0.646
size-3	0.238	0.158	2.268	0.132	-0.072	0.548

Source: outputs of the software Xlstat 2016

appendix 0-17: probit model for marketing innovation

Dependent Variable: MARKETING_INNOVATION

Method: ML - Binary Probit (Newton-Raphson / Marquardt steps)

Date: 02/09/19 Time: 14:17

Sample: 1 6566

Included observations: 6566

Convergence achieved after 3 iterations

Coefficient covariance computed using observed Hessian

Variable	Coefficient	Std. Error	z-Statistic	Prob.
C	-1.005522	0.076114	-13.21076	0.0000
EMPLOYMENT	-8.49E-06	5.12E-05	-0.165912	0.8682
FORMAL_TRAINING	0.786532	0.044521	17.66661	0.0000
RDEXPENDITURES	-3.91E-10	8.05E-10	-0.485992	0.6270
SECTOR	0.014803	0.021979	0.673511	0.5006
SIZE	0.102652	0.025658	4.000755	0.0001

TEMPR_EMPLOY	0.000600	0.000358	1.674652	0.0940
YEARS_EDUCATION	-0.014948	0.005671	-2.635958	0.0084
SKILL_WORKER	0.000329	0.000147	2.236750	0.0253

McFadden R-squared	0.063044	Mean dependent var	0.218702
S.D. dependent var	0.413398	S.E. of regression	0.398134
Akaike info criterion	0.987034	Sum squared resid	1039.354
Schwarz criterion	0.996340	Log likelihood	-3231.432
Hannan-Quinn criter.	0.990251	Deviance	6462.864
Restr. deviance	6897.724	Restr. log likelihood	-3448.862
LR statistic	434.8601	Avg. log likelihood	-0.492146
Prob(LR statistic)	0.000000		

Obs with Dep=0	5130	Total obs	6566
Obs with Dep=1	1436		

Source: outputs of the software Eviews 10.0

Appendix 0-18: Probit Model parameter for marketing innovation

Source	Value	Standard error	Wald Chi-Square	Pr > Chi²	Wald Lower bound (95%)	Wald Upper bound (95%)
Intercept	-0.220	0.301	0.531	0.466	-0.811	0.371
RDexpenditures	0.000	0.000	0.197	0.657	0.000	0.000
years_education	-0.016	0.006	8.204	0.004	-0.028	-0.005
Employment	0.000	0.000	0.001	0.981	0.000	0.000
tempr_employ	0.001	0.000	3.118	0.077	0.000	0.001
skill_worker	0.000	0.000	5.723	0.017	0.000	0.001
formal_training-1	0.000	0.000				
formal_training-2	-0.788	0.045	311.918	< 0,0001	-0.875	-0.700
sector-1	0.000	0.000				
sector-2	0.120	0.056	4.609	0.032	0.010	0.230
sector-3	0.026	0.044	0.342	0.558	-0.061	0.113
size-0	0.000	0.000				
size-1	0.103	0.294	0.122	0.727	-0.474	0.680

size-2	0.257	0.295	0.763	0.382	-0.320	0.835
size-3	0.295	0.297	0.986	0.321	-0.287	0.877

Source: outputs of the software Xlstat 2016

Appendix 0-19:standardized coefficients of probit for marketing innovation

Source	Value	Standard error	Wald Chi-Square	Pr > Chi²	Wald Lower bound (95%)	Wald Upper bound (95%)
RDexpenditures	-0.008	0.017	0.197	0.657	-0.041	0.026
years_education	-0.054	0.019	8.204	0.004	-0.090	-0.017
Employment	-0.001	0.024	0.001	0.981	-0.048	0.047
tempr_employ	0.029	0.017	3.118	0.077	-0.003	0.062
skill_worker	0.100	0.042	5.723	0.017	0.018	0.181
formal_training-1	0.000	0.000				
formal_training-2	-0.298	0.017	311.918	< 0,0001	-0.331	-0.265
sector-1	0.000	0.000				
sector-2	0.041	0.019	4.609	0.032	0.004	0.079
sector-3	0.012	0.020	0.342	0.558	-0.027	0.051
size-0	0.000	0.000				
size-1	0.051	0.147	0.122	0.727	-0.237	0.339
size-2	0.122	0.140	0.763	0.382	-0.152	0.397
size-3	0.112	0.113	0.986	0.321	-0.109	0.334

Source: outputs of the software Xlstat 2016

Appendix 0-20: logit model for marketing innovation

Dependent Variable: MARKETING_INNOVATION

Method: ML - Binary Logit (Newton-Raphson / Marquardt steps)

Date: 02/07/19 Time: 19:16

Sample: 1 6566

Included observations: 6566

Convergence achieved after 5 iterations

Coefficient covariance computed using observed Hessian

Variable	Coefficient	Std. Error	z-Statistic	Prob.
C	-1.664632	0.132356	-12.57689	0.0000

EMPLOYMENT	-1.30E-05	8.37E-05	-0.155761	0.8762
FORMAL_TRAINING	1.314958	0.073581	17.87083	0.0000
RDEXPENDITURES	-7.14E-10	1.30E-09	-0.548633	0.5833
SECTOR	0.025596	0.038340	0.667603	0.5044
SIZE	0.173149	0.044394	3.900255	0.0001
TEMPR_EMPLOY	0.000977	0.000584	1.673921	0.0941
YEARS_EDUCATION	-0.026069	0.009880	-2.638475	0.0083
SKILL_WORKER	0.000553	0.000254	2.175581	0.0296

McFadden R-squared	0.062797	Mean dependent var	0.218702
S.D. dependent var	0.413398	S.E. of regression	0.398197
Akaike info criterion	0.987294	Sum squared resid	1039.686
Schwarz criterion	0.996600	Log likelihood	-3232.285
Hannan-Quinn criter.	0.990511	Deviance	6464.570
Restr. deviance	6897.724	Restr. log likelihood	-3448.862
LR statistic	433.1537	Avg. log likelihood	-0.492276
Prob(LR statistic)	0.000000		

Obs with Dep=0	5130	Total obs	6566
Obs with Dep=1	1436		

Source: outputs of the software Eviews 10.0

Appendix 0-21: Model parameters of logit for marketing innovation

Source	Value	Standard error	Wald Chi-Square	Pr > Chi²	Wald Lower bound (95%)	Wald Upper bound (95%)	Odds ratio	Odds ratio Lower bound (95%)	Odds ratio Upper bound (95%)
Intercept	-0.416	0.565	0.543	0.461	-1.524	0.691			
RDexpenditures	0.000	0.000	0.254	0.614	0.000	0.000	1.000	1.000	1.000
years_education	-0.029	0.010	8.360	0.004	-0.049	-0.009	0.971	0.953	0.991
Employment	0.000	0.000	0.000	0.984	0.000	0.000	1.000	1.000	1.000

tempr_employ	0.001	0.001	3.159	0.076	0.000	0.002	1.001	1.000	1.002
skill_worker	0.001	0.000	5.553	0.018	0.000	0.001	1.001	1.000	1.001
formal_training-1	0.000	0.000							
formal_training-2	-1.317	0.074	319.079	< 0,0001	-1.461	-1.172	0.268	0.232	0.310
sector-1	0.000	0.000							
sector-2	0.222	0.097	5.208	0.022	0.031	0.412	1.248	1.032	1.510
sector-3	0.045	0.077	0.337	0.561	-0.107	0.197	1.046	0.899	1.218
size-0	0.000	0.000							
size-1	0.236	0.555	0.182	0.670	-0.851	1.324	1.267	0.427	3.758
size-2	0.506	0.555	0.831	0.362	-0.582	1.594	1.659	0.559	4.925
size-3	0.565	0.559	1.021	0.312	-0.530	1.660	1.759	0.588	5.257

Source: outputs of the software Xlstat 2016

Appendix 0-22: logit Standardized coefficients for marketing innovation

Source	Value	Standard error	Wald Chi-Square	Pr > Chi²	Wald Lower bound (95%)	Wald Upper bound (95%)
RDexpenditures	-0.008	0.015	0.254	0.614	-0.038	0.022
years_education	-0.052	0.018	8.360	0.004	-0.087	-0.017
Employment	0.000	0.022	0.000	0.984	-0.043	0.042
tempr_employ	0.027	0.015	3.159	0.076	-0.003	0.056
skill_worker	0.094	0.040	5.553	0.018	0.016	0.171
formal_training-1	0.000	0.000				
formal_training-2	-0.274	0.015	319.079	< 0,0001	-0.304	-0.244
sector-1	0.000	0.000				
sector-2	0.042	0.018	5.208	0.022	0.006	0.078
sector-3	0.011	0.019	0.337	0.561	-0.027	0.049
size-0	0.000	0.000				
size-1	0.065	0.153	0.182	0.670	-0.234	0.365
size-2	0.133	0.145	0.831	0.362	-0.152	0.418
size-3	0.119	0.117	1.021	0.312	-0.111	0.348

Source: outputs of the software Xlstat 2016

appendix 0-23: logit estimation of logistic innovation

Dependent Variable: LOGISTIC_INNOVATION

Method: ML - Binary Logit (Newton-Raphson / Marquardt steps)

Date: 02/07/19 Time: 22:45

Sample: 1 6566

Included observations: 6566

Convergence achieved after 6 iterations

Coefficient covariance computed using observed Hessian

Variable	Coefficient	Std. Error	z-Statistic	Prob.
C	-2.158635	0.155887	-13.84744	0.0000
EMPLOYMENT	-0.000108	0.000116	-0.933918	0.3503
FORMAL_TRAINING	1.101328	0.085030	12.95227	0.0000
RDEXPENDITURES	1.52E-09	1.41E-09	1.078047	0.2810
SECTOR	0.003948	0.045811	0.086173	0.9313
SIZE	0.213515	0.051832	4.119388	0.0000
TEMPR_EMPLOY	0.000907	0.000610	1.486496	0.1371
YEARS_EDUCATION	-0.034266	0.011522	-2.973991	0.0029
SKILL_WORKER	0.000184	0.000162	1.131674	0.2578

McFadden R-squared	0.045634	Mean dependent var	0.133719
S.D. dependent var	0.340376	S.E. of regression	0.333550
Akaike info criterion	0.753629	Sum squared resid	729.5023
Schwarz criterion	0.762936	Log likelihood	-2465.165
Hannan-Quinn criter.	0.756846	Deviance	4930.329
Restr. deviance	5166.076	Restr. log likelihood	-2583.038
LR statistic	235.7470	Avg. log likelihood	-0.375444
Prob(LR statistic)	0.000000		

Obs with Dep=0	5688	Total obs	6566
Obs with Dep=1	878		

Source: outputs of the software Eviews 10.0

Appendix 0-24: logit Model parameters for logistic innovation

Source	Value	Standard error	Wald Chi-Square	Pr > Chi²	Wald Lower bound (95%)	Wald Upper bound (95%)	Odds ratio	Odds ratio Lower bound (95%)	Odds ratio Upper bound (95%)
Intercept	-0.804	0.634	1.609	0.205	-2.047	0.438			
RDexpenditures	0.000	0.000	1.211	0.271	0.000	0.000	1.000	1.000	1.000
years_education	-0.039	0.012	11.360	0.001	-0.062	-0.016	0.961	0.940	0.984
Employment	0.000	0.000	0.964	0.326	0.000	0.000	1.000	1.000	1.000
tempr_employ	0.001	0.001	2.400	0.121	0.000	0.002	1.001	1.000	1.002
skill_worker	0.000	0.000	1.474	0.225	0.000	0.001	1.000	1.000	1.001
formal_training-1	0.000	0.000							
formal_training-2	-1.096	0.085	165.773	< 0,0001	-1.263	-0.929	0.334	0.283	0.395
sector-1	0.000	0.000							
sector-2	0.336	0.113	8.803	0.003	0.114	0.558	1.399	1.121	1.746
sector-3	-0.008	0.094	0.008	0.928	-0.192	0.175	0.992	0.825	1.191
size-0	0.000	0.000							
size-1	-0.056	0.622	0.008	0.929	-1.275	1.164	0.946	0.279	3.203
size-2	0.203	0.623	0.106	0.745	-1.017	1.423	1.225	0.362	4.151
size-3	0.414	0.626	0.437	0.508	-0.813	1.641	1.513	0.444	5.160

Source: outputs of the software Xlstat 2016

Appendix 0-25: logit Standardized coefficients for logistic innovation

Source	Value	Standard error	Wald Chi-Square	Pr > Chi²	Wald Lower bound (95%)	Wald Upper bound (95%)
RDexpenditures	0.019	0.017	1.211	0.271	-0.015	0.052

years_education	-0.071	0.021	11.360	0.001	-0.112	-0.030
Employment	-0.029	0.030	0.964	0.326	-0.087	0.029
tempr_employ	0.024	0.016	2.400	0.121	-0.006	0.055
skill_worker	0.029	0.024	1.474	0.225	-0.018	0.077
formal_training-1	0.000	0.000				
formal_training-2	-0.228	0.018	165.773	< 0,0001	-0.263	-0.194
sector-1	0.000	0.000				
sector-2	0.064	0.021	8.803	0.003	0.022	0.106
sector-3	-0.002	0.023	0.008	0.928	-0.048	0.044
size-0	0.000	0.000				
size-1	-0.015	0.171	0.008	0.929	-0.351	0.321
size-2	0.053	0.163	0.106	0.745	-0.266	0.373
size-3	0.087	0.131	0.437	0.508	-0.171	0.344

Source: outputs of the software Xlstat 2016

Appendix 0-26: probit estimation for logistic innovation

Dependent Variable: LOGISTIC_INNOVATION

Method: ML - Binary Probit (Newton-Raphson / Marquardt steps)

Date: 02/09/19 Time: 14:28

Sample: 1 6566

Included observations: 6566

Convergence achieved after 5 iterations

Coefficient covariance computed using observed Hessian

Variable	Coefficient	Std. Error	z-Statistic	Prob.
C	-1.266433	0.084399	-15.00539	0.0000
EMPLOYMENT	-6.49E-05	6.58E-05	-0.986873	0.3237
FORMAL_TRAINING	0.615918	0.048420	12.72022	0.0000
RDEXPENDITURES	9.83E-10	8.73E-10	1.126299	0.2600
SECTOR	0.005684	0.024638	0.230690	0.8176
SIZE	0.117411	0.028107	4.177334	0.0000
TEMPR_EMPLOY	0.000567	0.000364	1.557576	0.1193

YEARS_EDUCATION	-0.018975	0.006263	-3.029519	0.0024
SKILL_WORKER	0.000117	9.31E-05	1.261621	0.2071

McFadden R-squared	0.045914	Mean dependent var	0.133719
S.D. dependent var	0.340376	S.E. of regression	0.333509
Akaike info criterion	0.753408	Sum squared resid	729.3220
Schwarz criterion	0.762715	Log likelihood	-2464.440
Hannan-Quinn criter.	0.756626	Deviance	4928.879
Restr. deviance	5166.076	Restr. log likelihood	-2583.038
LR statistic	237.1971	Avg. log likelihood	-0.375333
Prob(LR statistic)	0.000000		

Obs with Dep=0	5688	Total obs	6566
Obs with Dep=1	878		

Source: outputs of the software Eviews 10.0

Appendix 0-27: Probit Model parameters of logistic innovation

Source	Value	Standard error	Wald Chi-Square	Pr > Chi²	Wald Lower bound (95%)	Wald Upper bound (95%)
Intercept	-0.494	0.327	2.280	0.131	-1.136	0.147
RDexpenditures	0.000	0.000	1.316	0.251	0.000	0.000
years_education	-0.021	0.006	11.418	0.001	-0.034	-0.009
Employment	0.000	0.000	1.061	0.303	0.000	0.000
tempr_employ	0.001	0.000	2.581	0.108	0.000	0.001
skill_worker	0.000	0.000	1.794	0.180	0.000	0.000
formal_training-1	0.000	0.000				
formal_training-2	-0.613	0.049	159.392	< 0,0001	-0.708	-0.517
sector-1	0.000	0.000				
sector-2	0.169	0.062	7.495	0.006	0.048	0.290
sector-3	0.003	0.050	0.004	0.948	-0.094	0.101
size-0	0.000	0.000				
size-1	-0.042	0.320	0.017	0.895	-0.669	0.585

size-2	0.094	0.320	0.087	0.768	-0.534	0.722
size-3	0.211	0.323	0.429	0.512	-0.421	0.843

Source: outputs of the software Xlstate 2016

Appendix 0-28:Probit Standardized coefficients of logistic innovation

Source	Value	Standard error	Wald Chi-Square	Pr > Chi²	Wald Lower bound (95%)	Wald Upper bound (95%)
RDexpenditures	0.022	0.019	1.316	0.251	-0.015	0.059
years_education	-0.070	0.021	11.418	0.001	-0.110	-0.029
Employment	-0.032	0.031	1.061	0.303	-0.092	0.029
tempr_employ	0.027	0.017	2.581	0.108	-0.006	0.060
skill_worker	0.034	0.025	1.794	0.180	-0.016	0.084
formal_training-1	0.000	0.000				
formal_training-2	-0.231	0.018	159.392	< 0,0001	-0.267	-0.196
sector-1	0.000	0.000				
sector-2	0.058	0.021	7.495	0.006	0.017	0.100
sector-3	0.001	0.022	0.004	0.948	-0.043	0.046
size-0	0.000	0.000				
size-1	-0.021	0.160	0.017	0.895	-0.334	0.292
size-2	0.045	0.152	0.087	0.768	-0.253	0.343
size-3	0.080	0.123	0.429	0.512	-0.160	0.321

Source: outputs of the software Xlstat 2016

appendix 0-29: logit model for process innovation

Dependent Variable: PROCESS_INNOVATION

Method: ML - Binary Logit (Newton-Raphson / Marquardt steps)

Date: 02/07/19 Time: 23:13

Sample: 1 6566

Included observations: 6566

Convergence achieved after 5 iterations

Coefficient covariance computed using observed Hessian

Variable	Coefficient	Std. Error	z-Statistic	Prob.

C	-1.946495	0.144884	-13.43483	0.0000
EMPLOYMENT	8.14E-05	8.47E-05	0.960940	0.3366
FORMAL_TRAINING	1.390492	0.077332	17.98081	0.0000
RDEXPENDITURES	1.97E-09	1.92E-09	1.026626	0.3046
SECTOR	0.007921	0.041642	0.190227	0.8491
SIZE	0.132127	0.047970	2.754377	0.0059
TEMPR_EMPLOY	0.001411	0.000592	2.384104	0.0171
YEARS_EDUCATION	-0.020965	0.010800	-1.941213	0.0522
SKILL_WORKER	0.000344	0.000234	1.468427	0.1420

McFadden R-squared	0.070274	Mean dependent var	0.175145
S.D. dependent var	0.380120	S.E. of regression	0.365620
Akaike info criterion	0.865435	Sum squared resid	876.5264
Schwarz criterion	0.874742	Log likelihood	-2832.223
Hannan-Quinn criter.	0.868652	Deviance	5664.447
Restr. deviance	6092.601	Restr. log likelihood	-3046.300
LR statistic	428.1542	Avg. log likelihood	-0.431347
Prob(LR statistic)	0.000000		

Obs with Dep=0	5416	Total obs	6566
Obs with Dep=1	1150		

Source: outputs of the software Eviews 10.0

Appendix 0-30: logit Model parameters of process innovation

Source	Value	Standard error	Wald Chi-Square	Pr > Chi²	Wald Lower bound (95%)	Wald Upper bound (95%)	Odds ratio	Odds ratio Lower bound (95%)	Odds ratio Upper bound (95%)
Intercept	-0.118	0.523	0.050	0.822	-1.143	0.908			
RDexpenditures	0.000	0.000	1.138	0.286	0.000	0.000	1.000	1.000	1.000

years_education	-0.023	0.011	4.333	0.037	-0.044	-0.001	0.977	0.957	0.999
Employment	0.000	0.000	1.473	0.225	0.000	0.000	1.000	1.000	1.000
tempr_employ	0.002	0.001	6.420	0.011	0.000	0.003	1.002	1.000	1.003
skill_worker	0.000	0.000	2.672	0.102	0.000	0.001	1.000	1.000	1.001
formal_training-1	0.000	0.000							
formal_training-2	-1.396	0.077	324.320	< 0,0001	-1.547	-1.244	0.248	0.213	0.288
sector-1	0.000	0.000							
sector-2	0.148	0.106	1.929	0.165	-0.061	0.356	1.159	0.941	1.428
sector-3	0.013	0.084	0.024	0.878	-0.152	0.178	1.013	0.859	1.194
size-0	0.000	0.000							
size-1	-0.357	0.510	0.491	0.483	-1.356	0.642	0.700	0.258	1.900
size-2	-0.053	0.510	0.011	0.918	-1.052	0.947	0.949	0.349	2.578
size-3	-0.131	0.515	0.065	0.799	-1.140	0.877	0.877	0.320	2.404

Source: outputs of the software Xlstat 2016

Appendix 0-31: Logit Standardized coefficients of process innovation

Source	Value	Standard error	Wald Chi-Square	Pr > Chi²	Wald Lower bound (95%)	Wald Upper bound (95%)
RDexpenditures	0.025	0.023	1.138	0.286	-0.021	0.070
years_education	-0.041	0.020	4.333	0.037	-0.080	-0.002
Employment	0.027	0.022	1.473	0.225	-0.017	0.071
tempr_employ	0.038	0.015	6.420	0.011	0.009	0.068
skill_worker	0.062	0.038	2.672	0.102	-0.012	0.136
formal_training-1	0.000	0.000				
formal_training-2	-0.291	0.016	324.320	< 0,0001	-0.322	-0.259
sector-1	0.000	0.000				

sector-2	0.028	0.020	1.929	0.165	-0.012	0.068
sector-3	0.003	0.021	0.024	0.878	-0.038	0.044
size-0	0.000	0.000				
size-1	-0.098	0.140	0.491	0.483	-0.373	0.177
size-2	-0.014	0.134	0.011	0.918	-0.276	0.248
size-3	-0.028	0.108	0.065	0.799	-0.239	0.184

Source: outputs of the software Xlstat 2016

Appendix 0-32: Probit Standardized coefficients of product innovation

Source	Value	Standard error	Wald Chi-Square	Pr > Chi²	Wald Lower bound (95%)	Wald Upper bound (95%)
RDexpenditures	0.027	0.022	1.431	0.232	-0.017	0.071
years_education	-0.030	0.018	2.737	0.098	-0.066	0.006
Employment	-0.023	0.026	0.810	0.368	-0.073	0.027
tempr_employ	0.038	0.017	5.246	0.022	0.006	0.071
skill_worker	0.074	0.038	3.838	0.050	0.000	0.148
formal_training-1	0.000	0.000				
formal_training-2	-0.248	0.017	203.856	< 0,0001	-0.282	-0.214
sector-1	0.000	0.000				
sector-2	-0.095	0.020	21.969	< 0,0001	-0.135	-0.055
sector-3	-0.168	0.021	65.668	< 0,0001	-0.209	-0.128
size-0	0.000	0.000				
size-1	0.018	0.148	0.015	0.902	-0.272	0.308
size-2	0.106	0.141	0.570	0.450	-0.170	0.382
size-3	0.092	0.114	0.661	0.416	-0.130	0.315

Source: outputs of the software Xlstat 2016

Appendix 0-33: probit estimation for organizational innovation

Dependent Variable: ORGANIZATIONAL_INNOVATION

Method: ML - Binary Probit (Newton-Raphson / Marquardt steps)

Date: 02/09/19 Time: 14:08

Sample: 1 6566

Included observations: 6566

Convergence achieved after 6 iterations

Coefficient covariance computed using observed Hessian

Variable	Coefficient	Std. Error	z-Statistic	Prob.
C	-1.441028	0.083254	-17.30876	0.0000
EMPLOYMENT	-0.000134	7.19E-05	-1.858157	0.0631
FORMAL_TRAINING	0.788050	0.045990	17.13541	0.0000
RDEXPENDITURES	1.13E-08	3.32E-09	3.394849	0.0007
SECTOR	0.064794	0.023401	2.768852	0.0056
SIZE	0.148257	0.027609	5.369909	0.0000
TEMPR_EMPLOY	0.001083	0.000365	2.963581	0.0030
YEARS_EDUCATION	-0.008834	0.006172	-1.431301	0.1523
SKILL_WORKER	0.000527	0.000169	3.110821	0.0019

McFadden R-squared	0.081205	Mean dependent var	0.168748
S.D. dependent var	0.374558	S.E. of regression	0.358464
Akaike info criterion	0.836815	Sum squared resid	842.5497
Schwarz criterion	0.846122	Log likelihood	-2738.265
Hannan-Quinn criter.	0.840033	Deviance	5476.529
Restr. Deviance	5960.557	Restr. log likelihood	-2980.278
LR statistic	484.0277	Avg. log likelihood	-0.417037
Prob(LR statistic)	0.000000		

Obs with Dep=0	5458	Total obs	6566
Obs with Dep=1	1108		

Source: outputs of the software Eviews 2016

Appendix 0-34:Probit Model parameters of organizational innovation

Source	Value	Standard error	Wald Chi-Square	Pr > Chi²	Wald Lower bound (95%)	Wald Upper

						bound (95%)
Intercept	-0.720	0.363	3.940	0.047	-1.431	-0.009
RDexpenditures	0.000	0.000	11.836	0.001	0.000	0.000
years_education	-0.011	0.006	3.192	0.074	-0.023	0.001
Employment	0.000	0.000	2.965	0.085	0.000	0.000
tempr_employ	0.001	0.000	9.357	0.002	0.000	0.002
skill_worker	0.001	0.000	10.721	0.001	0.000	0.001
formal_training-1	0.000	0.000				
formal_training-2	-0.789	0.046	293.142	< 0,0001	-0.879	-0.698
sector-1	0.000	0.000				
sector-2	0.219	0.060	13.576	0.000	0.103	0.336
sector-3	0.126	0.047	7.136	0.008	0.034	0.219
size-0	0.000	0.000				
size-1	0.262	0.356	0.543	0.461	-0.435	0.959
size-2	0.470	0.356	1.745	0.187	-0.227	1.168
size-3	0.549	0.358	2.350	0.125	-0.153	1.250

Source: outputs of the software Xlstat 2016

Appendix 0-35: probit Standardized coefficients of organizational innovation

Source	Value	Standard error	Wald Chi-Square	Pr > Chi²	Wald Lower bound (95%)	Wald Upper bound (95%)
RDexpenditures	0.246	0.071	11.836	0.001	0.106	0.386
years_education	-0.036	0.020	3.192	0.074	-0.076	0.004
Employment	-0.056	0.033	2.965	0.085	-0.120	0.008
tempr_employ	0.052	0.017	9.357	0.002	0.019	0.085
skill_worker	0.155	0.047	10.721	0.001	0.062	0.247
formal_training-1	0.000	0.000				
formal_training-2	-0.298	0.017	293.142	< 0,0001	-0.332	-0.264
sector-1	0.000	0.000				
sector-2	0.075	0.020	13.576	0.000	0.035	0.116
sector-3	0.057	0.021	7.136	0.008	0.015	0.099

size-0	0.000	0.000				
size-1	0.131	0.178	0.543	0.461	-0.217	0.479
size-2	0.223	0.169	1.745	0.187	-0.108	0.555
size-3	0.209	0.136	2.350	0.125	-0.058	0.476

Source: outputs of the software Xlstat 2016

Appendix 0-36: probit estimation of process innovation

Dependent Variable: PROCESS_INNOVATION

Method: ML - Binary Probit (Newton-Raphson / Marquardt steps)

Date: 02/09/19 Time: 14:47

Sample: 1 6566

Included observations: 6566

Convergence achieved after 4 iterations

Coefficient covariance computed using observed Hessian

Variable	Coefficient	Std. Error	z-Statistic	Prob.
C	-1.158662	0.080681	-14.36104	0.0000
EMPLOYMENT	4.86E-05	5.13E-05	0.947972	0.3431
FORMAL_TRAINING	0.809338	0.045779	17.67921	0.0000
RDEXPENDITURES	1.19E-09	1.00E-09	1.188871	0.2345
SECTOR	0.005717	0.023213	0.246300	0.8055
SIZE	0.077455	0.026979	2.870906	0.0041
TEMPR_EMPLOY	0.000852	0.000349	2.443938	0.0145
YEARS_EDUCATION	-0.011908	0.005999	-1.984987	0.0471
SKILL_WORKER	0.000204	0.000138	1.482498	0.1382

McFadden R-squared	0.070535	Mean dependent var	0.175145
S.D. dependent var	0.380120	S.E. of regression	0.365566
Akaike info criterion	0.865194	Sum squared resid	876.2673
Schwarz criterion	0.874500	Log likelihood	-2831.431
Hannan-Quinn criter.	0.868411	Deviance	5662.861
Restr. deviance	6092.601	Restr. log likelihood	-3046.300
LR statistic	429.7397	Avg. log likelihood	-0.431226

Prob(LR statistic)	0.000000		
Obs with Dep=0	5416	Total obs	6566
Obs with Dep=1	1150		

Source: outputs of the software Eviews 2016

Appendix 0-37: probit Model parameters of process innovation

Source	Value	Standard error	Wald Chi-Square	Pr > Chi²	Wald Lower bound (95%)	Wald Upper bound (95%)
Intercept	-0.075	0.287	0.069	0.792	-0.637	0.486
RDexpenditures	0.000	0.000	1.527	0.217	0.000	0.000
years_education	-0.013	0.006	4.552	0.033	-0.025	-0.001
Employment	0.000	0.000	1.499	0.221	0.000	0.000
tempr_employ	0.001	0.000	6.666	0.010	0.000	0.002
skill_worker	0.000	0.000	2.785	0.095	0.000	0.001
formal_training-1	0.000	0.000				
formal_training-2	-0.813	0.046	314.112	< 0,0001	-0.903	-0.723
sector-1	0.000	0.000				
sector-2	0.082	0.059	1.890	0.169	-0.035	0.198
sector-3	0.011	0.047	0.054	0.816	-0.081	0.102
size-0	0.000	0.000				
size-1	-0.221	0.278	0.630	0.427	-0.766	0.324
size-2	-0.050	0.279	0.032	0.858	-0.596	0.496
size-3	-0.092	0.281	0.108	0.743	-0.644	0.459

Source: outputs of the software Xlstat 2016

Appendix 0-38: Probit Standardized coefficients of process innovation

Source	Value	Standard error	Wald Chi-Square	Pr > Chi²	Wald Lower bound (95%)	Wald Upper bound (95%)
RDexpenditures	0.027	0.022	1.527	0.217	-0.016	0.070
years_education	-0.042	0.020	4.552	0.033	-0.081	-0.003
Employment	0.030	0.024	1.499	0.221	-0.018	0.077
tempr_employ	0.042	0.016	6.666	0.010	0.010	0.074
skill_worker	0.066	0.040	2.785	0.095	-0.012	0.144
formal_training-1	0.000	0.000				
formal_training-2	-0.307	0.017	314.112	< 0,0001	-0.341	-0.273
sector-1	0.000	0.000				
sector-2	0.028	0.020	1.890	0.169	-0.012	0.068
sector-3	0.005	0.021	0.054	0.816	-0.036	0.046
size-0	0.000	0.000				
size-1	-0.110	0.139	0.630	0.427	-0.383	0.162
size-2	-0.024	0.132	0.032	0.858	-0.283	0.236
size-3	-0.035	0.107	0.108	0.743	-0.245	0.175

Source: outputs of the software Xlstat 2016

ملخص:

الهدف من هذه الرسالة هو دراسة تأثير التدريب والتوظيف على الابتكار في شركات منطقة الشرق الأوسط وشمال إفريقيا باستخدام نماذج لوجيستيكي ونموذج بروبيت في مسح بيانات المؤسسات التي طورها البنك الدولي لبلدان الشرق الأوسط وشمال إفريقيا، أظهرت النتائج أنه في البداية، لا تهتم الشركات في مناطق الشرق الأوسط وشمال إفريقيا بالابتكار. لذلك، هناك عدد قليل من الشركات المبتكرة، حيث تتركز هذه الشركات المبتكرة أكثر من التركيز على التسويق وابتكار المنتجات. بعد نتائج نموذج لوجيستيكي ونموذج بروبيت، فإن البرنامج التدريبي الرسمي له تأثير إيجابي كبير على الإبداع في شركات منطقة الشرق الأوسط وشمال إفريقيا. أيضا، البرنامج التدريبي الرسمي له تأثير إيجابي كبير على جميع أنواع الابتكار. في المقابل، فإن التوظيف له تأثير غير مهم على الابتكار. وبالتالي، فإن الآثار المترتبة على السياسة العامة للنتائج توصي بأن الشركات التي ترغب في أن تكون مبتكرة في أي من أنواع الابتكار المختلفة ينبغي أن تولي اهتماما لبرنامج التدريب الرسمي.

الكلمات المفتاحية: رأس المال البشري، التدريب، الابداع، التوظيف، BEEPS data، نموذج لوجيستيكي- بروبيت

Abstract:

The aim of this thesis is to examine the effect of training and employment on innovation in the companies of MENA region. By using the logit and probit models on Business Environment and Enterprise Performance Survey developed by world bank of MENA countries, the findings showed that at first, the firms in the MENA regions are not very interested in Innovation. Therefore, just few firms are innovative, where these innovative firms are concentrated more than in marketing and product innovation. Following the results of the logit and probit model, the formal training program has a significative positive effect on the innovativeness of the firms of the MENA region. Also, formal training program have significative positive effect on all types of innovation. in the opposite, the employment has non-significative effect on innovation. Thus, the policy implication of the results recommends that the firms desired to be innovative in any of the different types of innovation should pay attention to formal training program.

keywords: human capital, training, innovation, employment, BEEPS data, logit-probit model

Résumé :

L'objectif de cette thèse est d'examiner l'effet de la formation et de l'emploi sur l'innovation dans les entreprises de la région MENA. En utilisant les modèles logit et probit sur l'Enquête sur les données des entreprises développée par la Banque mondiale des pays de la région MENA, les résultats ont montré qu'au début, les entreprises des régions MENA n'étaient pas très intéressées par l'innovation. Par conséquent, rares sont les entreprises innovantes, où elles se concentrent davantage que dans le marketing et l'innovation de produit. Suivant les résultats du modèle logit et probit, le programme de formation officiel a un effet positif significatif sur le caractère innovant des entreprises de la région MENA. En outre, les programmes de formation officiels ont un effet positif significatif sur tous les types d'innovation. Au contraire, l'emploi n'a pas d'effet significatif sur l'innovation. Par conséquent, dans la mesure où les résultats ont une incidence sur les politiques, il est recommandé aux entreprises désireuses d'innover dans les différents types d'innovation d'accorder une attention particulière aux programmes de formation officiels.

Mots clés : le capital humaine, formation professionnelle, innovation, emploi, BEEPS databases, modèle logit et probit