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Understanding the Development of University-Industry-Government Partnership within the Context of Developing Countries: The Case of Algeria

A thesis submitted in partial fulfilment of the requirements for the Degree of Doctor in Economics

by
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Abstract:

Collaboration became the predominant aspect of economic life. Countries that promote partnership among various actors in the local ecosystem are the world leaders or are among emerging economies. Further, the characteristic of such collaboration is strongly favoured in innovative programs that lead to the contribution of local authorities, industrials and higher education institutes. Yet, developing economies are still struggling for catching-up, know a weak level of connectedness among these three strands. One reason for this case is the long-standing period of war (colonisation and civil war) which was intensified by the abundance of natural resources. The research tries to look for further factors that hamper the development of university-industry-government partnership in developing economies by referring to Algeria as a case study. The main result, which was obtained by a statistical analysis of a questionnaire, demonstrates that institutions, the place of innovation as a resource as well as social capital dimension of actors have a decisive role in the weak level of collaboration in Algeria.

ACKNOWLEDGEMENTS

<u>DEDICATION</u>

To the spirit

of

my dear father

May God have mercy on him

DECLARATION

Whilst registered as a candidate for the above degree, I have not been registered for any other research award. I declare that the research contained in this thesis, unless otherwise formally indicated within the text, is the original work of the author. The results and conclusions embodied in this thesis are the work of the named candidate. The thesis has not been previously submitted to his or any other university for any other academic award, and does not incorporate any material already submitted for a degree.

Signed

Date

07 March 2019

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LITERATURE REVIEW

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List of Abbreviations

CNEPRU	Comité National d'Evaluation des Projets de Recherches Universitaires	Chapter 4
GDSRTD	the General Directorate of Scientific Research and Technological Development	Chapter 5
DNA	Deoxyribonucleic Acid	Chapter3
GDP	Gross Domestic Production	Chapter4
INAPI	L'Institut National Algérien de la Propriété Industriel (Algerian National Institute of Industrial Property)	Chapter 5
IBV	Institutional-Based View	Chapter3
IMF	International Monetary Fund	Chapter4
ISO	International Standards Organisation	Chapter3
KBV	Knowledge-Based View	Chapter3
KM	Knowledge Management	Chapter3
LIS	Local Innovation System	Chapter3
LMD	Licence- Master and Doctorate	Chapter 4
MBV	Market-Based View	Chapter 3
NIS	National Innovation System	Chapter1; 3
OECD	Organisation for Economic Co-operation and Development	Chapter 3
ONDA	L'Office National des Droits d'Auteur et des droits voisins	Chapter 5

	National Office of Copyrights and Related Rights	
PNDA	Plan National de Développement Agricole	Chapter4
PNR	Programme National de Recherche	Chapter 4
R&D	Research and development	Chapter3
RBV	Resource-Based View	Chapter3
RIS	Regional Innovation System	Chapter3
VRIN	Valuable, Rare, Inimitable, Non substituable	Chapter3

CHAPTER I

General Introduction

Introduction:

In February 2008, the Algerian government had introduced modifications (or update) to the 1998's law on orientation and five years program of scientific research and technological development. The most important article (n°3)[1] in the new update was about the place and the role to be played by the scientific research in Algeria, at least, as mentioned in the text, for the 2008-2017 decade. The law insists on the orientation of research efforts and resources to develop economic, social, cultural and technological stock of the country through the inclusion of research themes in specific sectors, including agriculture, health, infrastructure, industry and telecommunication, to cite few. Therefore, sectors were mobilised to collaborate with each other to implementing laws directives. Among these sectors, the industrial sector, represented by various productive entities in private and public sector. The later, a pivotal sector of the law was the higher education ministry, which would oversee the national research projects. As a result, a considerable number of projects were registered in this context that were distributed over specialized national research centres. Yet, it seems that the main purpose of the law is to involve higher education and scientific research institutions within its *ecosystem* of various social and economic *ecologies*[2]. Further, it tries to identify obstacles that hinder the development of the country and attempts to address them. This approach, of collaboration among different actors of heterogeneous background and missions, has been gaining increasing attention of specialized researchers, scholars, and policy-makers due to instant gains on reducing costs, optimizing resources and gaining time. In addition, these gains could be greater if the collaboration takes place for enhancing knowledge and innovation capacity. However, the engagement in co-partnership with a heterogeneous actor supposes the existence of numerous variables that guarantee the rights of the participating parties and determine their responsibilities as well. Framing these variables within a solid thought has resulted in the emergence of innovation ecosystem, which is in turn a recent configuration of the national innovation system, a concept that focuses on the collaborative benefits in terms of innovation.

  a- *National innovation System and the triple helix model: conceptualizing collaboration:*

The evolutionary economics, as Verspagen (2001) indicates, consists of a set of theories…[that] pay particular attention to the role of technology and institutions in the process of

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[1] For a detailed insight on the law's content, reader may refer to the original material on:
http://www.joradp.dz/FTP/jo-francais/2008/F2008010.pdf. Accessed on march, 14, 2017 at 22:13, local time.

[2] further clarifications will be made on the concepts of ecology and ecosystem, in chapter 3 of the research.

economic growth. Both institutions and technology are considered the foundation elements and desired objective of any innovation system. The later refers to *the network of institutions in the public and private sectors whose activities and interactions initiate, import, modify and diffuse new technologies"* (Freeman 1995). Lundvall looks at NIS as "*the elements and relationships which interact in the production, diffusion and use of new, and economically useful, knowledge ... and are either located within or rooted inside the borders of a nation state*" (Lundvall 1992). Nelson on the other hand define NIS as "*a set of institutions whose interactions determine the innovative performance ... of national firms*" *(Nelson 1993)*. For others, NIS is a "*set of distinct institutions which jointly and individually contribute to the development and diffusion of new technologies and which provide the framework within which governments form and implement policies to influence the innovation process. As such, is a system of interconnected institutions to create, store and transfer the knowledge, skills and artefacts which define new technologies*" (Metcalfe, S. 1995 as cited by (Niosi 2002).

Yet, the term creates some confusion in recent time. The reasons are that these definitions consider developed economies as referring point, while a projection attempt on developing economies may not fully match, given the lack of clarity surrounding the system itself and its prominent components; this is due to the type and quality of rules in these areas. In our best knowledge, there are several studies, which treated conveniences and efficiencies of the concept in the developing world. Despite that results diverge from one study (or countries) to another, the evidence is that they use the same definition, while it is indispensable to updating them vis-à-vis time and location. Consequently, an updating process of the term should be done to encompass these novelties. Accordingly, NIS is composed of *naturally heterogeneous and* formal representative *active actors who* interact *mutually* to develop national innovative capacity, namely *in the creation, dissemination and use of knowledge within this field or boundaries.* This definition is well suited to designate both parties. In developed world, where governance and democracy are highly respected, a network of altruistic interactions appears among society to get a maximum gain. On the other hand, violating democratic standards and governance requirements freeze the spread of interactions, which in turn squeeze the implementation of networks in developing world.

Besides, Innovation System conception was differently understood. While NIS is regarded as a general model, other researchers reduced it to local dimension. The Local innovation system signifies the intensification of firms and related non-market organizations whose aim is to produce novel products in localized area. For other scholars, IS refers to a regional system. This later refers to a '*constellation of industrial clusters surrounded by innovation supporting*

organizations'(Asheim and Coenen 2005). The emergence of the term was developed to respond to the success of certain regions in the developed world, especially the model of Silicon Valley in USA (Lundvall 2009, 142-143). However, we believe that the term conveys for countries with federal system ruling like Germany, Canada, Malaysia and India. The global view of the system consists of harmonizing national innovation policies toward a global trend, generally under the framework of world institutions, OECD for instance.

A genuine presentation of what the notion 'Innovation System' refers to, was explained by Etzcowitz and Leydesdorff when formulating the 'Triple Helix' concept. The model can be thought as dynamic development, represented by a spiral model of innovation, which is based upon the range of contracts and collaborative network amongst university, industry and government, and leads to more institutional suppleness that finishes up by the rise of hybrid bodies. It is, according to Etzkowitz (2010) 'a platform for institutional formation, the creation of new organisational formats to promote innovation'. This is why greater emphasis is placed on interactions, linkages and alliances that appear and progress between the three components. Therefore, three basic elements can be highlighted:

- A distinguished role of the university institutions in innovation activities;
- A tendency towards co-operative connection, where innovation is an outcome rather than a prescription from the government or industry;
- Each strand can accomplish the role of others, in addition to its traditional function.

Yet, the triple helix model can be conceptualized within three sub-mode: statist, laissez-faire and hybrid model. Each refers to a certain level of institutional dependency and collaboration willingness; the last one therefore is the ultimate level. The implications of the Triple Helix in its final stage on each partner can be listed in the following points: *First*, university receives an enhanced role translated by the adoption of new role beyond its traditional services of teaching and research. Modern universities tend to encompass 'business activities' namely through the capitalisation of research findings. Accordingly, this new model, converted into 'an entrepreneurial activity', was the results of two mutations: the first academic revolution led to the attachment of research, in parallel to preserving and transmitting of knowledge. The second academic revolution designates the addition of a third mission that of economic and social development. Therefore, the university acts as industrial firm by promoting the creation of new firms and introduce the capitalisation of knowledge as an academic function.

The triple helix model is essentially built upon the description of collaboration after the breaking down boundary and institutional rigidity. The principle requires the engagement of university, industry and authorities in flourishing discussion to enhance economy and social well-being, through formation of technology center, for example. In this context, the university undertakes the formation of students by providing training programs that correspond better to national needs. Firms, on the other hand, try to find and fund new supplier and government creates a stable environment.

The Triple Helix emerges when university, industry and government establish a reciprocal relationship with each other. Yet, this statement should be treated by caution. Indeed, establishing interaction among them does not necessary lead to the emergence of Triple helix as it is conventionally described.

University-industry-government partnership in Algeria: what status?

In this regard, one can consider the 1998 law and the 2008 update, as an initiative that tries to bring the Algerian economy to the correct rail. This call was necessary for two reasons: first, authorities have been trying to distance themselves from the dependence of natural resources, due to the instability that entails. Since the 1986's crisis and the financial shortness, experienced by the country during the 1990s, there have been sufficient reasons to remodel the national economy by creating productive and stable sectors that are able to guarantee stability for growth and development. Second, international economy has been directed to knowledge intensive products. About two third of international trade represent trade activities in high-tech goods. Therefore, countries have seized the importance of creating new knowledge and how this affects hardly their competitiveness. In this regard, further attention made for promoting activities that enhance the creativity by providing financial support to collaborative activities among university and industrial sector. In addition, the rise of knowledge economy has accelerated the pace of globalization, which was manifested by an unprecedented jump for ICT goods. As such, Algeria wants to take place in this new economic scene through the promotion of collaboration. Creating national research programs was seen as a best way to attain this objective; however, after nearly ten years, since the law, Algeria's international ranking in terms of innovation capacity has stagnated or retreated. Indeed, Algeria was considered as "economically not free" in 2008 as it ranked 102th out of 157 countries included in the world economic freedom report. Worst still, this ranking is in constant decline as it Algeria occupied 157th out of 186 in 2015.

However, one problematic issue for Algeria is the fact that its weak institutional conduct vis-à-vis business environment continues to underpin long-term economic development. In addition political instability and attitude toward foreign investments hamper the integration to the global economy; this can be viewed from limited efforts designed to improve regulatory efficiency, sustain private sector or propose policies to diversify the economy (Miller and Kim 2017). The spread of corruption plays a remarkable effect on the maintenance of bureaucratic behavior, delaying much more the process of business launching, namely for young entrepreneurs. For these reasons, considering Algeria as the less competitive economy seems logic and its ranking much more representative. According to the Global Competitiveness Report (WEF, 2017), Algeria maintains the last places with fewer supports to improvement. While the report of heritage foundation (2017) considers Algeria as a repressed economy, competitiveness index enforces this view. For instance, the last report in terms of the most problematic factors for doing business in Algeria highlights the burden of government bureaucracy as the foremost reason that hampers entrepreneurs to play their full role in the economy; besides, corruption hinders the operative and efficient allocation of resources or projects. However, an inadequately educated workforce with insufficiency to innovate is considered as hampers to the positive business environment (Schwab and Sala-i-Martin 2016). Indeed, national capability to innovation is both low and slow. Out of 138 studied economies, Algeria occupies the 112th position. This fact can be understood one we take in consideration the quality of scientific research institutions and firms' spending on R&D activities. Further explanations came from the collaboration between university and industry. The lagging innovation capacity and the quality of higher education and training explains the current situation when comparing Algeria to Middle East and North African countries.

Since the competitiveness of the economy, as well as its integral status in the global sphere, seem contradictory to its market capacities, reviewing governance indicators gives some answers on the current situation, and allows us to some extent to create connection between natural resources and interrelationship among the actors in innovation, as mentioned earlier. Similar to the other indicators we have referred to, the governance situation follows the same pattern as Algeria records a continuous decline in the variously related fields. World Bank governance data about Algeria register crash in some vital variables and relative observable degradation in others; only political stability has been increasing since 1998. In contrast, government effectiveness, voice, and accountability, registered a decrease since then. Rule of law and control of corruption, after a decade of relative stability, return to register negative signs especially after 2013. This can be understood when comparing the quality of regulations, which registers an absolute crash since 2005; thereby, the overall score of governance register a decline from 19 in 2008 to 17 in 2015.

These behaviors of governance, which have serious results on competitiveness and economic freedom, respond significantly to transitive channels described by Gylfason (2001). Apart from the famous symptoms of the Dutch Disease, excessive dependence on natural resources may result in rent seeking behaviors, which procreate corruption and distort the allocation of resources. In addition, an abundance of natural resources falsifies the real situation, leading government to lose sight for an effective management of economic growth, by the affection of bureaucracy and institutional quality. Nevertheless, the most dangerous channel of resources abundance lies in the tendency to develop the stock of human capital by reducing expenditures on or neglecting the education of the youths. Expenditures on education have many positive externalities at the long term including, to name a few: increasing labor efficiency, fostering democracy, improving health, and enforcing equality; thus, instituting good governance practices. On the other hand, one may relate education to quality of academia, research institutions or higher education institutions; therefore, expenditures on education determine the overall status of learning in the country. Additional insights will be presented in the next chapter. In the extreme side, a recent study by Stampini et all (2013), has shown that oil-abundant countries tend to neglect the private sector in their economies. Both as a share of total consumption or investment, this sector participates in a small portion; this is due to the presence of government in the economy and its relation to the extractive oil sector. Namely, this presence of the public sector is exacerbated when ownership of the natural resources returns to the Government, as in Algeria. Moreover, Corruption in the public sector tends to transfer financial resources to the latter, while the private sector suffers from a severe funding shortage and acute obstacles to obtaining loans. However, it is worth at this stage to demonstrate how the private sector manifests in Algeria as a way to understand its relation to other sectors.

The Algerian authorities, since independence, have been trying to attain economic, social, and educational international standards. The adoption of socialist regime, with the accompanied planned model, resulted in the emergence of solid industrial bases during the first years of planned programs. The industrialised industry was the best available option for the authorities to catch up with developed world; indeed, relaying on heavy industries was affordable by transforming hydrocarbon revenues to productive investments. Yet, as time passes, dependence on natural resource became necessary to cover increased social demand, principally feed by the demographic explosion. At the beginning of the 1980s, the manifestations of the cracking of the socialist system began to unfold, calling for an urgent diagnostic then a restructuration of the functioning system. However, authorities continued in the adoption of populist support policies to keep population calm or to buy social peace. By the mid-1980s, the limits of socialist model

came to an end after the remarkable shrink in public revenues with the crash of hydrocarbon price. A structural adjustment, during 1990s, was necessary to keep out the country away from bankruptcy. Unfortunately, reforms have limited results in their socio-economic aspects, due mainly to the failure of privatisation policy, investment regimes and dependency on natural resources. Indeed, recovery of hydrocarbons price, contribute to a structural change in terms of governance, where rent seeking behaviours have been multiplied considerably, feeding therefore the spread of economic and political corruption, that corroborates the findings of Sachs & Warner, (1995), and Robinson et al (2006) on the negative role of natural resource on some resource-rich economies. Such dependency has a permanent negative impact overall economy, even the psychology of the whole society; the industrial body was concentrated around extractive activities. Most of public investments were oriented to develop this industry, participating in somehow discriminative preferential behaviours. The other sectors were administered by the private operators, who look for their own profits (by establishing export-import enterprises). Further, rent seeking mentality overshadowed the economic reality of the country, where projects with huge financial values were attributed to incompetent businessmen, by bribing some officials, or access to political activity.

The dependency on hydrocarbons does not harm the economic environment, but it has an equivalent impact on the educational system including higher education quality. This can be understood when relating political lobbying, who want to exclude competent members, to access high political positions within the government, since their strict interests might be under risk (Robinson, Torvik, and Verdier 2006). Therefore, higher education's role in Algeria was reduced to produce calculated number of graduates with less competencies that are required in the labour market. Furthermore, these organisations are managed by the authorities and their legislative statute defines them as public entities that reflect government policies.

The above explanations give us a rich ground to conceptualise a specific model that relies the university, industry and government ecologies in Algeria. This situation considers the traditional triple helix model described by Etzkowitz and Leydesdorff; however, it conceptualises the existence of fourth model. In this model, the government still surrounds and controls academic institutions, which are subordinate part of the state. Moreover, the prime mission of government is to organise, and is anticipated to take the lead in initiating plans and offering the resources; therefore, a parental system is practiced on the academic milieu. On the other hand, the industrial sector is independent from government regulations, since the government does not need them, as it is financially dependent. That is to say weak control, even no control, is practiced on enterprises

and their activities. Further, the industrial sector does not communicate with universities, as the principle aim is to get their part from the rent. Industrials further do not consider to improve their practice by innovative ways since their profits are guaranteed by market ambiguities and policy instability due to violation of hydrocarbons prices. In some few words, university-industry-government interaction in Algeria is so weak and considerably limited. Therefore, understanding the reasons behind this case will bring academic explanation and constitutes guideline for policy-makers to draw policies in this regard.

   b- *Which factors influence the interaction?*

The dramatic level of collaboration in Algeria calls for an urgent diagnostic for possible factors that led to the present situation. Literatures on possible factors stresses on the role of institutional impact. In this vein. Scott (1987) views institutions as 'social structures that have attained a high degree of resilience. They are composed of cultural-cognitive, normative, and regulative elements that, together with associated activities and resources, provide stability and meaning to social life. Institutions are transmitted by various types of carriers, including symbolic systems, relational systems, routines, and artifacts. Institutions operate at different levels of jurisdiction, from the world system to localized interpersonal relationships. Institutions by definition bring stability but are subject to change processes, both incremental and discontinuous'. The Institutional approach deals with a social pattern that reveals a particular reproductive process, which is followed by rewards or sanctions. It is a theory that studies how organisations increase their ability to grow and survive in a competitive environment, by becoming legitimate in the eyes of their stakeholders, according to the total values and norms, in an environment, that govern the behaviour of a population, industry or a sector. Peng et al (2009) propose the Institutional-Based View (IBV) which considers strategic choice as a result of a dynamic interaction between organisations and institutions, in addition to market conditions and capabilities.

In addition to the role of institutions, understanding innovation theory matters for this pursuit. The theory distinguishes between the innovation process and the innovation system. Studies, on the first approach, deal with the different stages of innovation path within a firm (Knight 1967, Maidique 1980, Bessant and Tidd 2007, Kamal 2006). The second stream of studies focuses on the network of possible actors, which influence the creation, diffusion and use of innovation or knowledge (Nelson 1993, Lundvall 2009, Etzkowitz 2002, Carayannis, Barth, and Campbell 2012). That is to say, innovation is viewed as a prerequisite for development and a mandatory capital for enterprises to enhance its profits and competitiveness. Resource based view deals with this issue. Indeed, most enterprises that consider innovation as a key resource to their development

tend to collaborate than enterprises that deny this effect. Therefore, innovation is widely considered as a strategic asset, which is valuable, rare, imperfectly imitable and non-substitutable.

Yet, since firms look for partners that are capable to innovate, they tend to collaborate with other entities, namely with universities or research institutes. However, due to background heterogeneity, engaging with partnership necessitates the presence of certain aspects, which can be reduced to the level of trust and the degree of communication. Thus, an external network should be a perfect ground for a successive collaboration. Social capital, in this matter, summarises the effect. Indeed, Landry et all (2002) considers that: "innovation results from combinations of tangible forms of capital in conjunction with intangible forms of capital characterized by disorderly and sustained interactions occurring between firms and diversified sets of actors. These interactions are holistic, influenced by history, social values, institutions, and interdependence". Therefore, the success of innovation relies on the interactions and exchange of knowledge involving a great variety of actors of similar and diverse backgrounds. Managing these interactions not only facilitate the success of innovation process but determines the leadership of firms in terms of the way of framing the internal and external environment of doing business, as well as creating competitive advantage. This is to say that innovation becomes the matter of networks where heterogeneous, in addition to homogeneous, actors meet to run innovation projects.

On the other hand, studies on Algerian case are rare in this domain; Saad et al (2017, 2010) investigated various opportunities as well as challenges facing universities from developing countries in their role of creation and exchange of knowledge as a basis of innovation. They intend to do so by investigating the links of these universities with the systems of innovation and their position within the three stages of the triple helix. They finished by arguing that a healthy balance of diverse types of higher education institutions in a country might be necessary for better national innovation performance. In the same vein, Djeflat (2009, 2008) looks at the challenge that face Maghrebi universities in contributing to build an efficient National System of Innovation. He examines in depth the internal power game and the race to political positions, which put scientific work and academic achievements in a secondary position. In our best knowledge, these studies did not deal with factors that hinder the creation of positive partnership between university and industries, except for up-cited studies by Djeflat, who includes the rent seeking behaviors as hampering factor.

c- Research Questions and Hypotheses :

The main aim of the present research is to identify the factors that influence the emergence of collaboration between university, industrial sector and authorities in Algeria. The study is of

remarkable importance since fewer are the local academic studies in this field; therefore, it will be a background for further studies by researchers. Further, the present research would constitute a reference for policy makers when drawing suitable policy to encourage university-industry linkage, and/or public private collaboration. The research question could be announced as follow:

What are the factors that enhance or hinder the development of university-industry-government relationship in developing countries and in Algeria precisely?

The answer of this question therefore, concentrates on three key concepts: the concept of cooperation, that of trilateral relation and the Algerian context. For the first concept, cooperation and how it is organised within national boundaries. In our research, this cooperation is designed within the National Innovation System. Yet, for deeper understanding, we shed light on the following questions:

What is meant by National Innovation System?

What are its components?

How it is modelled in accordance with the occurring changes?

The last question refers to the development of trilateral collaboration and other development in Algeria. The sub questions for this key concept are:

> *How these actors are structured?*
>
> *Are they presenting one of the model described in the literature?*
>
> *And at which level the cooperation between these actors can be measured?*

Our hypotheses are summarized as follow:

- *Hypothesis one: institutional aspects*

Most of researches on innovation systems consider that institutions influence considerably the conduct of collaboration. Theory of institution, in this stream, involves regulatory, normative and cultural measures that prompt, enforce, and limit social and economic actions. This definition covers both formal and informal institutions. Regulative arrangements are formal and are levied by authorities through explicit rules, controls and rewards, whereas normative and cultural ones are informal and present strict, evaluative, and compulsory dimensions into societal life. The institutional theory reveals the prominent role in promoting innovation. Indeed, the role of institutions helps spreading the creation, dissemination and use of knowledge and innovation. Indeed, a continuous investment, in skill and knowledge for surviving conditions, not only determines the conduct of firms, but also regulates the performance of economies and the evolution

of societies. Besides, the process by which knowledge is created and diffused depends heavily on government policies that are the result of economic inducements and institutional milieu, which facilitates the interaction among different parties in the innovation processes. Yet, the promotion of knowledge requires the existence of strong, credible and stability- creation institutions. This is because knowledge and institutions are heavily connected and institutions, typically, constitute a road map of reference in reducing instability and guiding the behaviour and the process of innovation.

- *Hypothesis two: innovation and resource aspects*

In parallel to institutional effect, how innovation is perceived by firms can contribute to the promotion of collaboration with another actor. Innovation, which is viewed as a first successful application of a product or process, should be considered through two angles, innovation as process and innovation as a system.

Even if innovation process differs from one organization to another, a process within which innovation appears is the same. This includes Goals and Problems' Identification, Analysis, Development and Design, Conversion and commercialization. The system refers to national, sectoral, technical regional or local approach to innovation. Therefore, both of these angles affect considerably the establishment of collaboration.

- *Hypothesis three social capital dimension*

Landry et al (2002) consider that: "innovation results from combinations of tangible forms of capital in conjunction with intangible forms of capital characterized by disorderly and sustained interactions occurring between firms and diversified sets of actors. These interactions are holistic, influenced by history, social values, institutions, and interdependence". In addition, Fukuyama (2000) paraphrased the situation by referring to the social capital as "an instantiated informal norms that promote" [and] " must lead to cooperation in groups" [by reducing] "transaction costs associated with formal [institutions] like contracts, hierarchy and bureaucratic rules. Thus, social capital contributes to growing number of reciprocally positive trades, resolving mutual action problems, reducing monitoring and transaction costs, and improving information streams that will eventually expand economic performance and incentive economic activities (Ahmad and Hall 2017).

- *Hypothesis four: economic structure dimension*

This dimension is so important in the case of Algeria, since the country is heavily dependent on natural resource. Specialized literature on natural resource dependency shows that most countries with natural abundance have a tendency to prefer extractive activities in detriment of others. In developing countries, the case is still worse since natural dependency can transform to a curse with all negative impact on political, economic and social aspects. Among these effects, the spread of corruption, the rent seeking behaviours with the accompanying lobbying creation and finally the exclusion of capacities and competencies.

Conclusion:

The research, in an attempt to verify the hypothesis and answering the research question is structured around five chapters. Chapter two, investigates the importance of innovation as a system with the development that appeared to respond to changes. Chapter three reviews literature on the concept of cooperation, the innovation theory, the resource-based approach to innovation. Further, it sheds light on the importance of institutional aspects with the role of social capital in the establishment of collaboration. Chapter four reviews the development of the Algerian economy by dealing with the political development, the industrial structure and the higher education institutions. Chapter five analyses a questionnaire and summarises the findings.

CHAPTER II

The Dynamics of Innovation

CHAPTER II   THE DYNAMICS OF INNOVATION

Introduction:

The present chapter brings insights to the importance of collaboration and how it is developed through time. It deals with the concept of innovation systems in the first section, since this term constitutes the starting point to understand the dynamics of innovation. The concept of system itself refers to the elaborated connection among different actors. In a second section, the present chapter highlights the development of this system, which begins by the emergence of new form of knowledge creation. This model labeled "mode2" considers that knowledge is created via a network of interaction among various entities for the promotion of innovation and knowledge stock. For some researchers, there is a more detailed aspect that can describe the dynamics of innovation. The innovation results from a trilateral relation that gathers academia, industrial sector and local authorities. Understanding how this relation affects the state of innovation will be thus studied in a third section, while section four goes beyond the concept of the triple helix since international considerations necessitate the inclusion of further actors. The chapter ends by admitting the emergence of new concept, that of democratic competitiveness.

i-   National Innovation Systems:

It seems that political and economic events go hand to hand. While Cold war attenuated during 1990, new economic thought based on original hypothesises grew in parallel. The collapse of Soviet Union brought a similar move in standard economic growth models and neoclassical models precisely. As the same as Soviet Union failed to generate growth to almost all socialist countries, neoclassical growth models failed to explain miraculous advancement that has been enjoying South East Asian Economies during 1980s and 1990s.

For many specialists, the shortcuts reside in the simplistic and unrealistic assumptions of the model and the ignorance of the dynamic role of technology. Briefly, standard economic thought bases its analysis on the perfect behavioural power of the market. The underlying idea is that rationality that enjoys the representative agent leads to market equilibrium. However, agent rationality is constrained by resources scarcity and utility maximisation, rendering his choices an optimal position.

Unfortunately, less intuitive explanations result when introducing technological change in the model. This limitation in explaining economic growth was at the origin of new stream, which tackle the problem of technology and innovation dynamism within the model.

Under this thought, economic growth can be explained by an evolutionary process within which actors behave to draw a best-fitted policy by the mean of learning and discovery. This set of ideas is well known in literature as "evolutionary economics". One way to define evolutionary economics is that it refers to "a set of theories…[that] pay particular attention to the role of technology and institutions in the process of economic growth"(2001). As Dosi and Nelson (1994) highlighted the optimal behaviour of agent results from learning process that guide the whole economy which finishes up by the presence of temporary and highly suboptimal adaptation. That is to say, rational choice's assumption omits the factors that lead agents to behave as such rendering the prediction of behaviours an impossible task. Further, active agents in the economy include not only firms, but institutions, universities, organisations (governmental and non-governmental) media and society. This variety of actors gives rise to collaborative and network activities within which interaction, cooperation and partnership shape economic growth.

In parallel, the rise of evolutionary approach in economics brought new themes of study; most important one since 1990 is the National Innovation System. A simple search on the internet figures out a huge number of studies (3050000 entities[3], including books, articles and reports), by different sectors (Governmental and international institutions). That is to say, NIS overpasses its use as a concept to become a tool for testing economic performance in developed and developing world as well. What makes NIS popular is certainly its fluidity as a model and instrument for studying differences between countries in terms of productive and learning system that reflects the absorptive capacity and the learning capability of individual and organisation involved in innovation process (Teixeira 2014).

The diagnosis of the existing original definitions highlights such importance; indeed, founding fathers of the term all argue about the importance of institutions and their interactions. For Freeman, the NIS is "*the network of institutions in the public and private sectors whose activities and interactions initiate, import, modify and diffuse new technologies*" (Freeman 1995). Lundvall looks at NIS as "*the elements and relationships which interact in the production, diffusion and use of new, and economically useful, knowledge ... and are either located within or rooted inside the borders of a nation state*" (Lundvall 1992); Nelson on the other hand define NIS as "*a set of*

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[3] Result are as in 30-12-2014 at 16:22 using Google scholar engine.

institutions whose interactions determine the innovative performance ... of national firms" (Nelson 1993). For others, NIS is a *"set of distinct institutions which jointly and individually contribute to the development and diffusion of new technologies and which provides the framework within which governments form and implement policies to influence the innovation process. As such it is a system of interconnected institutions to create, store and transfer the knowledge, skills and artefacts which define new technologies"* (Metcalfe, S. 1995 as cited by (Niosi 2002). According to these definitions, innovation is the matter of institutions. Their mode and their timing of interaction shape the systematic environment of the emergence, development, dissemination and transfer of new knowledge. Therefore, our definition of the term refers to the "***set of distinct institutions and elements, in the public and private sectors, whose interactions in form of network determine the innovative performance, in terms of initiation, development, usage and diffusion of new knowledge and technologies within the borders of national firms***". Yet, some critics can be made. First: The epoch at which the concept emerged, indeed studies on NIS launched earlier in 1980s by the contribution of Freeman (Sharif 2006, Freeman 2004) then his printed work on Japan in 1987. It was followed by pioneering works of B.A. Lundvall (1992), R. Nelson(1993) and C. Edquist (1997) (Lundvall 2007). However, this era was characterized by the victory of American mode of economic thought. Liberalism jointly with the spread of multinational firms are considered as the engine for economic leadership; on the other hand, the diffusion of Silicon Valley model in the United States announces the beginning of new era, that of chipset and digital technologies. Another characteristic is the emergence of new powerful economies on the scene, China and India grew remarkably in ICT sectors, making more pressure on governments to sustain their local firms by setting up policies for collaboration and partnership amongst prominent parties. The need for identifying the system that wraps the unprecedented jump between industries, authorities grew consequently. Second for the geographical location, a recent study by (Teixeira 2014) shows that specialized journal, articles published and the most cited authors by the NIS literature belong to developed economies (USA and Europe especially) rendering thus the previous definitions partially relative. The third critic consists of author's occupation. For (Sharif 2006) there are controversies among practitioners about the academic or policy-making origin of the term. Prominent leaders of NIS work at university, public and supranational institutions or both. This is why we believe that the articulation and the way the NIS is defined reflects the author's occupation. In addition, no clear decision about author's first use of the term is done. (Sharif 2006) concludes that NIS concept arose simultaneously in both field at the same time.

Yet, the term creates some confusion in recent time. The reasons are that these definitions consider developed economies as referring point (second criticism), while a projection attempt on developing economies may not fully match, given the lack of clarity surrounding the system itself and its prominent components; this is due to the type and quality of rules in these areas. To our best knowledge, there are several studies, which treat conveniences and efficiencies of the concept in developing world. Even results diverge from one study (or countries) to another, the evidence is that they use the same definition, while it is essential to updating them vis-à-vis time and location. Further, new thoughts emerged while others expand since 1990s (first criticism); the globalization, which becomes a fact rather than a concept, has changed the ways of looking at and thinking of things. It was immediately accompanied with new concepts. The term «Governance», which is an economic synonym of democracy, appears recurrently in non-governmental world institutions like OECD, WB, and WEF to designate the conduct of micro and macro policy of institutions at local, national or regional level. As such, governance measures the quality of democracy in a given economy in the sense that it quantifies some basic requirement (the WB measures the governance by referring to 6 major criteria, while WEF uses 12 pillars). Both institutions classify developing world at the back (neck) of the list.

It results that an updating process of the term should be done to encompass these novelties. With regards to the up cited critics NIS, we believe, consists of **naturally, heterogeneous and formal representative** *active actors who* **interact** *mutually* **to develop national innovative capacity, namely** *in the creation, dissemination and use of know knowledge within a limited field or boundaries.* This definition is well suited to designate both parties. In developed world where governance and democracy are highly respected, a network of altruistic interactions appears among society to get a maximum gain. On the other hand, violating democratic standards and governance requirements freezes the spread of interactions, which in turn squeezes the implementation of networks in developing world.

Besides, looking at the previous definitions opens new windows for analysis. Reporting the word "national" renders the NIS concept less intuitive. A flexible use of the term "national" gives birth to two levels of analysis: the macro level, which refers to purely political meaning of boarders; and the micro level for referring to the type of systems.

Focusing on the macro level, an innovation system can refer to local, regional, national or global meaning. The Local innovation system, the smallest system, denotes the concentration of firms and related non-market organizations that collaborate to create new products in localized area. In

that sense, it constitutes the backbone of industrial clusters. Regional innovation system, which refers to a meso-level of analysis, consists of a '*constellation of industrial clusters surrounded by innovation supporting organizations*'(Asheim and Coenen 2005)[4]. The emergence of the term was developed to respond to the success of certain regions in developed world, especially the model of Silicon Valley in USA (Lundvall 2009, 142-143). However, we believe that the term conveys for countries with federal system ruling like Germany, Canada, Malaysia and India (to extent, we can include France). The global view of the system consists of harmonizing national innovation policies toward a global trend, generally under the framework of world institutions, OECD for instance.

The micro analysis level of innovation system gathers some intuitive concepts. The most reputed concept refers the sectoral innovation system. Malerba (2002) defines the concept as a set of agents carrying out market and non-market interactions for the creation, production and sale of new and established products for specific uses. To insure its vitality, heterogeneous interveners, with deferent background learning, interact through variety ways in market and non-market relations for a specific sector. A suitable example is the Agricultural innovation System. Under this concept, agricultural sector is seen as a network of multitude interactions from various actors whose main objective is to bring novel and useful technologies that affect positively the agricultural production (World 2012, Kingiri 2013, Temel, Janssen, and Karimov 2002). In a similar view, technological innovation system is regarded as a sector (a micro oriented variety of Sectoral Innovation System, if we use the proper words of (Suurs 2009, p38)) since it refers to a network of interactions from active agents; these cooperation is reflected by the generation, diffusion and the use of a specific technology (Carlsson and Stankiewicz 1991). Nanotechnology is a typical example. Developing a nanotechnology is not devoted to a specific sector; rather it is introduced in numerous key industries.

The National Innovation System is thus, regardless boundaries and level of analysis, a combination of institutions and organizations with the aim of promoting innovation capacity. However, a primordial role in all these efforts is preserved to firms. Either in local, regional, national, sectoral or in technological conception, the system keeps its vitality for the simple raison that firm is conceived of as a *processor of knowledge*, as a *locus* of setting-up, construction,

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[4] For further understanding, the reader is invited to consult:
- Cooke P 1992. *Regional Innovation Systems: Competitive Regulation in the New Europe*.
- Cooke P 1998. *Regional systems of innovation: an evolutionary perspective*.

selection, usage, and development of knowledge; and all other components of the system support it. (Feinson 2003) states that public and academic efforts support but never replace firms efforts in term of technology, while (Peters 2006) relates the functioning of the overall system by the firm which determines its efficiency. Others insist on the leading role of firms in term of size, numbers and activity (Niosi et al. 1992). This view is warmly infected by the surrounding events of last 1980s and early 1990s when firms constitute the source of growth.

Later in the mid of nineties, a new stream of interest, complementary rather than rivalry, described the shift in academia and higher education philosophy. The central idea is that knowledge within academia follows new trend that is different from conventional one in prominent characteristics. The following point highlights the shift in the mode of knowledge production.

ii-   'Mode2' of Knowledge Production:

The immediate perception is the existence of 'mode 1'. Also known as 'basic research', 'mode 1' knowledge production refers to the disconnection of research from real life concerns. University, as an '*Ivory Tower*'(Bok and Bok 2009), produces knowledge in accordance to pre-defined rules which are strictly followed and revised by a cognitive community; the generated knowledge is strictly mono-discipline and responds to disciplinary interests. Hence knowledge with its generative researches never leave university (only accessed by highly trained academic staff). In addition, the application of research's findings will be approved latter by other scientists of the same filed.

Yet, it has been recognised a transformation in the way knowledge is produced. The changing environment of research process can be summarised, according to Nowotny, Scott, and Gibbons (2003), in three elements:

- *The Determining of research Goals*:

Many programs have been elaborated at systemic, national and supranational level to responding to specific social and economic needs; generally to meet political agenda and developing future research capacity (here, different sectors and ministries engage in such activities).

- *Engaged Research*:

By combining the effect of public funding cut and the benefit of exploiting intellectual property, knowledge thus is not regarded as public good and will never be acquired freely. This pushes research toward society agenda and inquiries.

- *The accountability of Knowledge*:

This element follows the previous in the way that only effective and highly qualified research is commercialised. Managing research become a priority in developed and developing world both, for the sake of assessing research programs through publishing taxonomical criteria and indices.

As a result, research (simultaneously knowledge) underwent a remarkable shift in terms of studied problems, its quality and its definition. In an original work, Gibbons et al (1994) published a book whose core idea is to explain this transformation. The novelty is the introduction of 'Mode 2' term, which is based on interactiveness and distributiveness. Indeed, 'Mode 2' differs in some attributes.

- The First attribute is the increasing awareness that science does not take problem from nature then produces its application, in the sense that science itself seeks to retreat in the Ivory Tower; rather, it intertwines with society, economic and politics. That is to say, knowledge is only generated provided the inclusion of actors' interest; this means that problems are formulated earlier while communicating and dialoguing with different actors. The research activity may not take place until the group (the actors) defines the problem specificities (context) and how it will be solved (application). In that sense, the context of application frames the total atmosphere in which problem-solving is defined; and further covers a broader range of considerations, which go beyond market's aspirations to include industrial, political and societal interest. Simply stated, knowledge in 'Mode 2' is socially distributed as its diffusion takes place during its generation, and is highly interactive as the problem-solving includes a large set of considerations. Therefore, the first attribute concerns *'the context of application'*.

- The second attribute is '*transdisciplinarity*': in contrast to multi-disciplinarity, which necessitates pre-existing disciplines and regenerates new disciplines, transdisciplinarity refers to the recruitment of a '*range of theoretical perspectives and practical methodologies'*(Hessels and Van Lente 2008) to shape the group assent. Hence, heterogeneous skills and expertise, as well as the genius to manage theoretical and practical methodologies, condition the potential solution. As we can see, knowledge is not registered

in articles, but researcher and research teams contributes vividly to its production (in form of expertise they bring). This knowledge is said to be 'Tacit' that needs no theoretical aspects, i.e. embedded in the minds of individual researchers who work on the problem. Further, (Gibbons et al. 1994) depicts four specificities of transdisciplinary knowledge:

- *It is distinct and evolving*: its governing framework is not based on previous knowledge of a specific discipline, though elements of knowledge exist; this is why it is distinct. It is evolving because it is not developed then applied after. Once a consensus on theoretical aspect is attained, it will be difficult to refer it to a specific discipline: it will be transdisciplinary.

- *It is a contribution to knowledge*: while no dominant discipline leads the project, knowledge distinguishes its theory, method and mode of solving.

- *Its diffusing is instantaneous*: diffusion of results is communicated with participants at the time of their conclusion. The context of application in which the knowledge is produced reduces, even deny, the conventional channels of communicating results. This make transdisciplinarity a highly mobile knowledge or 'Tacit'.

- *It is dynamic*: in the sense that the solution attained (and the knowledge produced) can became a starting point of further development, or knowledge formulation. The solution itself (which is definitively confirmed and need no further validation) became a new problem in a different context of application.

- As a consequence, it results that there is a great diversity of entities and types of knowledge; this is labelled "Heterogeneity *and Organisational diversity*': the third characteristic. University constitutes a fragment part of potential entities where knowledge, science and innovation is produced; non-academic organisation gain place in that market such as governmental agencies, industrial laboratories, consultancies, resulting in an interaction of different skills and competences linked by means of formal and informal channels of communication. Therefore, a dynamic hybrid network is established within which a recombination of fields and areas leads to creating new forms of knowledge. Accordingly, organisational types change and vary in accordance to attacked problem and yield to a flexible team formation. Researchers can meet to tackle a specific problem, in a specific context of application, which disappear when solving the question (or redefines it), then work on different issue with very different context of application. Such flexibility reinforces and contribute to creating highly valued competence (this competence could be transformed to different context of application in researchers join different groups under

different organisational types: (inter/multi) national organisations, (non) governmental institutions…)

- Another attribute of 'Mode 2' is the increasing responsibility of scientists about what they create, on one side, and awareness of the overall society of what is produced. A sort of dialogue process, a conversation between science and society governs the creation of knowledge from the start. To be clear, there is a sensitivity for the impact of the final solution on society, in the sense that the solution has to incorporates public interests. This is due to the context of application in which the problem is defined according to actors' backgrounds. Scientists, hand to hand with lawyers, businessmen and engineers each contribute to forming final problem and then finding suitable solutions. Society as whole is considered when creating knowledge, and no group is regarded as outside the system. The forth attribute deals with '*accountability and reflexivity of science*'.

- Finally, a fifth attribute has been observed: '*Quality Control*'. Quality control concerns the peer-reviewers. Because the knowledge is defined and created in the context of application and includes overall society, reviews do not restricted to academia (and has to follows strictly codified criteria, predefined by the discipline, rather in encompasses broader range of political, societal, cultural and economic criteria; and good science cannot be measured by academic excellence, but judgements include the contribution to as well as the efficiency and usefulness of the overall solution. Differently stated, quality in traditional science is controlled by the importance of individual contribution to the advancement of the discipline, generally through judgments made by professionals and pioneers in their domain. Under 'Mode 2' controlling quality requires the inclusion of wider range of criteria that were considered to be outside scientific and technical system.

It is clear that knowledge production under "Mode 2" is merely dynamic. While the solution is on progress, testing results are communicated instantaneously and may lead to the formation of a new problem, and so on. A fertilised system of knowledge generation, in the form of a complex matrix, appears. This system differs from NIS especially in the leading roles. Whilst firms conduct the system and possess the supremacy to innovate, "Mode 2" distributes this role between participants and even with the whole society. The context in which the problem is designed innovates and controls the quality of solutions. Herein each participant takes part to the solution and its efforts are less useful outside the system.

During the last twenty years, "Mode 2" thesis has received an enormous interest. Many studies are conducted to testify and/or validate its claim; however, two studies contain the question. findings of a bibliometric study conducted by Martin (2011) witness a growing elements of interdisciplinarity as well as a significant shift of bibliometric research conducted in the context of application; also there are evidences of heterogeneous institutions. However, literature review, in a study by (Hessels and Van Lente 2008), reports a list of critics classified into three categories, generally addressing the lack of evidence to endorse "Mode 2" attributes namely transdisciplinarity, quality control and reflexivity.

Indeed, "Mode 2" thesis is one of many studies which tried to theorise the shift in the way knowledge, science and innovation are produced. Most of them appeared simultaneously with "mode 2". Their impact on research arena vary remarkably; though, only one receives a growing importance since its conceptualisation in 1997.

A clear image of what 'Mode 2' knowledge production is actively talking about was cleverly explained by *Etzcowitz* and *Leydesdorff* when formulating the 'Triple Helix' concept. Even these authors consider it as different from "Mode 2", there is no evidences to validate their claim; however, many facts document that the rapprochement between university and industry is not casual, but is built upon a mutual interest. Thus, any research agenda (defining research problem) must fit with the context of application. Another point is the institutional independency of actors: each partner belongs to completely independent environment in terms of mission and objectives; accordingly, heterogeneity constitutes an element of the Triple Helix concept. Further, 'Mode 2' encompasses it in the sense that a wider range of actors participates in the knowledge production, the Triple Helix model of innovation is built on three strands.

iii-   The Triple Helix Model:

The Triple Helix approach, as other innovation models, represents a new stage of capitalism evolution; the model exposes the transition from the industrial economy toward the knowledge-based economy, in which entrepreneurial activities in terms of innovation uncommonly grew to foster competitiveness and economic development. It can also be seen as a doctrine that argues a prominent role of government in economic activities. Though, it differs in that it stresses the historical continuity of collaboration among university, industry and government. From this point, one can define the Triple Helix as a dynamic development, represented as a spiral model of innovation, which is based upon the range of agreements and partnership network amongst university, industry, government and leads to more institutional flexibility and emergence of

hybrid organisations. It is, according to Etzkowitz (2010, p8), a platform for institutional formation, the creation of new organisational formats to promote innovation'. This is why greater emphasis is placed on interactions, linkages and collaborations that appear and develop between the three strands. There, three basic elements can be highlighted:

- A prominent role of the university in innovation;
- A movement towards collaborative relationship, where innovation policy is an outcome rather than a prescription from the government or industry;
- Each strand can fulfil the role of others, in addition to its traditional function.

Yet before dealing with these points, it is necessary to have a look at the historical development of the Triple Helix system.

According to (Etzkowitz 2003) the final format of the Triple helix model is the outcome of two previous ones, which he labelled 'statist' and 'laissez-faire'(Triple Helix I and Triple Helix II as in Etzkowitz and Leydesdorff (2000)).

- ***The Statist model***: under this configuration, the government takes the leading role in developing projects and providing resources; the government encompasses the industry and the university, which are considered as being subordinate entities or state-owned organisations. The Soviet Union in the past and most of Arab countries are typical examples of government dominating all initiatives (left side of the figure 1). Industry and university only receive support and guidance from the government, which provides planning, and exercises controlling and management activities, aimed at encouraging innovations (Razak, and Saad. *The challenges arising in the evolution of the triple helix institutional system.* In Saad and Zawdie (2011), pp. 191-206). The type of organisation is hierarchic and centralised with the industry as national champion and university as teaching institutions; the government thus, determines which industry should be adopted and sustained while university has to provide necessary trained workforce. In addition, the government organises technology projects and raises the level of research at universities to support national (regional) development. This trend might be observed in countries that try to develop independent technological industry[5] (Etzkowitz 2010), though research tends to be removed from industry needs and universities provide trained persons to work in the

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[5] Accordingly, most of countries adopt a statist model of the triple helix when taking into account strategic industries, such as armament, aeronautic, aerospace, agricultural (wheat), mineral (oil and water in the near future) industries. The government supports the dominant companies in the domain

other sectors; it researches have negligible role in the creation of wealth, then it lack any incentive to commercialise its research findings.

Figure 2-1: The Triple Helix Configuration
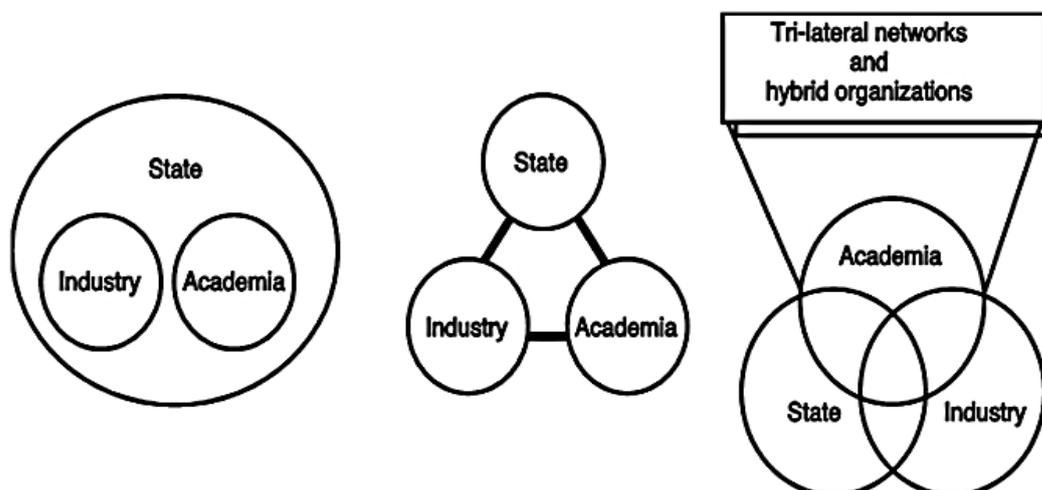
Source: (Etzkowitz 2003).

- ***The Laissez-faire model*:** under this configuration, a complete separation among institutional spheres takes place (middle side of the figure 1). the three elements operate independently as separate institutional spheres, by acting as competitive rather than cooperative in their relation with each other; this also hold for firms that operate solely both in R&D and product development. In this model, industry is considered as a driving force and the two other as supporting structures. The role of university is limited to provide training workforce and basic research; it is also asked to supply publications and graduates. From these sources, firms select what they judge as useful knowledge. The role of government is also limited to dealing with market failure; it can buy products for its own usage or intervene as regulator. It may play a civilian role only when the market fails to provide or performs an activity. Further, laissez-faire model is characterised by individualistic mentality; individual person (and not a group) can lead to the creation of new firm and thus receives great admiration. He may be seen as a hero if his/her managerial talents lead to the success of the firm. However, indirect interaction may exists in this model through an intermediary body. Its objective is to select prominent research, which can be transferred to industry in form of patents. Accordingly, the laissez-faire model considers industry as a locus of production, university as a lieu of basic research and

government as regulator. A strong boundaries definition determines the institutional role of each strand.

- ***The Hybrid model:*** this configuration reserves an equal importance to partners where university displaces military as leading sector (Etzkowitz 2002). A more flexible overlapping system of mutual interaction with a specific organisational structure emerges to promote innovation. Each partner tries to enhance the performance of two others (right side of the figure 1) and at the same time gains values from them; thus, there is a tendency to establish a common long-term strategy of well-defined goals.

The implications of the Triple Helix in its final stage on each partner can be listed in the following points: *First*, university receives an enhanced role translated by the adoption of new role beyond its traditional services of teaching and research. Modern universities tend to encompass 'commercial taches' namely through the capitalisation of research findings. According to Ragna and Etzcowits (2011) this new model which is transformed to 'an entrepreneurial activity' is the result of two revolutions: the first academic revolution led to the inclusion of research, in parallel to preserving and transmitting of knowledge. In literature, this type of university is well known as 'Humboldtian model' reflecting the idea of assuming teaching and research simultaneously. The second academic revolution designates the inclusion of a third mission that of economic and social development; the term of entrepreneurial university captures the idea that university commercialises the outcomes of its researches.

Second, each helix performs the mission of the others and takes their role. It does not mean that university become firms or act as governmental authority; rather it means that university for example develops capabilities to act as firms and firms improve their competences in providing reaching tasks. The idea is that each partner fulfils its mission and performs new tasks, generally considered as extreme to its original ones. That is, the government continues supplying rules and regulations that guarantee freedom, girths and duties of the society, while provides venture capital to help start new enterprises. Firms, the locus of production, still do offering goods and services in a competitive price and quality as their perform research activity. Yet, they conserve a great resource to offer training at higher standards and share knowledge by joint venture. The university act as industrial firm by promoting the creation of new firms and introduce the capitalisation of knowledge as an academic function.

Third, the Triple Helix model is built upon the description of collaboration emerged after the breaking down boundary resistance and institutional rigidity of spheres, most involved in

innovation. The principle requires the engagement of university, industry and authorities in flourishing discussion to enhance national (regional) economy and social well-being, through establishment of technology centre and development of growth agreement. In this context, the university undertakes the formation of students by providing training programs, which correspond better to national (regional) needs. Firms, among them, try to find and found new supplier relationship and government (national/regional) creates stable environment. Then a network of relationship appears at the front: university-industry partnership; public-private cooperation arises. Further, bilateral interaction among university-government; university-industry and government-industry increase remarkably. These forms of collaborating are mutual and spontaneous as shall we see in chapter 2.

Fourth, the inevitable result of university-industry-government rapprochement is the adoption of a 'hybrid structure' both as organisational and institutional. In terms of 'Mode 2' a context of application determines the framework of innovation policy by defining the problem from multiple views. The final agreement considers, implicitly, the adoption of unique structure to activate the innovation policy; this includes the organisational aspects as well institutional ones. The hybrid structure in terms of the Triple helix constitutes the ultimate goal of the model. It is located at the centre of the interaction; the hybrid organisation necessitates colossal efforts from the three partners. Their initial bilateral rapprochement facilitates the framing of broader arrangement to overpass boundaries and institutional bottlenecks of hybrid. Therefore, three types of hybrid structures appear; hybrid structure which relates university with industry; hybrid structure that gather university and government and hybrid structure of government-industry relation. Each partner within the structure fulfils specific considerations and responds to an agreed policy as it conserves an independent identity and boundary autonomy. In an advanced stage, the success of the hybrid organisations encourages the fusion for a unique body of triadic parties, in which innovation policy and programs even their execution, is an outcome of interaction rather than a dictation from a dominant party or an external body. The final hybrid structure or the Triple Helix organisation still conserves a core identity of parties; however, less attention is devoted to boundary separation. Further, entrepreneurial activities multiple their existence and take new forms such as entrepreneurial university or entrepreneurial government.

The Triple Helix describes, thus, an evolutionary process and the implications of interaction among partners. In such environment, high process of selection constitutes a key element for the emergence and the success of the hybrid organisation (chapter 2 will discuss the process of cooperation in biological field). However, a crucial remark when studying the Triple Helix model should be highlighted.

The Triple Helix emerges when university, industry and government establish a reciprocal relationship with each other. Yet, this statement should be treated by caution. Indeed, establishing interaction among them does not necessary lead to the emergence of Triple helix as it is conventionally described. University, industry and government may interact closely but negatively; the figure 2-2 presents two types of Triple Helix.

Figure 2-2: Passive and Active Triple Helix Format
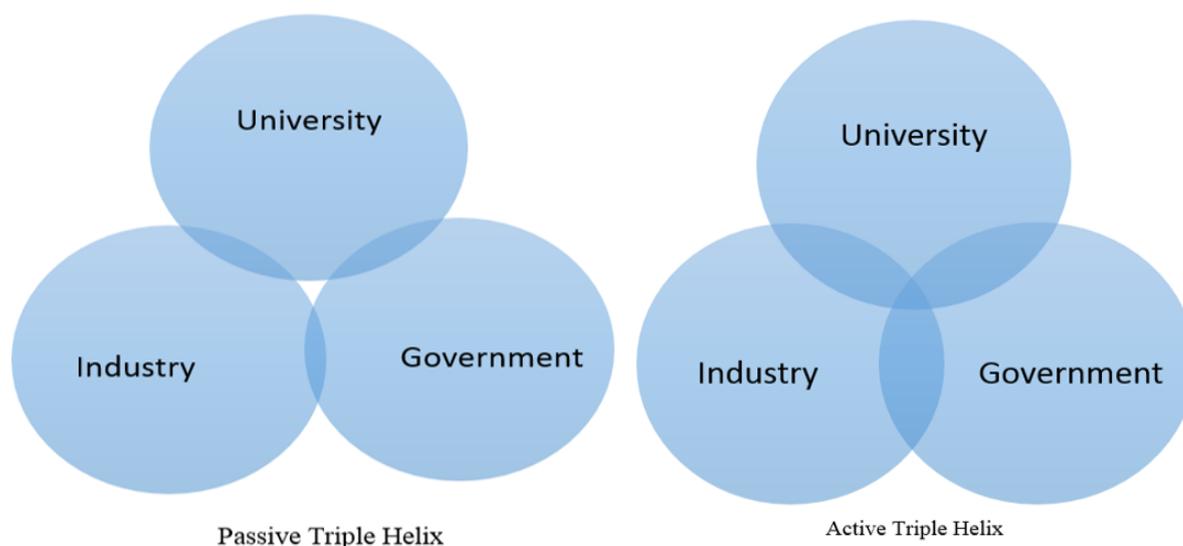
Source: adapted from leydersdorff

In the left side, a passive form of Triple Helix is formed. The neutrality concept here designs the intensity of interaction among the three strands and which lead to the formation of bilateral connection of two separate access. The benefit from collaboration is partial and policy designing excludes important portions for innovation. University, for instance, elaborates mutual policy/programs with industry and government separately and generates hybrid organisations accordingly. Under this format, any effort from the partners will never lead to the emergence of trilateral connection. An active format of the Triple Helix (right side of the figure 2-2) refers to the establishment of instantaneous triadic interaction with a unique hybrid organisation at the center of collaboration. The result is the drawing of a clear and complete image of innovation policy/programs; any further effort from any partners will change the conception of innovation policy of the two others. Further, active Triple helix will not exclude bilateral connection; a sort of take and give activities reshapes for the better the bilateral as well the triadic relationship. What can guess from these two formats is that the intensity of interaction, i.e. the willingness to cooperate, helps to pass from neutral to active Triple Helix.

Even the proposition of *Etzkowitz* and *Leydersdorff* on innovation knew a wider acceptance, researches on innovation systems carry to encompass new facts and enquiries both at national and global level it results new approaches and concepts, generally regarded as an extension to the Triple Helix. Introducing government to the initial relation not only helps to reorient efforts and resources toward macro goals, it brings new actors and novel concepts. This changing may be regarded as a result and related to the phenomenon of globalisation. The narrow connection of countries to each other obliges them to draw or try to align their policies to respond to global issues. Governments are in the obligation to choose and direct programs accordingly. The next point refers to these extensions. However, it is convenient to notice that triple helix model has received some critics and has limitations[6].

First, the triple helix model has some level of abstraction namely "actors" which are introduced without decent analysis (Cooke 2005, Tuunainen 2005). Then, the model fails to recognise the national settings that have influences on university, industry and government; this claim can be seen when analysing innovation systems among nations. Third, the model ignores people from the scene. Lastly, (Tuunainen 2002) argues that the triple helix approach provides weak justifications when explaining university-industry collaboration.

What can we guess from these critics is that the process of innovation and the passage from Knowledge based economy is not limited to the collaboration of the three strand devoted by the triple helix. Yet, the model can be served as a basic for further development that can lead to emergence of the Knowledge-based society, much wider than the Knowledge economy.

The extensions that the triple helix has submitted result in the adoption of a fourth helix, then the emergence of a fifth one. In what follow, we address these two points.

iv-   Beyond the Triple Helix:

Examining the third critics reveals that the triple helix model omits people from the picture. (Pillay 2005) stresses the necessity of social cohesion for both industry and societies to achieve

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[6] For a detailed understanding of these critics, readers are advised to return to the following references:

Balzat, Markus, and Horst Hanusch. 2004. "*Recent trends in the research on national innovation systems*."

Brännback, Malin, Norris Krueger Jr, Alan Carsrud, and Jenny Elfving. 2008. "*Re-visiting the "Molecular Biology" of regional innovation systems: Competing models of technology development*."

Lavén, Fredrik. 2008. *Organizing Innovation. How policies are translated into practice.*

Viale, Riccardo, and Andrea Pozzali. 2010. "*Complex adaptive systems and the evolutionary triple helix".*

economic and social development. That is to say that any study must include or may take into consideration civil society as a *key variable* in the conclusion of results. Further, global integration, challenges and issues that arise (firmly speaking ecological issues) exert pressures on innovation and knowledge creation.

  Carayannis and Campbell   (2009) stress the necessity to add a fourth strand within the innovation system to understand the rise of the knowledge societies in the twenty first century. The new helix refers to civil society, and is placed at the centre of the model. The public under the quadruple helix participates in the design of innovation process. Its quality as "innovation users" involves the society to the production process. Furthermore, the quadruple helix model considers civil society as innovative partner and knowledge producer in line with academia, industry and government. Citizens have the power to propose solution, ideas, or new type of innovation for other strands, which are invited to support then exploit the citizen-based innovations. However, civil society opinion's is highly influenced by media and/or culture. Indeed, two passages in Carayannis and Campbell (2009) state the following: "*…media reality overlaps with political and social reality; perception of politics primarily through the media; and the laws of the media system determining political actions and strategies …*". *"…On the other hand, the public is also influenced by culture and values…"*. In this regard, Ivanova (2014) stresses the role of media and consider it as the fourth pillar. According to this author, the innovation activity is performed in an external space of consumers, which requires the setting of a mechanism to guarantee a stream of communication between university-industry-government and consumer, and maintain favourable conditions for the growth of innovations among consumers. The required infrastructure is declined to design all mean of mass media. Throughout her study, Ivanova demonstrates how high hume (informational technologies) is now shaping public awareness and consumer consciousness to the extent that the modern economy is characterised by the standardisation of production in individual consumption. Accordingly, extending the standard Triple Helix model to a Quadruple Helix might include the media and results for new interactive areas of commercial advertising, public provision of information and usage of communication by the government. Other new area on the form of Triple Helix emerged within the Quadruple Helix model, namely media-industry-government; media-industry-university and media-university-government. Finally, a unique hybrid organisation of four partners appear at the core of the model, as shown in figure 2-3, panel a gives an introductory presentation of the Quadruple Helix model. Therefore, four circles are putted on contact with minimum interaction and unique hybrid contact at the centre. Panel b is more inclusive; the four circles are in advanced, dynamic relations with nine primary contact: six as double helices and three as triple helix) and one sophisticated relation at the core (note that many

figures are presented to show the Quadruple Helix concept. All of them agree about the positive interactions of the spheres in contrast with the Triple Helix were a neutral model can exist. This result is one powerful point of the Quadruple helix model when studying innovation system with regard to producers-users aspects).

Yet, even there is a wide convention about adding a fourth helix, there is a debate about its nature. Media cannot be considered as the ultimate delegate of civil society; the voice and the influence of the public can also be channelled by the power of Non-Governmental Organisations (NGOs) (Heng et al. 2012). These authors consider that the power of the public is well expressed when it is unified under the umbrella of NGOs whose role is to defend social objectives rather than completing political or economic goals. The influence of NGOs came from their right to organise sanction, boycott or embargo. Further, NGOs can provide information and establish a link between other strands.

One important point, even result, when adding civil society or the public, which are formulised under "media" or "NGOs", is the introduction of the term "*Governance of Innovation*" and "*Knowledge Democracy*". Indeed, the complexity of the model exercise additional pressure about sharing and diffusing tasks or results instantaneously and among participants equally. Carayannis and Campbell (2009) refer to the term "Knowledge Democracy" because the innovation program or the knowledge adopted is mandated by the majority, i.e. recognising the concept of pluralism in a society and the respect of other opinion which lead to an unbiased decisions as they are ligitimated by the majority.

The complexity of the environment within which innovation is produced, renders the understanding of innovation system more ambiguous. The adoption of Global Innovation System, because of Globalisation stream, adds new variables to the process of innovation/knowledge creation; using *Etzkowitz and Leydesdorff*'s term, additional helices are needed to conceptualise the new interval of innovation. Indeed, one challenge that arise world consciousness is the question of climate change and ecological awareness; accordingly, novel terminology emerged namely "*the Green Economy*" and *"Naturally-Friend Activities". Carayannis and Campbell* in an advanced proposal introduce environment issue as an imperative factor for innovation the same as industry, university or civil society; therefore, the Quintuple Helix model contextualises the Triple Helix and embeds the Quadruple Helix by extending the architecture of innovation to the global ecology. Further, the Quintuple Helix model can be seen as a framework for transdisciplinary analysis of

sustainable development and social ecology (Carayannis, Barth, and Campbell 2012). This can bring a full analytical comprehension of how innovation is produced when social sciences, social science, humanities, politics and economics are oriented toward a unified objective of prosperity and protection. The Figure 3 conceptualises the Quintuple Helix model.

Figure 2-3: The Quadruple Helix model of innovation

a.   Standard presentation   b.   Interactive presentation
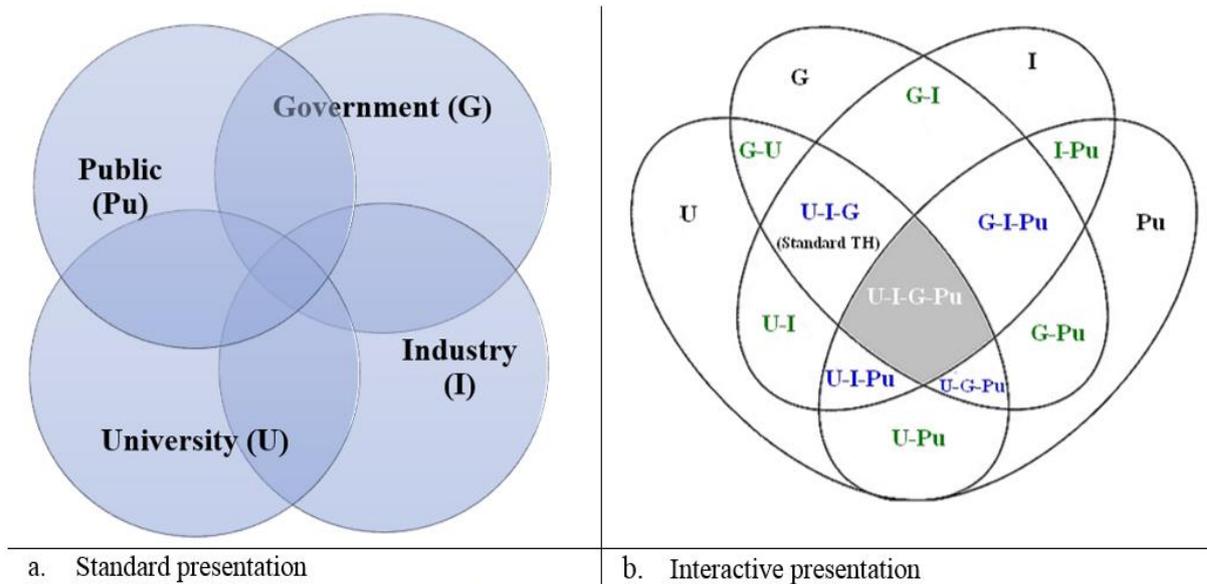
Source: panel "a" adapted from (Carayannis 2013). panel "b" adapted from (Ivanova 2014)

As for Quadruple helix, adding new helix generates additional interactions. We can see that the Triple Helix consists the platform for the Quintuple Helix. In addition to the standard Triple Helix model advanced by *Etzkowitz and Leydesdorff*, one can subtract fifth additional trilateral interactions, which are: U-I-E; U-G-E; U-P-E; I-G-E and G-P-E. In each of them environmental issues constitute the core of discussions and programs. For instance, any rapprochement between university and industrial sector should consider climate change as a departure point for research; this is because environment prevention became an important asset for corporations and a key variable of academic researches. Hence, any scientific advancement must be in favour of environment. Further, the concept of competitiveness may see a drastic deviation to designate *environmental competitiveness* where an economy is considered as competitive if its activities are harmless vis-à-vis the environment. Therefore, Government will favour those industries and researches, which fit better to the environmental criterion.

On the other hand, the Quintuple Helix model facilitates the emergence of new interactions in form of Quadruple Helix; this refers, in addition to the model advanced by *Carayannis and*

Campbell, to U-I-G-E; U-G-P-E; U-I-P-E and I-G-P-E. The multiplication of such four length interactions lead us to invent a new term, that of "***Democracy of Competitiveness***".

The competitiveness within economic thought has been used to designate the product side; that is to say that a firm, a sector, an industry or even a country is competitive if its production costs are relatively or absolutely less than its rivals. However, with the coming of the Quadruple helix view of the twenty-first century economy and the rise of environmental issue advanced by the Quintuple helix, the production process does not concern firms only; civil society can participate vividly in the setting of product characteristics which reflect their preferences and thus, the product contains user side since its elaboration. This cooperation between producer-user sides at the earlier stage of production, under the framework of government and enforcement of research institutions, will orient efforts to reduce costs and create advantage in selected industries. We notice that the selection represents both participation and acceptance of all actors and includes both side of production in contrast to the traditional view; therefore, the competitiveness is rather "*democratic*".

The democracy of competitiveness is well presented in the Quintuple Helix; the rise of green economy and naturally friend products reflects the influence and the weight of "*the public*"- represented as NGOs and Media- in the selection of actions, products and innovation programs that take in consideration the protection of environment. This vision is far away from the purely industrial approach of competitiveness. That is to say, industries and production sectors that are designated to exports reflect the convention of different actors in an economy, including non-market performers and respond to global queries.

Referring to the figure 3, one can find numerous examples in real life where the centre presents a pumping mechanism. One example refers to cardiovascular system in human body. The circulatory system here refers to the flow and the transport of knowledge and innovation to and from organs to provide consistency, development and sustainability of the knowledge economy. Each organ (helix) provides (participates by) new ideas, creative tasks and shares new practices that are helpful and necessary for the others, the same when the hand takes a cup of water and the head open the mouth to escape dehydration then dysfunction of the entire body. Furthermore, the lieu of interaction of contributors (the heart) is so important. Its role is to accept all contributions, treat them and pumps results equally and efficiently among helices. Notice that the more helices cooperate, the greater benefit results as shown by the blue arrows. Another example can be borrowed from physics or astrology; indeed, both solar system and nucleus relate the continuity of

the whole system to the power generated by the rotational movement of its components around a centre, which guarantees the redistribution of energy to the entities.

Apart this discussion, one can question whether the environment should be presented as a separate actor, the same as the remaining four helices. This is because university, industry or civil society are either producer or user of innovation while this quality is hard to be distinguished with environment. However, climate change and other global warming are mandatory factors to draw policies in the twenty-first century.   Figure 3, b captures this idea. In contrast to figure 3, a, environment is not an independent strand; rather it is the result of human (societal) consciousness about his (its) continuity (sustainability) and the surrounding creatures.

The inclusion of environment provokes the integration of further helices into the model, which however, require substantial specification, operationalisation and the development of relevant indicators (Leydesdorff 2013).

Figure 4 : The Innovation Systems
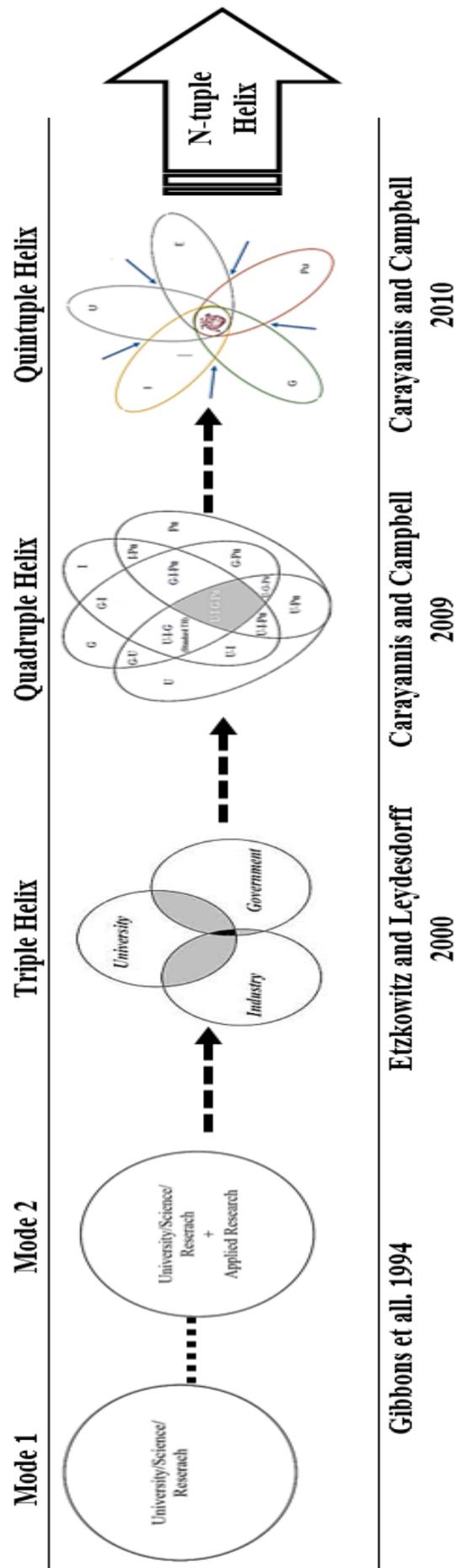
Conclusion:

The innovation system has seeing a rapid change. At the turning of the last century, different approaches emerged with the aim to understand and explain changes in the pattern of innovation and knowledge creation. All these changes resulted when university adopted new role with additional missions. However, five stages can be distinguished. At the beginning, and for a long period of time, the dominant model of knowledge creation consists of "Mode 1" when university transmits divine knowledge and undertakes the mission to illuminating people about religion. In an advanced stage, a Humboldtian university model was born. In this station, questioning and observing phenomena constitutes the engine for knowledge advancement. Yet, the interwoven events at global level during the twentieth century contributed to the adoption of collaborative thought. The Triple Helix model on innovation, belonging to this stream consists of establishing partnership between three main blocs of knowledge production which are university, industry and government. This view has gained acceptance of wider range of academic, practitioners and policy-makers. In addition, a fourth approach of innovation system resulted to include user-side. The Triple Helix according to this view represents a half part model of innovation. This is because innovation ideas are primarily inspired or influenced by consumer and users; accordingly adding "civil society" to the model brings further understanding to the process of knowledge creation. Finally, the rise of global warming and the green activity practices calls for the inclusion of environment as a fifth partner, thus the emergence of the Quintuple approach of innovation system. We notice that the last two models include the concept of "Democracy". While the Quadruple helix enforces the democracy of knowledge, the Quintuple Helix model facilitates the rise of "*the democracy of competitiveness*". In addition, there is believe within research community about prospective extensions of the innovation model to include additional helices.

Yet, a common observation that re-appears since the conception of "Mode 2" is that knowledge production results from an established partnership between naturally different actors, both in term of goals and missions. This remark is further complicated with Quadruple and Quintuple models. Therefore, the question to be addressed is what brings these heterogeneous entities to create cooperation? Furthermore, which factors facilitate the success of these partnerships to improve the innovation environment? The next chapter addresses these questions.

CHAPTER III

Literature review

Introduction:

The current chapter is composed of five sections. First, a quick review of the cooperation theory brings some light on how entities choose the partners. The behaviour that governs species in their complex environment will oblige them to exclude some actors from the scene. What are the reasons? And why entities behave as such are discussed later. The innovation theory in second stance will provide insight on the role of innovation within firms. This importance is capitalized by two concepts: the process and the systems. Both of these concepts consider innovation as happening in an interactive milieu of different actors from different sectors. The system approach of innovation insists on the role of institutions in the setting up of beneficial co-partnership for innovation. The third element introduces the concept of resource-based view. As mentioned, innovation is no longer a separated act but, it is also a valuable resource for firms to grow and expand, it is rare and costs much to acquire it. Therefore, it is inimitable and non-substitutable. The fourth elements treats the role played by institutions in providing necessary environment within which innovation can circulate easily and properly among participating actors. Last, social capital describes the informal attributes on institutions that have an active role in creating network of collaboration namely the level of trust and the quality of communication.

i- The Theory of Cooperation:

Previously we have cited that Knowledge-based economy belongs to evolutionary economics. This is due to the fact that most of its activities result from cooperation, which is viewed according to evolutionary jargon as *any adaptation that has evolved to augment, improve the reproductive success of partner*s. That is why we refer in this chapter to the theory of cooperation, first in terms of biological field then in terms of human and organisational field respectively[7].

a)   Cooperation in biology and natural field:

Since earlier writings of Darwin, the problem of how and why cooperation evolves constitutes a focal point for biologists as well naturalists. The question is further complicated when including complex entities such as a whole population or human species. Therefore, what explain cooperation and how it evolves gained a fertilised ground of studies. However, understanding the concept of cooperation from biology and natural science angle brings primitive sights on the mechanism and incitements for cooperation. According to the encyclopaedia of Britannica, biologists refer to cooperation to describe *the process by which individuals in groups benefit by working together to gain access to food and other resources*. More precisely, cooperation is said to be the result of evolution, which is based according to Axelrod and Hamilton (1981) on the struggle for life and the survival of the fittest. This argument retains the Darwinian principal of selfishness that is naturally favoured as behaviour. That is, a gene causing a behaviour that increases the fitness of its bears will be favoured by natural selection and those behaviours that accumulate in natural population will be those that best serve the selfish interest of the individual. Accordingly, a sort of relatedness and family relationships frame the action and enforce some attitudes of kin discrimination or creates Greenbeard effect (Gardner, Griffin, and West 2009). Selfish behaviour under kin discrimination results when an individual prefers to direct aid toward those that share with some genes in common, as the case in long-tailed tits population. Another scenario when selfishness be favoured is Greenbeard effect when the actor selects its social co-operators according to the sharing traits; this seems to be the same as kin discrimination, but here the aid is directed to those individuals even if they are not close relatives or even share the genes in common. However, the individual prefers cooperate with individual carrying the same

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[7] Referring to the theory of cooperation does not mean we adopt and believe in Darwinian doctrine of species' origin.

characteristics (all members having green bread in this case). Limited dispersal is another example, within biological field, where cooperation is guided by selfishness. The idea is that an individual control its cooperative behaviour to limited individuals with whom none of gene similarity or family relatedness appear.

The evolution of cooperation under selfish behaviour as we have discussed, can be grouped to three levels of intensity: selfish behaviour reaches the extremity within Greenbeard cases when the actor selects those that respond to specific characteristics and it is ready to disadvantage its relatives to reach them. The extreme case is when the actor shares, in addition to its relatives, aids with limited number of non-relative members.

b)　Mankind societies and cooperation:

Genes, cells or animal casts behave without any complicated bias of religion, gender or kin colour. Their behaviours, even they follow a scientific law, can be classified as spontaneous, the same as a computer accomplishes programmed tasks. For instance, monkey troupes, let us say since the famous observations of Darwin, tend to behave violently against any member that commits sexual intercourse. This act is neither learned nor be the result of any intellectual progress in the society. Genes, unconscientious entities, fulfil the same function within their environments; they cooperate to create a complete conscientious Mankind. Further, genes that create an organ within a specific human body refuse to accept an extra-gene of another body even they are supposed to create the same organ. These acts of selection or discrimination are not transmitted between generations, but are the result of program's execution, the same as the information written in DNA.

In contrast, Mankind behaviours explain and result according to numerous variables. Some of them are personal, geographical or political; some others explain their ethnicity, gender or belief. In addition, some behaviors evolve through time and reflect intergeneration transmission of belief, customs and culture. That is why human cooperation is complex in term of interactions and factors. Consequently, every act and every activity that includes human factor must be studied, explained and understood according to his behavior. For instance, understanding the development of relationship among heterogeneous organizations must be understood under the development of human behavior toward cooperation. Therefore, in this section the focus is to shed-light on human cooperation.

In contrast to genes and animals, cooperation within human societies tends to respect some cultural, geographical and ethnical norms, in one hand and contributes to develop social norms, on the other. This is because human kind is the only species, which transmits, consciously, its overall knowledge to future generation as a direct result of its choices made according to time and place. Accordingly, researchers studied human cooperation and came out with intuitive results such as reciprocity and altruism.

Altruistic behavior had been seen as controversy to evolutionary explanations, which favors natural selection. An altruistic actor tends to increase the benefit of a recipient and thus is abandoned by nature, consequently. Yet, altruistic behavior is well established among human and is viewed as sign of goodness. This controversy brought about different explanations. Evolutionary explanations claim the existence of some relatedness between participants. To demonstrate the fact, Hamilton's (1964) justifications coins the term "Kin Selection" in which an actor has a tendency, by bringing aid or assuming certain risks, to save the survival of his genes invested in the recipient, generally one of his relatives. Altruism, from a religious point of view, consists of a fact by which an individual seeks God blessings or soul peace, while no reward is planned. In what concern geographical location and ethical documents, Ibn-Khaldun observed that those who live in countryside (Bedouins) tend spontaneously to be altruists then sedentary people. This is because they are less likely to be affected by negative developments occurred in towns, which are the result of civilization[8].

In an action similar to altruism, reciprocal act refers to a feedback reward for a person who acts generously on other's behalf. Indeed, rewarding a positive behavior by a similar action enforces the establishment of trust and cooperation among social groups, even no relatedness come out. This means that reciprocation is another act of altruism, which is viewed as a behavior whereby an actor acts in a manner that temporary increase its costs while increasing other's benefits, with the expectation that the other will act in a similar manner at a later time. Thus Trivers'(1971) "*Reciprocal Altruism*" term was used to explain the evolutionary process of cooperation. Yet evidences show that individuals within human societies are equipped by two qualities of cooperation or cheating and their tendencies toward any behavior differ in accordance to situations and circumstances. The existence of specialized infrastructure such as laws, police forces or courts consist that incentives to cheat increase in an exchange situation between individuals where the

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[8] For more details, readers are invited to read chapter 4 of the first volume, untitled: ***Bedouins are closer to being good than sedentary people***, both in original or translated versions.

characteristics of such exchange are not well determined (Fehr, Fischbacher, and Gächter 2002); therefore actor is willing to reflect another's behavior in an attempt to stop or diminish his loses. This leads both of them to observe and analyze other's behaviors, the same as they play a game. Therefore, understanding the evolution of human cooperation must refer to the study of the game theory. The following point refers to the relation between cooperation and the game theory.

ii- Cooperation and the Game theory:

Game theory deals with problems of decision making in the presence of multi-person/multi-agent situations. Its application is widely used in numerous fields of scientific studies. In economics, the theory of the games is almost used in all area of interests. This is because economic activities result from systematic structures, based on interactions between more or less independent agents. Moreover, given that the interests of these actors are expected to coincide, strategic behavior necessary plays a momentous role to review or comprehend their actions.

For a long time, game theory was considered to be solved at zero-sum value. The implied idea within this view is that the interests of players are in extreme opposition. That is to say, what can one player gain is equivalent to what another mislays. The incompatibility of player's interests determines the game-value, one where each player minimizes the maximum loss imposed by the other one (the mini-max strategy).

Yet the relevance of zero-sum as an optimum for the game was investigated due to the actual game's environment. Indeed, interests of participants do not always present a head-on situation; rather there are considerable incentives of confrontation and cooperation. Therefore, an alternative explanation appeared in result. One beautiful explanation is Nash equilibrium strategy. In what follow, basic game strategies are presented.

The big picture of the equilibrium states that participants trace a profile to be reached and it must be adhered by each one to avoid, and then diminish, any incentives to cheat. Therefore, the reached equilibrium is a case where a participant loses a single opportunity to increase the reward at the expense of another.

The Nash equilibrium serves as a coin stone for other strategies that vary according to time and information availability.

b-1 cooperative strategies within the game theory:

As highlighted above, Nash equilibrium, advanced as an interpretation to game's real environment, was widely used in social and economic context due to delicacy of human relations, which carry contradictions and cooperation simultaneously. The multitude of players with multiple interests reflect the complexity of chosen strategies. Indeed, participants may possess complete or partial information and the decision she/he takes may be simultaneous or successive. Consequently, game strategies depend on information availability and time of decision-making and four strategies emerge:

1- Bayesian Equilibrium   2- Perfect Bayesian Equilibrium

3- Nash Equilibrium   4- Perfect Nash Equilibrium

However, one of the most strategy, often referred to, in cooperation theory is the Prisoner's dilemma. The standard presentation of the concept assumes catching of two thieves suspected to commit a murder. In a separate investigation room, they can either confess or keep silent. If both confess, they receive six years in jail each. However, if one confesses, the other will stay in jail for nine years; the confessor gains liberty. Yet, if both keep silent, the police have no right to arrest them and will kept them until investigations terminate. So both stay a fewer time in prison.

The payoff matrix in figure 2-1 depicts the negative of the number of years in prison that they will get. Evidently, each of them wants to diminish his penalty .For example, looking to the thief 1's strategy, it can be seen that "confess" as strategy overcomes "don't to confess" strategy. If thief 2 confesses, thief 1 passes six years in jail or nine years if he does not confess. However, if thief 2 chooses not to confess, thief 1 regain liberty instead of one year if he keeps silent too. Therefore, the optimum strategy for the first thief when acting solely is to "confess".

Figure 3-1: the prisoner's dilemma.

		Thief 2	
		Confess	Keep silent
	Confess	(6.6)	(0.9)

Thief 1	Keep silent	(0.9)	(1.1)

The same reasoning applies for the second thief where the best strategy in acting solely is "confessing" assuming six years in prison. The dominant strategy in acting separately, for bot of thieves therefore, is to confess.

The payoff matrix of the figure shows that both can decrease their punishments if they cooperate and choose not to confess. In this case, each will stay one year in prison instead of six or nine. Unfortunately, there is a tendency for each to cheat the other to gain instant liberty. Moreover, for the second time we return to the dominant strategy in the prisoner's dilemma. This is why the "confess-confess" strategy is qualified as game equilibrium and is referred as Nash equilibrium.

In one realistic case, game theory can be applied to determine strategies in an economy with negative externalities from pollution. The assumed strategies for this game are copied in figure 2-2

Figures 3-2: game strategies with external negative pollution.

		Company B	
		Less pollution	High pollution
Company A	Less pollution	(6.6)	(0.9)
	Less pollution	(0.9)	(1.1)

If no control exists, each company prefers to maximize profit by polluting more instead of setting up heavy investments on controlling pollution equipment. Further, if there is an altruistic behaviour from one company, which decides to clean its pollution, then, this will lead be reflected on its production costs and prices and thus fewer consumers or market shares. If these costs are judged high, then, it can be eliminated from the market. Therefore, competitive pressures and the

desire to survive conduct the existing enterprises to towards the dominant strategy that is explained in prisoner's dilemma.

This situation is one example of a state where Adam Smith's concept of non-market mechanism (hidden hand) is remarkably corrupted. In addition, this is a situation where Nash equilibrium is in discordance with social norms, when decentralized markets or equilibria become dangerous as it disturbs social equilibrium. Setting up regulations, laws and institutions appears as vital necessity and call for government intervention. In our case, imposing taxes on pollution emission induces companies towards less pollution strategy. In this option, companies gain less but the environment is well protected.

Except of this odd case cooperation strategies result in a better-off position for all participants provided their full harmonization. Evidences from modern era document the benefits of collaboration even among heterogeneous parties. One example in economic field is the rise, then the intensification of cooperation agreement between university and industry or partnership joining public and private entities, in different forms and models. However, the main questions posed to understand cooperative tendencies are:

- What is the best number allowed for participants in the cooperation agreement?
- What are the incentives to collaborate?
- How should collaboration costs and gains be shared between them to guarantee equity and reinforce cohesion?

Peña & de Arroyabe (2002, 57-73) list the following principles:

a) Cooperation is favoured when individuals gain is remarkably less than acting in conjunction. That is, the incentive to cooperate depends on the cooperation function.

b) The return from cooperation must be equally shared among participants.

c) The contribution of participants equals at least the amount of the resources provided individually. That is, the value of gains is proportional to the initial contribution.

d) The return from cooperation increase each time a new participant joins the group.

By analysing these principles, one can deduce, at least and restrictively in our research study, the contribution of different concepts such as institutional theory; resource-based view concept; theory of innovation; social capital theory; innovation ecosystem and linked ecologies. The contribution of institutional theory to understand the enforcement of cooperation in the field of innovation is to indicate the existence trajectories forcedly determined by social context

(ecosystem) in which the various agent (viewed separately as an ecology) operate. However, it seems necessary to demonstrate the concept of innovation as a theory.

iii. Theory of Innovation: Process and System Perspectives

In the recent era where globalization overwhelms all aspects, innovation is viewed as a mandatory prerequisite for economic development and sustainability. This regard refers to development as the implementation or enforcement of the ability to creating new combinations of existing resources and it can be defined as Schumpeter noted as:

- Procreation of unprecedented goods or quality widely accepted by the public;
- Introduction of new method of production;
- Extension and development of new area for a given product, industry or sector
- Utilisation of new resource of stuff or semi-finished products
- Application of new organization.

These attributes however fit exactly with the modern definition of innovation as *the first successful application of a product or process.* Further, one can address innovation issues under two approaches: process perspective or system approach. Studies, for the first approach, deal with the different stages of innovation path within a firm (Knight 1967, Maidique 1980, Bessant and Tidd 2007, Kamal 2006). The second stream of studies focuses on the network of possible actors which influence the creation, diffusion and use of innovation or knowledge (Nelson 1993, Lundvall 2009, Etzkowitz 2002, Carayannis, Barth, and Campbell 2012). The following point deals with innovation theory from process perspectives.

c) The innovation process:

Even if innovation process[9] differs from one organization to another, a reoccurrence of some stages lead to adopting a common model for almost all sectors and industries. The model is composed of five phases: identifying the goals or problems to be solver; analysis; development and design; conversion or transformation and commercialisation.

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[9] Innovation process differs from process innovation. While the later, according to OECD (2005) means *"the implementation of a new or significantly improved production or delivery method [*and*] includes significant changes in techniques, equipment and/or software"*; innovation process *"can be viewed as the single phases of a complete product life cycle. This cycle includes the invention itself which is developed and advanced until market introduction and which is eventually followed by the product's broader diffusion and imitation(Zeschky and Gassmann 2016, Carayannis 2013)*

- *Goals and Problems' Identification:*

The foremost stage in the process is problem-centred or goals selection. Organisations (firms, enterprises and industries) should clearly define, highlight and precise what they need to narrow their innovation plan; therefore, an earlier outline of the innovation program became known. Thus, identifying goals or problems presents a critical stage for the whole process. Organisations are called to involve a good cross-section of businesses to achieve these goals, which in turn will mobilise a range of intermediaries to this end, including internal expertise of the organisation or even establishing an expertise with customers and client network for a better overview of the market.

- *Analysis*:

The resulting roadmap branches to the next step, which consists of a composition of real world discovery of the current situation, problem plot, sibling clients, defining their needs or detecting challenges. However, a plan that focuses only on customers' analysis may engender a fatal failure of the organisation. Analysing what is happened outside its boundaries helps escaping serious errors during the innovation process. Thus, it is essential to investigate what rivals and competitors are doing. Any patters that may have an impact, either direct or indirect, on the organisation existence must be involved in the program. Auxiliary, it is also recommended to take profit and learn from any outside innovations that will have links to the innovation process of the organisation. This means establishing cooperation with potential actors in innovation generation, usage and transmission (universities, research centres, government, and civil society: media and associations, and other complementing industries). This external analysis is accompanied by an internal one where organisations determine the available assets, resources, competencies, and which can be helpful.

- *Development and Design:*

Data and information resulting from previous stages help in elaborating and developing a thought portfolio that incorporates ways that help organisations innovate to meet their goals and address their problems. These ways include resources, steps, time and dosage for each segment once this step is done, an initial evaluation and prioritisation will prompt a testable innovation portfolio.

- *Conversion*:

At this level, organisations tend to translate and transform thought into practical innovation product that could be elaborated for a predefined marketplace. The underlying point is to test the innovating product, service or idea within a restricted scope in the aim to identify client acceptance and or consume the innovation and are willing to pay for it. This implies elaborating prototypes subject for further modification in term of costs and reconfigurable design.

The conversion stage is critical level. As provided prototypes (innovation) will most likely be subject to adjustment or modification in the light of customers and market feedback. Therefore, some innovations succeed while others will need additional time of test-evaluation to get market voice. This stage is also critical as organisations ted to protect their intellectual properties.

- *commercialisation*:

The final stage in the process consists of developing the final prototype, after modifications and testing, to full-scale operations. Thus, it is necessary to insure access to production facilities, plan for a suitable distribution channels including logistics. At this level, external cooperation and collaboration across the organisation, other form of partnerships can influence the positioning, the future and the success of the product in the designed market.

Research findings showed a negative correlation between risk levels and costs along the innovation process. As the organisation gains trust in the innovated product, it simultaneously builds large vision of the technical and commercial issues, which diminishes dramatically the level of product failure. Nonetheless, the costs spent, since earlier stage of discussing ideas through laboratories, prototype designing and development to final product, increase radically in response. It is also important to notice that the whole process we have just described refers to management practice within companies, whose principle function is to provide goods and services for markets. This is because there is another stream of literatures that treat the process from historical point of view and refers to it as innovation models (Meissner and Kotsemir 2016, Zizlavsky 2013). The literature list five models. These are the *technology push model*. The model is based on the idea that a new invention is pushed through R&D, production and sales capacities on the marketplace, without suitable thought of whether it fulfils consumers' needs. Further, the model highlighting the entrepreneur as the person taking the threat and overcoming the obstacles in order to extract the monopolistic profits from the introduction of original ideas.

The *market pull approach*, in contrast, considers innovation activities through R&D are made primary to respond to what consumers and clients suggest. The market pull model starts with potential customers asking for improvements to existing products; therefore, these needs and

demands of the market determined the work of research and development departments in companies. The third model of innovation process emerged during seventies, where criticisms about capability of technology push and market pull to explain interactions between science, technology and market. It was believed that the interactions are more complex that the simple picture brought by the previous two models. As a result, a *coupling model* (an interactive one) gathers the technology push and market pull approaches into an inclusive model of innovation, and established a more widespread and nuanced approach to the question of the factors and players involved in innovation. Under this model, the focus is put on the effects of feedback between phases of market research and previous linear models. Innovation process "coupling" is successive and can be alienated into distinct stages and dependent on each other. Phases interact through feedback to preceding stage. This model suggests that suppliers and customers should be closely "coupled" in product development teams. The third innovation model correspond to the innovation process, which can be considered as a communication complex network, intra and extra-organizational, linking together various individual functions, the scientific community and technology market. However, it did not specify the driving forces for the innovation engine.

The *innovation system*, as the fourth model, appealed to enlighten and endorse the fact that complexity of innovation necessitates connections not only from an extensive range of agents inside the firm but also from collaboration amidst firms. This approach establishes an unprecedented explanation of innovation from a system perspective, which comprised an emphasis on interactions, inter-connectedness and cooperation. It assumed that firms with limited resources to develop innovation solely could benefit from creating relationships with other firms and organizations. The set of elements in the innovation system and their interconnectedness and ways of interaction are the key factors for success and functioning of this system. The last model is thought to be evolutionary, and is aimed to catch approaches to contest the main shortcoming of previous models. The crucial features of evolutionary models are the exterior milieu (patent regimes, market structures, standards and regulations, as well as natural environment). Evolutionary models argue that innovation involves change and decisions on innovations are made not only based on price consideration, but imperfections are necessary conditions for technical change to occur in a market economy; in addition, results from innovation activities are to a large degree determined by the evolutionary process.

The process of innovation is, for firms and organisations, a determinant activity to guarantee survival and continuity namely in recent era of strong complexity and antagonistic competitiveness. Firms or organisations that omit planning their innovation process face high probabilities of exclusion or disappearance; in view of that, and for challenging this issue, firms

that face shortness in their innovative capacity within its internal boundaries, look further outside by establishing strategic alliance and/or signing cooperation with potential knowledge providers. At that level, innovation is no longer understood as a process, but a system approach needed to comprehend innovation theory. The next point deals with the issue.

d) The innovation systems:

Systems of Innovation are frameworks for understanding innovation that have become popular particularly among policy makers and innovation researchers all over the globe. According to this concept, innovation and technology development are the results of a complex set of relationships among actors in the system. Therefore, one can define Innovation System as the flow of technology and information within a network of organizations (which include people, enterprises and institutions) within an economic system that is directly involved in the creation, diffusion and use of scientific and technological knowledge, as well as the organizations responsible for the coordination and support of these processes.

The intellectual roots of the innovation system approach to the production and dissemination of knowledge lie in attempts to understand the complexities of the innovation process that have taken place over the past years. Two key features of the process have arisen from this analysis.

The first is that innovation is essentially the result of an interactive process between many actors, including companies, universities and research institutes. Individual organizations rarely possess all the knowledge necessary for the whole process of innovation. As a result, they need to combine scientific, design, engineering and operational knowledge from different sources.

The second feature is that innovation does not follow a linear path that begins with research, moves through the processes of development, design and engineering, and production, and ends with the successful introduction of new products and processes. Rather, it tends to encompass continuous feedback loops between the different stages.

Thus, the innovation system provides a coherent analytical tool for handling the disparate processes of knowledge creation, distribution and use, as well as the ways that these affect productivity, competitiveness, and economic and social development.

Another important aspect of the innovation systems approach is that it can be applied to different levels of the economy, depending on the willing of the researcher to study innovation at a 'supra-national', regional, national, local or sectorial level.

At a wider level, National Innovation System (NIS) focuses on the study of the flow of knowledge, as well technology and information, among people, enterprises and institutions which are considered as key factors to the innovative process (OECD 1997). Further, one can see the system as an open, dynamic and complex structure that incorporates interactions within and between organizations, institutions and socio-economic structures, which define the rate and direction of innovation and competence building emanating from the process of science based and experience learning (Sharma, Nookala, and Sharma 2012). The emergence, as well the circulation of innovation is relative to its activities. these are, according to Edquist (2011): 1) R&D provision; 2) competence building; 3) formation of new products; 4) articulation of quality requirements; (5 creating and changing organizations for developing new fields of innovation; (6 networking through markets and other mechanisms; (7 creating and changing institutions; (8) providing incubation activities; (9) financing innovation; and (10 providing consulting services.

In addition, the measure and evaluation of national innovation systems emphases on knowledge and information streams. They are grouped in four categories: 1) *inter-firms interactions* that take different forms such as joint research activities and other collaboration practices. 2) *Firms, universities and public research institutes' interactions* by comprising joint research, co-patenting, co-publications and further formal linkages. 3) *Diffusion of knowledge and technology to enterprises*, namely the rates at which the industry adopts new technologies and diffusion through machinery and equipment. 4) *the movement of technical personnel*, by stressing on the personnel mobility within and between the public and private sectors. Yet, linking such flows to firm capabilities displays that high levels of collaboration, technology diffusion and personnel mobility participates to improving the innovative ability of enterprises in terms of products, patents and productivity.

At a lower level, Regional Innovation System (RIS) refers to a set of interrelating private and public interests, institutions, and other organizations whose final goal, under a framework of organizational and institutional arrangements and relationships, is to generate, use and disseminate knowledge [within a determined geographical region] (Doloreux and Parto 2005). Its field of study out passes innovation theory to overlap economic geography, where it can be understood as a group of geographically adjacent enterprises, R&D institutes and universities, which supports and produces innovation(Liu and Chen 2003). In additional, the increased importance of RIS as

research study is viewed, simultaneously, as a result and a ground of Krugman's point of view about production concentration in specific regions[10]. The increased focus on regions as the best geographical scale for an innovation-based economy relies to the prominence of specific and regional resources in motivating the innovation capability and competitiveness of firms. This what bring Porter to claim that the continuing competitive advantage in a global economy is local, arising from a concentration of highly specialized skills and knowledge, institutions, related business and customers in a particular region.

Yet, RIS can be perceived from five aspects[11], which are: 1) *Regional Innovation Milieu*, which refers to social, economic and natural factors, combined to form the integrated milieu of regional innovation. 2) *Regional Innovation Elements,* these are the fundamental ingredients elements coming from the milieu. Their role is to form the innovative units and participate the innovation process. 3) *Regional Innovation Units* they can be regarded as the relatively independent participants of regional innovation, and they have their special functions within the whole system, especially enterprises, universities, R&D, local government and services, the units serving other innovative units and the whole innovation.

4) *Regional Innovation Structure*: the RIS structure is regarded as the steady integration of innovative units and their innovation-oriented relationships. It can be perceived at two aspects of organizational structure and spatial structure. 5) *Regional Innovation Function*: the RIS function can be considered to have impact on its environment and itself through the operation and the output of the system. The functions can be analysed first through the innovation scale, including the quantity of innovative products, patents, research papers, talents and second through the outer impact on social progress and economic development.

Some research re-question the innovation process within RIS. The argument is that a region is a wider concept to understand innovation. Further, it is observed that innovation is produced, at Local regions. The Local Innovation System (LIS) is a spatial and social system concentration of techno–economic structures and associated political–institutional structures that act in a systematic manner and result in interactive learning to create new products and/or services in specific niches of business. Therefore, four elements are principle in the drawing of the system:

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[10] According to the Nobel Prise Committee, the main contribution of Krugman is the analysis of the effects of economies of scale, on international trade and on the location of economic activity

[11] For a detailed understanding see Liu, Shu-guang, & Chen, Cai. (2003). Regional innovation system: Theoretical approach and empirical study of China. *Chinese Geographical Science, 13*(3), 193-198.

- a network of innovative firms, localized in the same space and bound by horizontal and vertical interactions;

- a set of research and educational institutes, such as universities and research centers, which produce scientific knowledge that contributes to innovative processes.

- a series of infrastructure provisions that incentivize the localization of innovative firms within the given area;

- The existence of collaboration mechanisms among all these actors, capable of encouraging mutual learning and thus processes of innovation.

One can state that cooperation among firms and research institutions is an important aspect. However, Local Innovation System distinguishes from NIS and RIS by the following characteristics: (i) sectorally and institutionally diverse knowledge-generating businesses and institutions, able to draw innovative ideas from many potential sources; (ii) firms at high levels of specialization, capable of supplying the best to national and international markets; (iii) commercial and marketing know-how, based on awareness of international markets and technological conditions; (iv) a social culture that demonstrates and tolerates diversity, and offers new ideas and ways of doing things; (v) firms that are able to exploit knowledge and to support knowledge applications by others; (vi) high levels of technical sophistication among producers and users of technology; (vii) economies of scale; (viii) international knowledge spillovers from sophisticated customers, including locally represented multinational companies, which provide the LIS with information on leading-edge knowledge, products and services. While all these characteristics are objectively possible elements of an LIS, individual localities will have different combinations and strengths in each of them. In many cases, one or more of these phenomena will be missing altogether.

In addition to NIS, RIS and LIS, innovation system can be studied from sectorial or technological sides. The sectorial system (SIS) denotes the process of innovation path among the building blocks in a given economic sector (Malerba 2005, 2004, 17-18); these blocks are:

1) *Knowledge and technologies*: refers to the domain in which the limits of the system are defined and are at the centre of analysis.

2) *Actors and networks*: which are heterogeneous in types and include broad range of market and non-market agents. Their specific learning processes encourage them to interact through a communication processes and in multiple ways by means of market and non-market relationships. Therefore, innovation process consists of

systematic interactions between a diver set of actors for the production and exchange of knowledge related to innovation and its commercialisation.

   3)   *Institutions*: the role of institutions is to shape the actions and interactions of actors in the system. However, many institutions have a national character and thus have different impacts on different sectors.

A Technological Innovation System (TIS) (Carlsson and Stankiewicz 1991) is defined as an active network of agents co-operating in a specific economic/ industrial area in a certain institutional structure and involved in the production, dissemination, and exploitation of technology. The system is viewed from knowledge/competence flux rather than the conventional flows goods and services. As the previous innovation systems, the TIS is structured over three main elements (Suurs 2009): *actors*, *institutions* and *technologies*. Actors gather all organisations that have an impact, direct or indirect, on the actually generation, diffusion and utilisation of technologies of focus. Institutions are to frame the actions and behaviours of agents in the system toward a specific technology. By formal institutions, we refer to rules, laws and regulations generally codified and enforced by authorities in charge; while informal institutions denote social norms and values or social paradigms. Technological factors comprise of artefacts and the technological infrastructures in which they are integrated. The techno-economic workings of such artefacts, comprising cost structures, safety, reliability, effects of up-scaling etc., are of crucial importance to comprehend the feedback mechanisms between technological change and institutional change.

It results that innovation, seeing as process or system, is the outcome of cooperative efforts at different steps and among heterogeneous agents. It cannot be considered an isolated fact accomplished separately by agents. Thus, to understand the development of cooperation among university, industry and government, we need to understand properly how these strands operate with innovation both internally and externally. In doing so, a new question about why the actors focus, by spending money and investing time, on innovation especially. The quick answer is that innovation, and in a general understanding: knowledge, gain a growing importance as a main source of rapid prosperity of economies and is valued as a capital asset for firms. The understanding of how cooperative activities develop, in addition to what innovation theory brought, is better explained if we know the significance of innovation for university, industry and government (and equivalently all other actors).

Many studies have been done in this field and led to the emergence of Resource-Based View theory. The following section deals with this concept.

iv- The Resource-Based View Theory:

a)   *The Fundamentals of the RBV Theory*

As a theoretical approach, RBV is viewed as a model that considers resources as a foremost variable to firm performance. This view is very different from market-based approach, which focuses on external factors and market orientations as source of performances and place of competitiveness formation. Market-Based View states that competitive advantage of a firm resides in the way the firm performs differently the same activities to its rivals. In this regards, researchers (Bain 1968 among others) found that industry structure affects firm's performances, namely: barriers to entry, product differentiation, number of competitors and the level of demand. Indeed, a firm, in a monopolistic situation, benefits from strong market position and consequently performs better than its competitors. Reducing the number of rivals in an industry, by high barriers to entry, enhances firm's competition and performances (Makhija 2003); that is, greater market power is often linked with higher firm's value.

On the contrast, the Resource-Based View looks at the interior environment of the firm namely the heterogeneity of resources it holds. Therefore, the advancement of a given firm is viewed by the way it combines these resources in the manner that saves time and costs. According to Barney (1991), these resources comprise all assets, skills, organizations, firm's characteristics, information and knowledge which can be organised and used to enhance the firm's efficiency and effectiveness. He also categorises theme into physical, human and organisational capital resources. Nevertheless, they cannot be qualified as market factors, but they are attained via an active and continuous accumulation. Further filtration of resources leads to classify them as tangible and intangible assets. Tangible assets denote the capital of a firm and entail items such as property, equipment and supplies. These set of resources are simply acquired from marker and add little to firm's advantage because competitors can also possess them. The intangible assets cover capabilities and interactions within firm's boundaries and take account of employees, customer relationships, unique technologies, and intellectual property (patents, trademarks and brands, for instance).

Unlike physical resources, trademark reputation is built over a long time and is something that competitors cannot buy from the market. Intangible resources frequently remain within a corporation and are the chief cause of sustainable competitive advantage. Resources can also be viewed as strategic and non-strategic. Strategic resource describes the asset that is valuable, rare, imperfectly imitable and non-substitutable (also known as VRIN framework). Thus, a combination of these attributes gives competitive advantages some sustainability and ensures a lap of firm's superiority in the industry. In fact, a distinctive resource is one that leads to value creation or cost shrinking, in the sense that a firm is able to outperform its rivals or reduce its weaknesses; this would mean that the cost invested in the resource remain lower than the future returns. A valued resource (first attribute) refers to one that enables a firm to comprehend and/or to implement strategies with the aim to improve its effectiveness and efficiency (Barney 1991); otherwise, the resource may lead to a competitive disadvantage and critical misplaces in the industry.

In line with the concept of value, firm's resources have to respond to rareness characteristics. Rare resources lead to value creation by the mean of reducing potential competitors. If the resource is available for all active firms in the industry (or a sector), the possibility to offer competitive product become harder task as rivals have the access to the used resource. However, if the resource is controlled by a unique firm or by a determined number of firms, thus they are able to control the product and their competitive advantage. A strategic resource must be of less existence among rivals (existed and potential ones); otherwise, the firm may only realise a competitive parity.

The third attributes for resource to be strategic is the ability to imitating. Imperfect imitability suggests that the cost of duplicating or copying the asset constitutes a heavy charge for competitors. The acquisition of such resource is thus restricted to the firm. For Madhani (2009), impediments for imperfect imitability differs. He lists, among others: difficulties in obtaining resource, ambiguous relationship between capability and competitive advantage or complexity of resources. If the resource is costless then the firm enjoys a temporarily competitive advantage.

The last characteristic is non-substitutability. If a resource is valuable, rare and hardly imitable but it is easy to be replaced by a similar or an equivalent resource, then this resource could not sustain the competitive advantage of the firm. Differently stated, if other firms are able to counter the firm's value-creating strategy with a similar resource, price is broken down to the level it equals the discounted future rents, leading to zero profit. In this case, the firm's competitive advantage is viewed as temporarily. Nonetheless, in the market is unable to provide an equivalent resource, the firm enforces its competitive capabilities as long as rivals could not substitute the designed resource.

The following figure summarises these characteristics, with reference to the corresponding possible case of competitive advantage that a firm comes across according to the absence features. If a resource is qualified as non-value created, firm may encounter a disadvantage; otherwise, it enjoys a competitive parity if the resource is homogenously distributed across other competing firms. If the resource is heterogeneously distributed, there is a chance to gain a temporarily advantage when the resource is imperfectly imitable. A sustained competitive advantage is achieved when the firm uses a combination of resources that are valued, rare (heterogeneously distributed), imperfectly mobile (inimitable) and is hard to replaced.

Figure 3.3 : Resources' features according to RBV
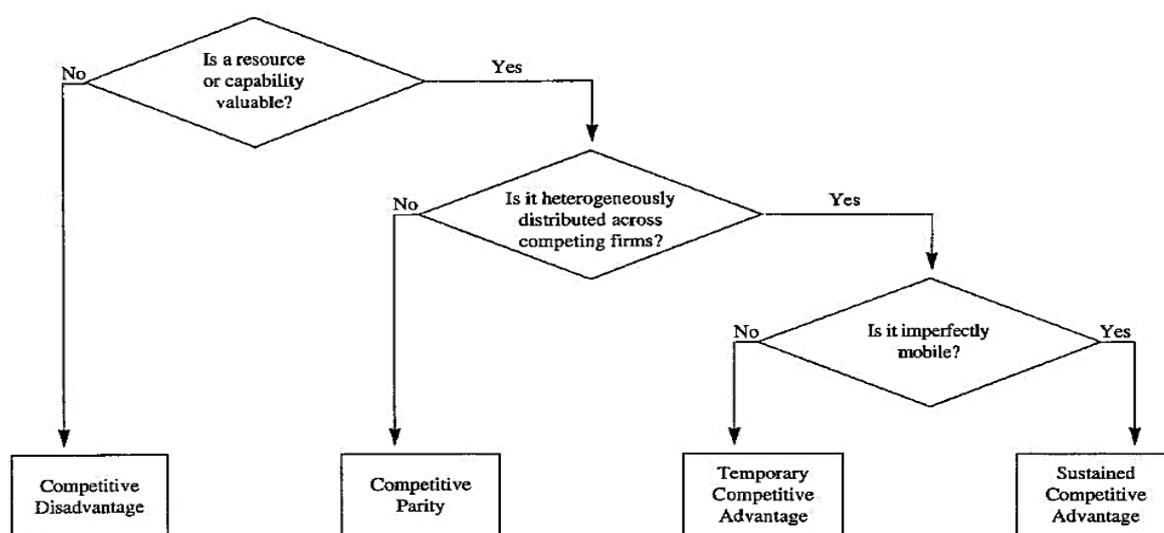
Sources : Mata, Fuerst, & Barney (1995)

b)   *Resources and capabilities*

One can wonder whether capabilities are classified as resources. Researches on the question are distinguished in their results. However, resource mobility, firm's inability to alter its accumulated stock of resource and resource mobility are at the origin of firm's heterogeneity in terms of the strategic resources it possess and control. Therefore, viewed separately, each firm can be regarded as a unique bundle of tangible and intangible resources and capabilities. As discussed earlier resources can be defined as all the assets that are secured semi-permanently to the firm. This comprises commercial, financial, human, physical, technological, and organizational properties used by firms to improve, fabrication, and supply products and services to its customers. These resources can be classified as tangible (financial or physical) or intangible (knowledge carried by

employees, skills and expertise, firm's reputation, for instance) (Kostopoulos, Spanos, and Prastacos 2002).

Yet, Capabilities refer to all kind of capacities that a firm delivers to organise and manage different resources, using organizational procedures, in the aim to affect a determined end. These capabilities are information-based, fundamentally intangible processes, which are specific to a firm and subject to progress over time through complex interactions among the firm's resources. They can be apprehended as 'intermediate goods' made by the firm to provide superior productivity of its resources, as well as strategic suppleness and protection for its ending product or service (Amit and Schoemaker 1993).

However, capabilities and resources differ is some points. Capabilities are firm specific since they are embedded in the organization and its processes, while an ordinary resource is not. This specificity of capabilities entails that if an organization disappears from the market, its capabilities would dissolve in consequence; in contrast, the resources still exist under the possession of a new owner. The second feature that distinguishes a capability from a resource resides in the fact that the primary purpose of a capability is to enhance the effectiveness and productivity of resources that a firm possesses in order to accomplish its targets, and this is what Amit & Schoemaker (1993) meant by 'intermediate goods'. Therefore, resources are commonly more static in nature while capabilities are more dynamic[12] and evolving trough time.

Apart of these distinctions, resources and capabilities are used interchangeably to mean all assets, capabilities, organisational processes and knowledge that a firm possesses and controls to implement strategies for the enhancement of its efficiencies and capabilities (Barney 1991). This definition indicates that a firm uses resources, which are not properly totally on its ownership; besides, these resources and capabilities are the result of interaction of various agents, as it is the case of knowledge and the process of innovation. The following discusses how knowledge is considered and become the most important asset for firms.

c) Knowledge and Innovation in RBV:

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[12] Scholars (Teece, Pisano, and Shuen 1997, Ludwig and Pemberton 2011) talk further about dynamic capabilities. Dynamic capabilities, unlike ordinary capabilities, are exclusive to each firm and embedded in the company's history. They are captured not just in routines, but in business models that go back decades and which are difficult to imitate.

Before going further, it is worth to re-mention that knowledge is a set of immaterial asset that encompasses the information and expertise of a company's employees, their skill with business processes, group work and through-job learning. Knowledge (technically speaking: Knowledge capital) differs from traditional physical factors in that it is built on skills that employees share among them, in order to develop efficiencies. That is, a firm that accounts skilled employees, who have access to knowledge capital, benefits the firm from a comparative advantage vis-a-vis its competitors. On a similar way, innovation usually denotes changing processes or generating more processes that are effective, products and ideas. Differently stated, the concept of innovation is captured in the fact of creating new value and/ or capturing value in a new way. In businesses, this means realising original ideas, creating active products or improving existing services on the marketplace. In that sense, knowledge is the cornerstone of innovation; and the way to melting them constitutes a specific retouch for firm in the creation of distinctive capabilities. Yet, how knowledge and innovation are perceived within the RBV approach? The remaining of the in hand section deals with.

It is widely agreed that the Knowledge Based View (KBV) is an updated version of the RBV, in response to recent economic orientations[13]. This is due to its consideration of knowledge as the essence of firm's excellence in term of organisation and behaviour. Indeed, the concept 'knowledge' has been used in different fields of strategy(Bertram 2016) including strategic alliances, capability transfer, merge and acquisition and product development. Such importance renders obligatory the re-examination of the RBV; according to Barney et all (2011) four reasons explains this need: first, researchers tend to use resource-based theory rather than resource-based view. Second, perceptions resulted from RBV joined other research topic such as institutional economic or organisational economics. Third, RBV reaches a point where empirical evidences, critical examination of methodology and critics and their reviews are documented. Finally, RBV gives birth to new perspectives like natural-resource-based view and KBV.

The protagonists claim that heterogeneous knowledge and capabilities are at the origin of sustained competitive advantage and firm's excellence. Knowledge within a firm can be conceptualised as stock and flow (Dierickx and Cool 1989) stock of knowledge refers to accumulated knowledge assets and flow designs streams of knowledge in and among organisations. Therefore, the more stock and flow of knowledge is, the more competitive

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[13] By recent economic orientations, we mean the global adoption of knowledge based economy as a new model of economic scene.

advantage is sustained. This means that a firm that has a capability to recombine its knowledge and apply it to new market prospects can grew and benefit from a competitive advantage and reduce rivalry. Thus, firm's superiority is highly conditioned by its continuous capacity to innovate. However, production activity necessitates a combination of individual and specialised knowledge, and the ability to integrate them gives advance to the firm. Grant (1996) in this stream proposes the knowledge-based theory of the firm in which non-propriety of knowledge (tacit knowledge) determines the sustained competitive advantage for the firm. Lioukas et al (2016) in a similar manner, insist on the role of IT capabilities[14] as a potential source for sustained competitive advantage as it responds to VRIN characteristics. Pee & Kankanhalli (2016) extend the view to consider Knowledge Management (KM) capability as an additive or formative aggregate of a firm's ability in seizing, sharing, applying, and generating knowledge. Such a firm, thus, is expected to profit from the additive value synergies and perform better than others. Kostopoulos et al (2002), from strategic point of view, summarise the importance of IT and KM capabilities on firm's ability to innovate. This is because, these capabilities (qualified as intangible assets) bring together the essential factors affecting the creation of sustainable advantage. A sufficient stock of experienced human capital with advanced technical skills, know-how in R&D projects, and risk-taking propensity rises the likelihood of a firm to invest in innovative activities. Therefore, firms are called, in addition to their ability to create knowledge internally, to cooperate and engage in other forms of alliance with external environment to create catalysts for innovation and to strengthen their technological progress against rivals.

In the end, the process of innovation creation, as mentioned in previous section (the theory of innovation) results from various integrations among internal as well (heterogeneous) external agents. Those agents, namely external agents, are heterogeneous in their mission, function and prospects, which may lead during their close interaction to create disputes or disagreements. That is why establishing rules, norms and laws contribute to limiting such odds. Therefore, reviewing the importance of institutional theory facilitates the understanding of the implementation and the

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[14] According to Lioukas et al (2016), IT capabilities are organizational skills and capabilities related to IT, which enable a firm to influence and exploit its present IT assets more positively. Comparing to IT assets, IT capabilities have better and more durable performance implications on firms, since they are more difficult to imitate. These capabilities can be grouped as *human IT knowledge* and *IT culture*. *Human IT knowledge* can further be divided into *technical IT capability and managerial IT capability*. Technical IT capability refers to the IT knowledge of engineers and other technical specialists, whereas managerial IT capability refers to the IT knowledge of employees in managerial positions.

development of cooperation among heterogeneous agents, interfering in the creation of innovation and knowledge. The following section examines the issue

v- The Institutional Theory[15]

According to Merriam-Webster online dictionary[16], in the section: full definition of institution, the term is defined differently; while in one case it refers to a more physical building, the term is used to design a set of customs, practices, or laws that are widely recognised and used by a given society. In a third case, it refers to the act of beginning or creating something, which is paraphrased as the action of instituting something new (more likely to be as an innovative act). This multi-usage of the term creates a disagreement among scholars and researchers when trying to conceptualise the meaning. Scott (1987) assert the absence of a conventional and universal definition of the term and viewed institutions as '*social structures that have attained a high degree of resilience. They are composed of cultural-cognitive, normative, and regulative elements that, together with associated activities and resources, provide stability and meaning to social life. Institutions are transmitted by various types of carriers, including symbolic systems, relational systems, routines, and artifacts. Institutions operate at different levels of jurisdiction, from the world system to localized interpersonal relationships. Institutions by definition bring stability but are subject to change processes, both incremental and discontinuous*'(Scott 2004). Consequently, an institutional context involves regulatory, normative and cultural measures that prompt, enforce, and limit social and economic actions. This definition covers both formal and informal institutions. Regulative arrangements are formal, are levied by authorities through explicit rules, controls and rewards, whereas normative and cultural ones are informal, and present strict, evaluative, and compulsory dimensions into societal life.

The Institutional Theory deals with a social pattern that reveals a particular reproductive process, which is followed by rewards or sanctions. It is a theory that studies how organisations increase their ability to grow and survive in a competitive environment, by becoming legitimate in the eyes of their stakeholders, according to the total values and norms, in an environment, that governs the behaviour of a population, industry or a sector. Scott (1995), as cited by Fang et all (2012), suggests that organizations follow taken-for-granted expectations of external institutional

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[15] In this study, the term" institution" refers to rules and/or habits that condition (by enabling or constraining) actions and behaviors of people. These conditions include material and non-material sanctions such as loss of legitimacy.

[16] http://www.merriam-webster.com/dictionary/institution. Accessed on 29/09/2016 at 14:55.

actors in order to attain social conformity and legitimate recognition[17]. The institutional environment can describe and limit prevailing institutional norms, such as family or professional norms, and thus it influences the structure of actors in the market, like the rate and size of current organizations and the type of emerging new, as well. However, this thinking contradicts the RBV's instructions, namely in term of firm's heterogeneity as source of sustained competitive advantage. Indeed, the tendency of firms to obey social conformity lead them to adopt the same structures and strategies; this lead to the emergence of homogenous firms, which in turn influence their innovative capabilities (reduce firm's superiority in the market). By contrast, the capability to innovate is foremost characteristic for firm to gain competitive advantage. To solve this puzzle, institutional economics emerges to study the impact of market and nonmarket institutions on organisation and firm's behaviours, and considers markets as an outcome of the complex interaction of these institutions (individuals, firms, states, laws, rules and social norms). The rapprochement can be understood from the institutional context of resource selection. The institutional context refers here to rules, norms, and beliefs that delineate or implement socially acceptable economic behaviour. The institutional context at micro level (individual level) consist of decision-makers' customs and beliefs; at the firm level, it comprises organizational culture and politics; at the inter-firm level, public and regulatory forces and norms of an industrial sector. (Oliver 1997, Darnall 2003, Peng et al. 2009) all conclude that institutional context matters for firm's heterogeneity and superiority. Oliver (1997) observed that resources choices are subject, in addition to economic considerations, to institutional environment that govern the whole economic behaviour. Therefore, managers select resource that are VRIN compliers and simultaneously respond to normative rationality[18]. She suggests that the process by which the procurement and the accumulation of resources is normatively rational. And this lead to sub-optimality in resource

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[17] We notice that Scott classifies institutions to three categories: regulative, normative and cultural-cognitive. Regulative pillar refers to practices of rule-setting, monitoring, sanctioning and incentivizing, and incorporates a range from formal legislation to less formal rule making. The normative pillar comprises together values conceptions of the preferred or the desirable and norms, the scripts outlining desirable goals and legitimate means of attaining them in the agentic pursuit of the elusive 'what ought to be'. Finally, the cultural-cognitive institutional pillar refers to the inter-subjective processes and frameworks which enable sense making at the junction where the individual meets the external world of stimuli (Osipovič et al. 2016, Scott 2004).

[18] By normative rationality, Oliver (1997) refers to choices induced by historical precedent and social justification. That is, choices are made according to institutional context of the firm.

judgements and in the use of amassed resources. Then, heterogeneity of firms resides in the capability to manage their normative rationality rather than relying on RBV approach.

In a similar vein, Darnall (2003) remarks that institutional pressures motivate companies to consider their environmental decision, i.e. applying for ISO 14001. In the study, he demonstrated that coercive pressures[19] from regulatory and social actors influence early firms to adopt ISO 14001; however, this had a positive impact on building capabilities in managing environmental issue, since then. Nonetheless, in order to be ISO 14001 adopter, firms have to implement an environmental programme, value their environmental effects, establish environmental objectives, apply a strategy to attain their goals, establish monitoring and corrective-action procedures and introduce management reviews. Those efforts are then examined and evaluated by auditors to certify or not their readiness vis-à-vis the international standard's guidelines.

In a global vision, Peng et al (2009) propose the Institutional-Based View (IBV) to highlight the role of institutions in shaping firm's decisions. The core contribution is that IBV represents a complement to market and RBV approaches of strategic management. The approach finds its roots, first, with the rise of (new) institutionalism view, which stresses the importance of institutions in economic activities; it is also grew as a response to the criticisms of RBV about the ignorance of history and institutional context, whilst formal and informal pressures of policies and media shape competition. Further, the IBV considers that strategic choice is the result of a dynamic interaction between organisations and institutions, in addition to market conditions and capabilities. That is to say, a reflection of formal and informal institutions is converted into capabilities that help drawing best strategies for firm, contribute to its heterogeneity, and thus enhance to sustain its competitive advantage.

In parallel to its importance in shaping firms' heterogeneity, the role of institutions helps spreading the creation, dissemination and use of knowledge and innovation. Indeed, a continuous investment in skill and knowledge for surviving conditions not only the conduct of firms, but determines the performance of economies and the evolution of societies. Besides, the process by which knowledge is created and diffused depends heavily on government policies that are the result of economic inducements and institutional milieu, which facilitates the interaction among different intervenient in the innovation processes. Yet, the promotion of knowledge requires the existence of strong, credible and stability- creation institutions. This is because knowledge and

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[19] Coercive pressures refer here to regulative institutions, according to Scott (2004) terminology. The author (Darnall 2003) mentions, among others: legislators, lobbyists, the courts, activists, consumers, protests, citizens groups, the media and direct negotiation to cover the meaning.

institutions are heavily connected and institutions, typically, constitute a road map of reference in reducing instability and guiding the behaviour and the process of innovation(North 1990)[20].

In this regard, recalling the definition of NIS advanced by Freeman (1995)[21] helps understand the role of institutions in promoting innovation. The author stresses the growing importance of institutions (in their wide sense) as a main key for a firm to strengthen its innovative capability and gain competitive advantage. However, this ability is further enforced by the network of interactions encompassing: national education system, industrial relations, technical and scientific institutions, government plans and cultural backgrounds[22]. In a similar vein, NIS is rather a cluster of institutions, policies, practices that regulates countries' or sectors' capacity to produce, practice and disseminate innovation.

From this stand, regulative institutions frame the tendency of innovation and knowledge creation; and are viewed, according to Edquist and Johnson(1997) and North(1990), as formal forms where the rules are codified and/or supported by some authorities. Indeed, formal institutions give strength to designated act, actor or sector and shape the attitude and the interaction of actors. Their forms vary to encompass laws, policies, regulations, standards, guidelines and may extend to sign international agreements or protocols. However, their existence is conditioned by the presence or the absence of legitimate authorities. Consequently, it determines the level of order or chaos that can exist alongside the contact between actors. Further the government has a decisive '*parole*' in this field in the sense that it can impose restriction on what is acceptable or technically appropriate. As such, this institutional form are more influential than other forms, as it decides which informal institutions or constraints are approved, accepted or prohibited (Obeng and Agyenim 2011) and leas to legal sanctions if they are not respected by actors. Besides, regulatory institutions, seek to attain three main objectives, which are:

- Facilitate consistency and enable collaboration in between actors;
- Recognise and debrief needs and demands;
- Coordinate strategies for approaching these needs and demands.

In this regard, government regulations and criteria serve as an important incentives or barriers to innovation. Accelerating innovation in telecommunication and network services are highly

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[20] North (1990) offers a comprehensive explanation on the role of institutions and their changes in shaping economic performances.

[21] See page 2 of chapter II (to be apdated)

[22] In the proper words of Scott (2004), this set of institutions can be grouped as regulative, normative and cognitive institutions.

determined by government actions in developed and developing countries, for instance; the same holds for pharmaceutical innovation in most countries. In parallel, government can set up contract of collaboration on R&D and/or product development. for example, the Department of Transport and the Transport Research Board (two major actors in the domain of transportation in the USA) coordinate their efforts to disseminate information relative to innovative concepts and practice in the field of transportation (services, financing infrastructures and their development) trough conferences, articles and seminars (Boghani and Jonash n.d). Yet, it is wealthy to note that public policies, in term of fostering innovation and knowledge accumulation, depend according to development stage; Almeida et al (2010) remark that according to economic maturity stage, which is characterized by distinctive assets, deficits and industries, the government shapes the strategies and incentives that fit with its particular profile in fostering innovation. Tax incentives, for example, emphasis more on capital expenditure and less on enhancing revenues in the earlier stage; this is due to the top priorities which focus on modernizing industries. In the later phase, tax priority moves to providing funding for R&D in order to accompanying start-ups or newborn companies, which suffer from certain difficulties. In the advanced stage of development, public policies concerning tax incentives focus on the output of R&D as the government usually wants to get profits from existing innovative activities.

In the sense of Edquist & Johnson (1997) such incentives constitute one function of institutional roles in sustaining the innovation process. Further, they consider salary and wages schemes, property right regimes as equivalent incentives that permit a generation of rent, provide monopoly of knowledge for certain time and facilitate the dissemination of knowledge. These incentives may extend to cover government subsidies, bilateral/trilateral commitments to insure sufficient resource allocation to organizations involved in learning and innovation, such as universities, research institutions.

Institutions, from another angle, reduce the accent of uncertainty by providing necessary information about market situation or partners' behaviors. In this regard, laws that precisely determine the repayment periods vis-à-vis investment projects influence time perspective, risk management and evenly uncertainty in innovation. The role of institutions here is crucial because innovation projects tend to elapse at earlier stage. Some (but a smaller number) resist and fail during market test. This may result from the lack of appropriate information at right time and place; therefore, rules, practices and stable relationships between participants in innovative projects are highly welcomed to provide information.

However, if the lack of information lead to instability in relationships, the presence of suitable institutions contributes to the management of disputes and collaboration. As conflicts characterize the innovation activity, institutions can regulate and control conflicts between parties. University-industry cooperation is likely exposed to disagreement; for example, the communication networks and the established pattern of collaboration between them may easily be affected by conflicts and reciprocal doubt. The reason may be that universities tend to be long-term oriented and put fewer attention to costs reduction; in contrast, industrial firms are oriented to productivity, cost diminishing and wiling to attain customer needs. However, dealing with such disagreement turn to depend on norms, rules, practices of cooperation, democracy and other institutional variants.

In regards to these functions, institutions influence and be influenced by organizations. The institutional environment in which the organization exists designs its behavior for incentives, risks or uncertainty that may be faced during the innovation process. In the extreme side, organizations influence institutions in the way that certain institutions are developed, or be relevant in the operation of or in the connection with organizations. Such mutual impact has a determinant role in framing the innovation system and creates substantial differences between economies related to the performance and the operation of the knowledge economy.

The set-up of regulatory institutions, in addition to reducing uncertainty and creating incentives, contributes to the construction and the spread of state of trust and confidence among partners. This attribute is a precondition necessity in the process of collaborative innovation, which means that all partners are conscious about the influence of their acts and behavior on other's well-being, in addition to their well-known position in pursuing their promises and fulfilling their responsibilities. Likewise, the presence of trust means that partners are highly credible in their interaction with each other. Apparently, either in collaborative or cooperative relationships the main key for the good of the whole or the success of projects, the presence of trust is mentioned as the foremost variable in establishing long-lived partnership in innovation field; this is due to the outcome behavior, which results. Indeed, in a collaborative relationship a kind of responsibility grew due to highly invested state of trust among partners who seek the benefit of the whole; therefore, a synergy and synergic effect will help allow to improve the state of innovation. In a cooperative form where the motive for establishing relationship depends on the successful project outcomes, trust settles down the preconceived success feeling between partners whose pre-established behaviors is to win; therefore, both trust and wining objectives cover the collaborative relationship toward positive outcomes that enhance the capacity of innovation and learning process. Yet, the level of trust determines the operational performance of the innovation network

as heterogeneous organizations within the network fail, relatively, to overpass uncertainty even by the presence of rules; therefore, trust becomes the primary mean to reduce the complexity.

It results that formal institutions, presented in the form of regulations, go in parallel with informal institutions. This later type consists of socially collective rules, generally unrecorded, that are made, communicated, and enforced outside of officially sanctioned channels' (North 1997). Informal institutions are equally known but not mentioned in writing form and tend to be more persistent than formal rules. Besides, the influence of informal institutions is frequently allied with the trust-based informal relationships. This is documented by studies where firms tend to depend more on social networks and ties to facilitate social interactions and resource exchanges when informal institutions are prevalent(Geng and Huang 2017); this is evidently true when a spread state of trust is trenched as well as reputation effects. In the field of innovation, informal institutions help firms obtaining valuable information and offer potentials to learn about new technologies or tacit knowledge. For example, in a society with high levels of trust there is collaboration and feelings of interchange amid its members, which make the milieu more resourceful than distrustful society. Putman(1994) in this regard argues that social networks allow trust to become transitive and spread a sense of responsibility helping by turn innovative agents to meet, even risks are likely present at certain degree. The presence of reciprocity among members, associated with higher level of honesty, ensures that contracts will be honoured and guarantees lower compliance cost and litigations. In this case, agents are prepared to undertake risks, which help, flourish innovation activities as well the innovation system as a whole. Thus, informal institutions represent a vital ingredient in the innovation process as they contribute to save resources by reducing some costs like transaction cost and information sharing; these resources may be used as innovation related expenditures. Further, informal institutions are at the origin of social network, which examines the social dynamic of interactions between organizations within the same milieu by forming what is known as *ecologies of innovatio*n or further *innovation ecosystem*[23]. As for the importance of social network in the innovation creation, Landry et al (2002) considers that: "*innovation results from combinations of tangible forms of capital in conjunction with intangible forms of capital characterized by disorderly and sustained interactions occurring between firms and diversified sets of actors. These interactions are holistic, influenced by history, social values, institutions, and interdependence*". This passage shed lights on a specific aspect that governs informal institutions: that of social capital. The subsequent section explores the significant

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[23] A detailed review of these two concepts is explored in the following sections

role of social capital in the knowledge-based economy as well as the collaboration in terms of innovation projects.

vi- The Social Capital Theory

As mentioned in the previous paragraph, innovation is no longer a discrete event of an isolated inventors or researchers by involving tangible form of capitals; rather it results from the combination of various templates of intangible capitals like intellectual, cultural, network and social capital. Therefore, the success of innovation relies on the interactions and exchange of knowledge involving a great variety of actors of similar and diverse backgrounds. The excellence in managing these interactions not only facilitates the success of innovation process but determines the leadership of firms in terms of the way of framing the internal and external environment of doing business, as well as creating competitive advantage. This is to say that innovation become the matter of networks where heterogeneous, in addition to homogeneous, actors meet to run innovation projects.

The multiplication of these relationships, in parallel to enforcing the existing ones, contributes to reduce transaction costs between firms and between firms and other actors (Landry, Amara, and Lamari 2002) rendering these firms more competitive than those acting in isolation. Consequently, engaging in social relationships limits the incurring of risks as the pre-established trust works at isolating (or reducing) the opportunistic behavior of participants; likewise, innovation activities flourish due to the high level of trust. Indeed, participants (either individuals or organizations) in a network are less frequent to devote resources to protect themselves from exploitation and the disposable resources will be allocated to innovation in new processes or products.

Fukuyama (2000, p3) paraphrased the situation by referring to the social capital as "*an instantiated informal norms that promote*" [and] " *must lead to cooperation in groups*" [by reducing] "*transaction costs associated with formal* [institutions] *like contracts, hierarchy and bureaucratic rules*". Indeed, it is argued that market activities grow since people enter into economic exchanges with other people because of trusting large number of persons and more notably trusting the individuals they do not necessarily know. Thus, social capital contributes to growing number of reciprocally positive trades, resolving mutual action problems, reducing monitoring and transaction costs, and improving information streams that will eventually expand economic performance and incentive economic activities (Ahmad and Hall 2017).

Despite its growing importance as a key player in economic growth and performance, various definitions are advanced to shed light on what the term is about; although these differences, a review of major claims reveal that social capital is all about connections and interactions among individuals, between organizations or amongst firms. Bourdieu (1986), Coleman (1988) and

Putman (1994) all argue that social capital consists of the apparent value inherent in networks and relationships created through socialization and sociability as a form of social support. However, Putman stresses on the role of norms and networks in the spread of social capital culture. These norms may vary the englobe simple act of reciprocity to more complex systems like belief doctrines, which are used by any social group to attain cooperative aims (Putman 2000).

This presentation considers the existence of two types of social relationships: one that flourish between people (or organizations) sharing some characteristics (let us say family members); and another that emerges between people (or organizations) with diverse backgrounds. Using social capital jargon, bonding and bridging social capital capture these cooperative relationships. Bonding social capital refers to a permanent relationship between group members who share homogeneous norms; in general sense, it refers to horizontal connectedness among individuals within the same social group (family members, stream of thought, culture, political party, ethnicity, religious belief or business associations)[24]. Therefore, one main characteristic of bonding social capital is proximity in physical or moral values. The benefits of being part of such milieu can be summarized as shown in the following table.

Table3-1: Social Capital Types: Good and Bad Attributes.

Social capital types	Advantages	Disadvantages
Bonding (also known as strong ties)	Attitude & Identity Solidarity Social sustenance Fine-grained info Tacit knowledge Cooperation	Redundant info Isolation Legitimacy discount
Bridging (also known as weak ties)	Renewed information Varied perspective Rational flexibility	Not all weak ties bridge

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[24] Making a connection between social capital theory and cooperation theory, bonding social capital can be approached to kinship in the process of selection.

Members in bonding network know each other due to close proximity of physical and moral values, which tend to the formation of common attitudes, behaviors or styles. Yet, these positions are strictly enforced by the same identity, previously they share (as family members), or result in its creation (as a religious or intellectual belonging). Furthermore, as the tie is created there will be a stream to enforce it by multiplying acts of solidarity. One great religious example on bonding social capital is the emphasis of the prophet Mohammed (PBOH)[25] on the highly conserved place of neighbor. Indeed, as they share spatial proximity for a considerable period of time, neighbors develop certain common attitudes and agree for policy-like planes to deal with different cases they may come across. Another best example about bonding social capital is the case when a blind man carries another man with physical handicap; in this case, the negative effects of handicaps are reduced by sharing available capabilities of both men. As the blind man devotes his movement ability, the other man offers his eyes to guide him while walking, and the cooperation results in a best well-off situation. In general, the solidarity that exists among members develops to take several forms like social sustenance, by which individual reserve a fraction of his/her money for the benefits of the others without asking for rewards. In real terms, individual will not look for physical or material rewards, but he/she looks for moral or future benefits. By future reward, they preserve their chance to be sustained when facing harassments. Moreover, by devoting funds, individuals look for inner peace and happiness that increases their productivity and life quality; or, they wait for divine rewards in the other life. Besides, as there is no risk to be exploited, individuals share all information they knew for the benefits of the all, using explicit methods of knowledge transfer like articulation, codification and verbalisation. In some cases, there are information, which are hard to be stored in conventional means; in this case, tacit knowledge is also transferred to group members within bonding social capital, due to high value of interaction and the establishment of trust among them. Tacit knowledge is shared spontaneously and randomly with or without intention. Hence, the overlap of these characteristics contributes to the promotion of cooperation among members of society and develops strong ties among individuals, which help them to be more creative and innovative.

Yet, besides these advantages, bonding social capital presents some weaknesses. For example, the limited contact with foreign members results in isolating the group to the outside environment

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[25] The Prophet Mohammed (Peace Be upon Him) is the messenger of God to all creatures in Islam. In addition, his great miracle is the Holy Quran.

and this may have several negative impacts at short and long term. one of these impacts is the routine which results by repeating same activity or contacting same people; therefore, the is a risk that activities turn into mechanic tasks and by turn a risk to diminish innovative capability of the group. Another negative impact results from repeating same information. If considering the isolation toward other groups, then there is a weak possibility to get new ways of doing things, or novel thinking that ameliorates products and services. Generating new ideas grow by sharing original cogitation from new people; however, same members tend to offer diminishing knowledge among them, reducing by turn the ability to create fresh knowledge and remarkable innovations. In addition, reliance over bonding form of relations results in reducing the amount of legitimacy among individuals, since their acts are free-based reference and are basically coming from routine practices; indeed, many tribe members consider their culture, in general, and practicing religious rituals as supreme reference and deny any other culture or rituals even they are false. In contrast, bridging social capital provides new information, which is originated from varied perspective and flexible thought. If knowledge form is qualified as tacit within bonding relations, knowledge under bridging forms is principally explicit; this means that it takes formal forms, i.e. easily communicated and shared, therefore, it is recorded, expressed as words, number and other coding forms within books. If so, the tendency that this information streamed from various sources increase considerably since the group is opened to external environment; accordingly, undetermined flows, inside and outside, the group is valid, rendering the information fresher and much more up-dated to social exigencies. Thus, a rich as well a dynamic thought governs the group to reduce any tendency to bias or extremist understanding of the information. The level of cooperation and collaboration is expected to flourish in this form even if not all forms of can succeed.

Social capital, by these two dimensions, constitutes a key factor in the existence and development of cooperative behaviours between individual or organisation, as any relation implies one form of social capital, intentionally performed or not. It is highly recommended to insure a continuous and stable cooperation among university, industry and government relationship to perform socially benefit acts, namely in term of promoting innovation and knowledge creation. This role is confirmed by Gelauff (2003). In his work, social capital consists of norms and networks that support cooperation, where both bonding and bridging networks play crucial role in the creation of new knowledge trough "community of practice". Considering that innovation activities become a complex and collective process, there is an increasing appeal to promote cooperation among people and organisations and insure an enduring stream of new knowledge and

information. Therefore, a society as a whole becomes a community of practice since their everyday interactions can be graded as voluntary innovation process. Notice that when we pass from micro to macro level, cooperation network shift from bonding to bridging ties and tend to create a mega bonding form or what is known in literatures by "knowledge society"[26]. In this context, all available form of knowledge is shared to facilitate information flow, which results in the emergence of an interactive process, linking both formal and informal relationships among various actors through interacting within social networks. These connections allow people to work together to attain things they could not do on their own or they achieve with significant difficulty and/or at an excessive cost. Accordingly, economic actors implicated in social capital networks may incur less transaction cost, benefit from positive coordination, and reduce the possibility to duplicate efforts and avoid costly contractual quarrels.

It is clear that trust, in this context, stimulates innovation between people and within organisations through reducing the need for monitoring and control mechanisms. Therefore, it encourages actors to cooperate and exchange resources: like information, experiences or expertise and knowledge; trust diminishes the need for intervention to correct rare dishonest cases. In addition, associational activities help in promoting cooperation and interaction among actors, and create dense networks, within which people learn new knowledge, concepts and opportunities required to innovate quickly due to the improved cooperation within a collaborative network (Doh and Acs 2010). By combining the role of trust and associational activities, the social capital has been considering as a resource for competitive advantages, since it can boost the individual and collective capacity based on collaborative practices.

Similarly, it may become a cause of enhancement or maintenance of the competitiveness in member organisations in networks. Indeed, social capital can delivers access to exterior assets and competences that are delivered in form of information; yet, the primer for establishing inter-organisational links is to look for features that permit better adaptation, for organisations, vis-à-vis their competitive environment, with opportunities for positive effects and economies of scale without loss of competitive flexibility. Besides, there is also a chance to benefit from fresh ideas, which can be converted to new products, processes, management tools or even market performance. In this context, the network becomes an important bank of ideas and a significant incubator for the advancement of organisational innovation. This is because innovation is

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[26] Generally speaking, passing from a family to a tribe, country and nation, members of these communities constitute bonding ties when considering their sharing characteristics. In these regards, if there is a possible alliance attack, the global community is qualified as bonding social capital.

influenced significantly by the formation of networks and alliances, leading to a variety of external relationships that have positive result on innovation. Therefore, the development of complex cooperative actions amid actors becomes conceivable via social capital, since the results of innovation tend to be relied on accessible knowledge, which is shared and improved consequent to user experiences and scientific research. Thus, the transfer of technical and scientific knowledge, necessary for innovation, is complex and interactive (Faccin, Genari, and Macke 2017). Social communications facilitate individuals' learning about how to share important information with each other, draw common perception, and attain other resources and ideas. The generation and application of new ideas is therefore promoted by social interaction. In addition, there is a claim that the innovation process benefits from the engagement that is established among partners, which offers various form of opportunities including: information integration, knowledge bases integration, behaviours and different ways of thinking. In addition, the communication, between a diversity of partners upsurges the promises of new combinations of knowledge (Xu 2011).

The theory of social capital offers a wealthy ground to understanding the development of cooperation and collaboration among homogeneous as well as heterogeneous actors. Referring to bounding and bridging form of linkages, individuals or organisations tend to cooperate due to the presence of high state of trust and the absence of opportunistic behaviours. Even if engaging in cooperation is perceived as gaming, deciding whether to collaborate relies on feedbacks from pre-established confidence amidst individuals (viewed as living beings in general). The resulted cooperation is the ultimate willing to transfer attributes and share characteristics, which enhance the performance of groups and societies. Within these groups or societies, every isolated act, subject to be transferred or shared, refers to an innovation since it will be perceived, understood and explained by the community in different way and will be used in diverse fields. Therefore, one idea can be applied in different systems, environments that help and contribute to the idealisation of the society as a whole; thither, cooperation can be understood in term of ecologies, and innovation is generated within an ecosystem. To shed further light on this issue, a leading example in the knowledge community is the idea of development advanced by Darwin. Even the original thought was apprehended in biology, its extension has been gained wider range of scientific field including physics, psychology, sociology, politics and economics. However, even there is a rejection of evolutionary thought by some scholars, it was at the origin of opposite critics leading to the emergence of parallel thought, which is considered as new knowledge that contribute to expand our understanding of things. Accepting or rejecting ideas, thought or products is subjected

to the scope of circulation and usage; differently stated, actions (moral or physical) are valued by its level of share and communication between individuals and organisations.

Cooperation, implicitly innovation that results, can be understood under the umbrella of ecologies and ecosystems. The remaining of this chapter highlights the importance of two concepts; these are linking ecologies and ecosystems.

vii- Linking Cooperation to Ecology and Ecosystem:

The theory of cooperation suggests that partners collaborate to augment, enhance and guarantee the success of reproduction that affects their well-being. Considering that each partner (any kind of living spicy) has its personal attributes, characteristics and behaviours, it can be reduced to present a separate ecology which presents a fraction of an ecosystem. Based on the definition of these last two terms, the development of cooperation that emerged among university-industry and government can be framed within these concepts. The following point links cooperation to ecology, then rethinks about innovation as the result of a specific ecosystem.

a) *University, Industry and Government as Ecologies:*

The term "*ecology*" refers to the scientific analysis and study of connections between organisms (if we think of them as organisations) and their milieu. It covers the study of interactions that organisms have with each other, with other structures, and with non-living components of their environment. That is, the prime interest of ecology is the set of relationships that exist between organism and its surrounding environment. Abbott (2016) uses 'ecology' to refer to a set of social relations that is best understood in terms of interactions between multiple elements that are neither fully constrained nor fully independent; these elements are "*not thought to move together at all; rather, they constrain or contest each other. ''Ecology'' thus names a social structure that is less unified than a machine or an organism, but that is considerably more unified than is a social world made up of the autonomous, atomic beings of classical liberalism or the probabilistically interacting rational actors of microeconomics*" Abbott (2016, p39).

Accordingly, three components should be present, which are actors, relation and location; actors are individuals, groups, or even complex entities such as industries or states that preserve a certain degree of independency in purposive action and hold some forms of capital. Location is a referential position in a social space; actors experience diverse organisational restrictions dependent on which situations in the social space they live in. Both, actors and location are not logically or automatically related but rather are established and surrounded by the relations among

them (Liu and Emirbayer 2016). Actors, location and relations are flexible, fluid, dynamic and accomplish each other leading to the emergence of linked ecologies (Abbott 2005). Linking ecologies refers to several spatial, temporal, and organisational scales, which may be hierarchically linked such as professions, religions, state, country region and university milieu; therefore, an ecology is regarded as a particular social structure rather than a theoretical framework, which can be understood by many other means. Additionally, actors and location are subjected to relation that is considered as "prior" condition. To shed light further on what Abbott really means by an ecology, using his example of '*university ecology*' is worth enough (Abbott 2001).

Location among academic disciplines is founded by a rigorous course of interaction between groups, including competition, accommodation, alliance or absorption. The competition is a distinctive one. Researchers' competition is defined by the critics and ameliorations made on studies done by them. Therefore, academic activity can be imagined in terms of two systematically different fields and a tangled network of links between them. In one side, there is the potential academic work and there are people who do that work, on the other side. That is, there are various ties between several areas of work and various bodies of workers. For each of groups represent varying levels of connection to and control over numerous fragments of work to be done. Under this circumstance, any change at individual link affects, implicitly, the equilibrium of other surrounding links. That is to say, values of any discipline (qualified as gain or loss of authority) will not change without shifting or enticing other disciplines. To this challenge, the level of complexity increases as there is conventional body of academic works (Abbott 2001)which is under constant reformulation, modulation and being reshaped by disciplines that try to modify the activities of other disciplines for sake of interpretation of having dominance over them[27].

In a similar vein, government can be thought as an ecology. Indeed, in its political endurance, government is framed by many different actors such as administrative departments, political parties, non-governmental associations and civil servants. Locations in the political ecology are made out of matters of political concern, and they are considered as decisions (or actions), outcomes and political issues. These locations (bundles) are attached to one another by social action, made possible by the process of interaction and competition, and not by functional necessity.

By generalising the concept of an '*ecology*', an unlimited set of ecologies emerged; for instance, one can consider the public, the state or the media as a separate ecology. Further, evidence shows

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[27] One can think about the principle of borrowing activities from other actors, which is advanced by the Triple Helix model; refers to the chapter II for further understanding.

the existence of a complex interaction that links these ecologies together. For example, medical experts have to enter the political ecology to contest health policy. Public ecology is an ensemble of attempts, which aim to create a defined social space. In some cases, one ecology may overpass its boundaries for the good reason. That is why linked ecologies come from the same awareness that there are perpetual efforts at exploiting other ecologies for strategic motives for individuals as well as for organisations (Madsen 2016).

To illuminate further the concept of linked ecologies, Abbott (2005) recognises two types of linkages between ecologies: *hinges* and *avatars*. Hinges refer to technical innovations that transform several different professions at once, or simply professional strategies; differently stated, hinges are disputes or policies that can function within altered ecologies at the same time and provide dual rewards for actors in two different ecologies. Avatars denote the extension of a prevailing profession into a novel ecology; hence, avatars can be understood as a replication of ideas and skills of one profession into a new ecology and are seen as a *hinge institutionalisation* that an actor creates in an adjacent ecology as its representative. Hinges and avatars are the result of human coalitions and positional movements that creates political process as an outcome of the deployment of individuals and organisations around specific issues.

The concept of linked ecologies has been widely used in several case studies, including finance, auditing, international relation, business and economics. Its ability to provide arguments on how coalition, cooperation and strategic alliances are produced make it an outstanding tool to understand the development of trilateral relationship between university, industry and government. The university ecology by engaging in cooperation with industry seeks to find convenient place to test its new ideas and invention. It looks for financial support for promising projects. It looks for fresh data and real problems that face the industrial sector. And it looks for suitable employment for its graduates. The industrial ecology attempts to cooperate with university to have permanent access to newest ideas and inventions that can be transformed to profitable products. It shares the burden of funding issues by establishing mutual research and development projects. It look for diminishing costs by using licencing and patenting instead of doing the whole job by considering universities as R&D departments. Consequently focuses its efforts to be more competitive. The government ecology looks for strategic location in the international scene. By enforcing beneficial collaboration between university and industry, the government gain leadership in terms of sovereignty both political and economic power, and get social peace needed for inclusive growth then sustainable development.

Accordingly, there is a place to see ecologies behave in their social network. Looking of linked ecologies in terms of social capital, each ecology by using hinges and avatars tries to bridge the

other ecology and lead to the creation of weak ties (bridging social capital). However, these ties are emerged since there is an increased level of trust and para-absence of exploitation between ecologies (ecologies). In this case, no ecology seeks to take advantages by exploiting the other. No one tries to get dominance over other since such behaviour will affect the whole system. Further, avatars are the equivalent of the primary principle that govern the triple helix model where each [ecology] takes the role of the other while maintaining its primary role and its distinctive identity. Thus, such adaptive cloning and strategic hybridisation are necessary for the continuous existence of these ecologies in the current century, and cooperation is the key factor for its success.

If considering innovation as the prime objective that drive actors (considering as ecologies) to cooperate, it results that their interaction is firmly produced within a unique and global system, where these ecologies interconnect to improve the state of innovation; this system is well conceived within the concept of "*innovation ecosystem*". The following point highlights the importance of the term to understanding the development of cooperation among heterogeneous ecologies such as university, industry and government.

b) Innovation as an "Ecosystem":

University- industry linkages are a highly cooperative process that generates common profit for companies, research institutions and their surrounding economies. Firms benefit from access to original ideas, research facilities, highly skilled human capital, patented and licensed intellectual property, and improved technological capacity. Universities profit from augmented incomes from entrepreneurial activity such as licensing profits and professorial consulting, capital gains from vending parts in academic start-ups, and assistances to universities from successful entrepreneurs, as well as better admittance to industry facilities and occasions for sponsored research. Bramwell et al (2012, p47) stresses that: "*economies with robust university-industry linkages are advantaged … of flexible and skilled talent, a concentration of jobs in creative industries, high levels of public and private investments in existing and emerging industries of strategic importance. [they are further] capable of mobilizing economic assets to pursue a different source of growth during times of economic downturn*". Therefore, focusing on their interactions within the surrounding environment is better understood within ecological systems or simply within an ecosystem of innovation, since their approximation itself is a kind of innovation according to Schumpeter's concept of innovation.

An ecosystem, in a strictly biological term, describes a community of biotic and abiotic components that are interacted as a system through energy cycles and flows. They are linked together by external and internal factors and are of various shapes and sizes. In a similar idea,

Innovation ecosystem is a conceptual analogy that is used to help demonstrate how innovation essentially happens. Thus it refers to the economic rather than the energy dynamics of the complex relationships that are formed between actors or entities whose functional goal is to enable technology development and innovation (Jackson 2011). This ecosystem can be of small or large scale and the components are symbiotic and frequently interact at diverse stages. The biotic part of the ecosystem encompasses a various kind of people with different capability and skill sets such as scientists, technologists, lawyers and marketers. The abiotic components (Bramwell, Hepburn, and Wolfe 2012)cover the physical resources that play a role in the innovation process include equipment, components, communication technologies and the physical spaces available to work or operate in. To these participants, there are many exterior elements that impact innovation ecosystems; these can consist of leading programmes and council regulations or rules. Government policy has also direct influences on the success of innovation ecosystems by means of funding programmes, tax enticements and the creation of specialised agencies.

As such, governments all-over the globe continue to check for the best operative means to support partnerships among industry and research institutions, boost initiatives that diminish the cultural gaps between those sectors, and develop policies and conditions to permit the exchange of ideas and knowledge. Government leaders establish a number of policy initiatives and instruments that strengthen the level of linkages and interaction between ecologies within an innovation ecosystem. These emerging approaches to innovation underline the prominent role of governments as both funders and drivers of university-industry knowledge streams. Particularly, governments need to afford leadership, policy guidance, and subsidy for research and related infrastructure, and to encourage alignment among research universities, research parks, technology incubators, and other relevant actors in innovation [ecosystem] (Bramwell, Hepburn, and Wolfe 2012).

Innovation ecosystem provides the necessary assets to build relationship among various ecologies implied in the creation, dissemination and the use of knowledge and innovation. Therefore, it encourages growth and reaction to interior and exterior events, and stimulates the transaction of knowledge from academia and higher education ecologies to industrial ecology. The form of such assets varies widely according to the implemented institutional body by the government ecology; this may incorporate entrepreneurial capacity, business intelligence, R&D enterprise, technology commercialization, human capital, physical infrastructure, to cite some (TECNA 2011).

An approximate framework for the concept of innovation ecosystem is presented in figure 4 bellow. The starting point begins with researchers who participate in the emergence of new ideas

and inventions, which motivate them to create their start-up, or push their results to corporations that need them or are capable to explore the findings commercially. However, companies and organizations have to deal with todays' challenges and try to respond to problems related to their activity. These issues are stimulating for research, and necessitate connecting interdisciplinary knowledge. On the other side, authority set policies, procedures and motivations for innovation. The response from other participants allow the adaptation of its policy to the real needs. As regulations take their final forms, universities update their education program to new situation and encourage students (especially PhD students) to create their own company (start-up). Consequently, the start-ups do not have sufficient skills for successful management of a company. Government can intervene by set-up specialised organisation providing help and assistance for such form of company by the creation of incubators, for example. Each component interacts with the others, and the success of the ecosystem depends on the integration of feedback from experimentation, on the right use of technology (Nourani 2017).

Figure 3-4: The Innovation Ecosystem Framework.
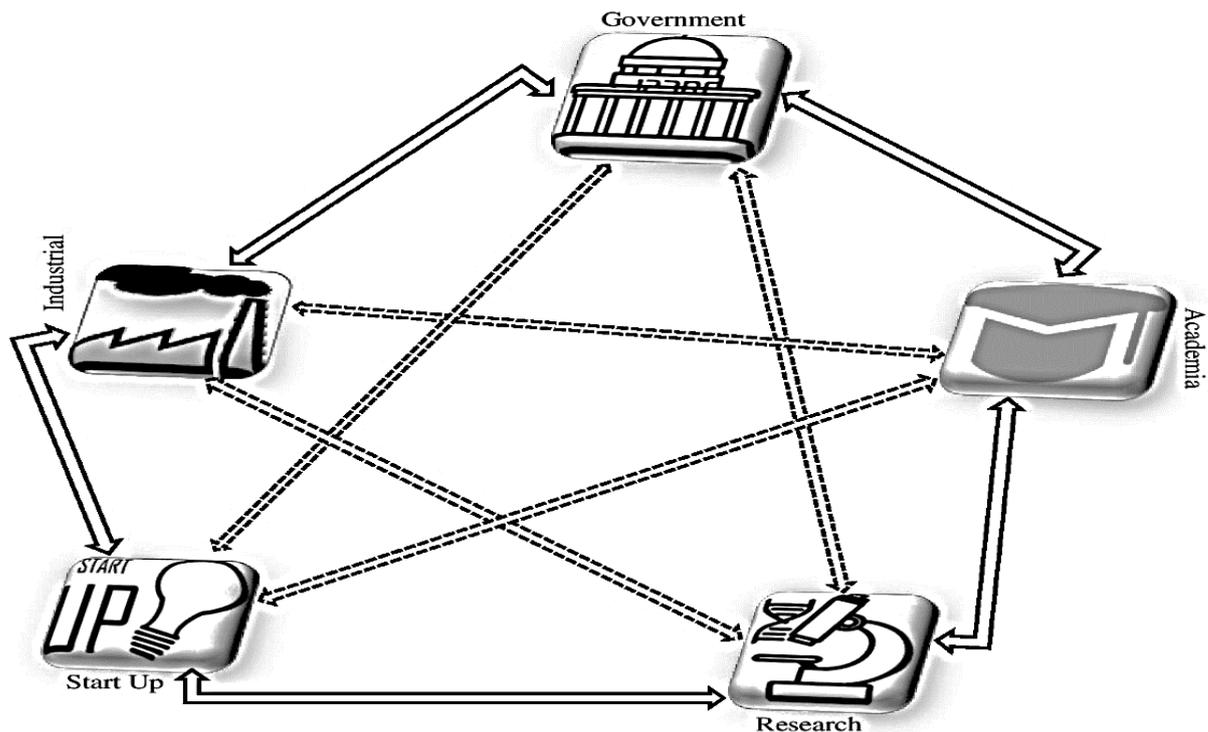
Source: author own conception.

Conclusion:

The conceptual framework depicted in the figure above, calls for an urgent update of the NIS concept. Indeed, as we demonstrated in the previous chapter, NIS refers to the sum of elements and relations, which co-operate in the creation, dissemination and usage of new knowledge. Within the innovation ecosystem, the elements refer to biotic components or simply the living ecologies such as research institutes, universities, enterprises and governments; the relations are the abiotic items, which are regarded both as input and as output of biotic convergence. Therefore, we suggest the usage of national innovation ecosystem to fit better with local and international circumstances that include heterogeneous elements.

In summary, the chapter referred to important concepts that have effective impact on the development of collaboration among actors. In first stance, we demonstrated the importance of cooperation as an indispensable factor that determines the conduct of numerous livings of various dimensions and milieus. From micro gens to macro galaxies, cooperation represents the hinge that creates the panoramic view of life. In a second section, the chapter dealt with the theory of innovation, since this later is the outcomes of cooperation among different participants. This is why it became mandatory for enterprises to program their innovation horizons to conserve and strengthen their market positions. Similarly, governments have to prepare their local, regional and national ecosystem to embrace innovation activities through the implementations of specialised organisations and setting up of clear regulations that facilitate collaboration. As a result, referring to institutional theory was a necessary step to understand how these aspects affect the development of partnership in the field of innovation, especially between university, industry and government. In the last section, the present chapter denoted the importance of social capital in the knowledge economy.

CHAPTER IV

Algeria as a Case Study

Introduction:

Algeria occupies the head list of African countries. Its large geographic area is further reinforced by its long coastlines. This strategic positioning at the southern shore of Mediterranean Sea plays a dynamic role. Indeed, Algeria manifested multiple attempts of settlements and colonialism. Since 1962, Algeria finished the conquest era and draws its present personality as a free democratic republic after 132 years of battles against French republic. Since then, the country marked different stages of political, societal and economic development. In the economic field, the shift to free market doctrine since the second half of the eighties opened door to radical change in terms of practices and policies; however, the nature of the country's economy guided the conception and prospects of the country and direct the way people behave. Dependency over hydrocarbons (in terms of exports volume and incomes) creates a fragile link between long-term planning and international energy market. In parallel, societal pressures have posed remarkable challenges for successive governments. Continuous needs, with an increasing trend, for housing, health care, education and feeding obstruct authorities to take actions in terms of sustainable or inclusive growth. Indeed, authorities have been focusing on diversifying income revenues outside hydrocarbons, mainly by creating a solid industrial and manufacturing sector; in a first stage, mega public structures had been created to respond to import substitution industrialization during the seventies. This strategy brought about restructuration of existing public societies, which were divided into interrelated enterprises. Yet, the revision of economic model led to the adoption of capitalist doctrine and focuses on privatizing most of these enterprises. In the field of social enforcement, ensuring high quality of educational system during the first years of independence fastened the setting up of primary and higher education organizations, which is manifested by free education principle. Therefore, organizing international conferences in different research fields pushed up researchers forward rendering the Algerian educational system as one of leading example of recently independent nations.

Yet, the Algerian case is one that should be studied carefully to understand recent and future trends and this for both level and domain of analysis. Indeed, the present thesis tries to deduce possible factors that help fasten the cooperation among U-I-G to promote innovation and growth. Factors that hamper such cooperation would be highlighted. The present chapter deals with the aimed task throughout the discussion of three main points: in the first section, the research focuses on the main characteristics of the economy. This we believe shed-lights on principle trait of public policies since the independence. The second section deals with the structure of industrial sector and its share in the economy. This task helps understand whether policies sustain the formation of

solid industries and the possible impact of certain industries on drawing policies. The last section investigates the state of the art of academia, in general, and higher education in particular. In doing so, the research forms an initial image on the level of cooperation among these actors.

i- The Development of the Algerian Economy: Past and Present Insights:

The actual start of Algeria as an independent country, from the economic side, can be traced back to 1965. It was confirmed by the nationalization of hydrocarbons. Indeed, colonial when leaving the country got with it whole staffs that had paralyzed effects on the natural functioning of things; however, the highly positive spirit of the whole society defeated the challenge and revived the country. In the first lieu, there was a unanimity to adopt socialist doctrine and then reanimate the country in accordance. Such adjustment, in companion of political willingness, had had noticeable results namely on the overall economy. In terms of economic growth, annual percentage change varies remarkably; the percentage growth since 1962 up to 2015 is about 4, 1[1] %, a moderated performance for an economy with potentials like Algeria. It is worth mentioning that inter-decades, even year-to-year, growth varies considerably. The above-registered percentage was sustained by high growth of about 6, 5% during the first two decades of independence[2]. A crash of performance was observed in the following decade, and then reinforced during the nineties with a growth of 1.8%. However, a recovery is pronounced by the opening of the century; overall growth in the last decade reached 4%, while the percentage of the actual decade is about 2.8%. Yet, in-depth vision sheds further light on the economic performance of Algeria. Total dysfunction of the country at the eve of independence explains the large negative growth of -19.7% and it may be viewed as a logical process of things. Indeed, colonial, when leaving the country, brought with it the technical staff, leading administrations, industries and other vivid sectors in urgent need of professional labor force. The situation was aggravated by the similar exodus of Capitals made free between Algeria and France, which was estimated at 2 billion francs at the end of 1962; therefore, the recession was provoked in industrial, trade and construction sectors. Foreign exchange also knew a decrease due mainly to shrink in the Gross Domestic Production. The situation was completely reversed in 1964. The year was considered to be laborious (Parodi 1964) as authorities headed to establish the socialist philosophy effectively. One way was by setting up novel structural

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[1] Values and percentages in this section are those published by the World Bank (metadata) or are calculated using these data; otherwise a notice will be made. See the link http://databank.worldbank.org/data/reports.aspx?source=2&type.

[2] Indeed, excluding the periodes1962-1970 and 1970-1980, the overall growth rate fall to 2.8%.

bases that match the socialist model and this in almost all fields. In the agricultural field, there was an enormous increase in the socialist cultivable land to reach 3 million hectares only in 6 months[1]. Industrial sector knows similar reorganization by defining in 1964 the ministry of artisanal industries and mining; consequently, the national coordination and programming commission of socialist industries was responsible for determining global objectives to be reached for each enterprise "d'interet national" and for each industrial branch in separated departments. In addition, the ministry of economy and departmental directions of the industry studied the new investment projects and eventually renewing the investments in accordance with objectives fixed by the national commission (Parodi 1964). Further, an annual program approved by the ministry focuses on:

- The creation of new industries by the state;
- plans for production, commercialization, provision, and funding;
- Plans for each industrial branch in each department;
- Equipment plans for each enterprise.

The Algerian industry was enforced by the establishment of a new organism responsible for promoting the research and exploitation of subsurface resources excluding hydrocarbons. In this regard, it carries out or has carried out geological or mining research, to operate or manage mines and quarries of the State, and to market their products.

For the exterior sector, the creation of socialist pilot stores manifested a new way of managing exchanges. Their main mission was to fight against speculation and to create a healthy emulation in the retail branch; however, there was a need to reinforce it by professional groups to effectively control on local trade. The foreign trade saw a prohibition for the transaction of three categories including coffee, tea, and butter.

Yet, up to 1970, year to year growth was positive and encouraging, therefore, inspiring authorities to adopt the quintuple plan as development strategies. Indeed, 1970 saw the launching of the first plan that is considered as the backbone of Algerian economy and through it a solid industrial base would be founded. It was estimated that the plan requires 27740 million of dinars of which 26400 million as investments during the first three years (Walter-Nicolet 1970). The sectoral distribution covered the most vital fields such as industry, agriculture, infrastructure and education, and a biased attempt to the industrial sector, which receives 45% of the total amount.

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[1] In March 1963, cultivable land affiliated to government was about 880.000 hectares; in October, the part raised at 2600.000 hectares. See (Parodi 1964) for details.

We can read this option as a mandatory to create a balanced industrial apparatus capable of promoting and maintaining economic growth. Thus, the industrialized trend focused primarily on:

- Expanding a modern industrial sector;
- Transforming the productive structures of the economy;
- Absorbing unemployment and underemployment;
- Increasing productivity and per capita income.

In result, industrial value added to GDP increased during this period to attain 57% in 1974.

In parallel, training human capital constituted a pivotal element in the development strategies and prerequisite factor for the battle against underdevelopment. Authorities, by means of institutes of technology, invested 11% of GDP in national education in order to transform the young society to producers as soon as possible(Walter-Nicolet 1970).

Viewed as successful plan, a second quadruple plan started in 1974 to reinforce, say, to complete the previous one. The focus here was the completion of previous projects namely those in the industrial sector that receive an increasing share as shown in the following table.

Table 4.1: Repartition of investments according to quadruple plans.

	First plan					Second plan		
	1970	1971	1972	1973	1974	1975	1976	1977
Hydrocarbons	1592	1845	2111	2332	3467	4854	8315	12300
Non-hydrocarbons	1634	1842	2731	3431	4699	7796	8238	12101
in which:								
Mechanical industries	170	265	648	854	638	1479	1718	2400
Energy	285	176	286	228	271	494	616	1100
Steel	599	741	869	942	1552	2155	2263	2400
Building materials	68	140	272	558	936	1486	1022	2200
Chemicals	161	19	195	267	595	1000	932	1000
Textile	55	63	106	153	225	405	535	1100
Leather					13	14	45	39	85
Other industries	203	347	315	370	425	617	976	1626
Extractive industries	93	91	40	46	43	108	37	190
Total	3226	3687	4842	5763	8166	12650	16553	24401

Source: (Nancy 1979).

It is clear that investments were devised to interpret political wishes about imports substitutions philosophy. Accordingly, mega public societies were created to respond to economic and social needs. However, the table depicts the absence of food industry due to huge deficits in terms of self-sufficiency in major large-scale crops. On the extreme side, hydrocarbons sector received nearly 50% of total investments; and it was the unique sector, during these two plans, that saw its percentage share increase indeed. All other sectors registered an increase in nominal term with a decline in percentage share, however. In addition, the table shows an accentuate will to set-up heavy industries to the detriment of light manufactories, such as textile (less than 3%) and leather (less than 0.5%). Such disequilibria will have serious problems on the social front, which was effectively under pressures of housing, unemployment, clean water as well an infrastructures shortage.

At the beginning of the eighties, authorities re-evaluated its strategic choices to respond better to social intentions and its economic capacities. This revision was seen as a necessary adaptation to national and international events. It was also agreed on the excessive use of hydrocarbons as the main source of financing, in addition to serious regional and sectoral disequilibria, the multiplication of speculative phenomenon and the aggravation of paucity situations. We should add the increasing recourse to external financing, poor valuation of human as well material resources of the country and the rejection of planning as a coherent model for economic and social development. This challenge implies the restructuration and reorganization of enterprises in order to ameliorate technical, economic and financial performances by means of limiting the recourse to external borrowing. Therefore, the determination of cooperative policy that aims diversifying partners and enforcing relation with developing and socialist countries was seen as a best available option to over cross the situation.

Yet, in practice, things seem unchanged and less was done to transform token decisions to effective actions. In fact, if excluding the restructuration of enterprises to create some regional equilibrium and the opening of both fruits and construction market to private sector, the structure of investments maintains its big traits namely propensity to investment in hydrocarbons sector, with a share of 49% of total investment and 27.6% of GDP in 1984 (Ollivier 1985). Such preference to hydrocarbons can be understood by referring to the commitment of paying debt and debt services that absorb more than 60% of generated resources. However, the drop in oil price since 1986 accelerated the pace of change and culminating by the adoption of the free market economy through the structural adjustment program under the auspices of international monetary organizations up to 1998. This decade had witnessed radical changes in economic spheres as well as the cultural and political field. a brief remembering of events is the re-establishment of weak

positive growth in 1998 from a negative value in 1991, 1993 and 1994 as shown in figure1 below. The performance of the economy during the nineties is well depicted in figure 4.1 and 4.2, where a severe decline was manifested almost in all sectors, with 1.8% and 2.1% of growth. One reason to explain the case is the fluctuation of sector participation in the generation of GDP. Figure 4 shows a weakening of industrial[1] share to 49.7% in 1992 and 46% in 1998 down from 53% in 1991.

Generally, the development of GDP growth in Algeria is affected by the conduct of two sectors that are industry (red line in figure4.1) and services dashed line in figure2). Effectively, the weight of public sector in economic life and the over-reliance on hydrocarbons exports are key elements to justify the past, present and possibly future economic conduct. Yet, if there are efforts to facilitate business climate to the private sector, public actions still dominate the economic activities even in the telecommunication domain, which was considered as the way to encourage private operators. This can be traced back to political and economic choices made after independence. On the other side, public spending is also a determinant variable; almost all projects are launched by the government and this is valid for past and present era. The evident result is that public presence, both as producer or consumer, affects the economic cycle and therefore guides other vital aspects of the country; however, this weight is rather related to the nature of ownership for income-generating sources. The national enterprise for the production, transformation and the other related activities (SONATRACH) is the first older state-owned corporation that is qualified as the cornerstone of the country; it activities reach 100% of Algeria's foreign trade that generates nearby 40% of government revenues (Tagliapietra 2017). Thus, combining the dependency on oil rent, public sector weight, as well as the inability of existing enterprises to create jobs, explains the position of the services sector in the economy and its impact on wealth creation. By contrast, the share of agriculture is remarkably neglected (green color in the figure2) but paradoxically increased during crises periods, namely during 1986-2000. The catastrophic status of agricultural sector explains the failure and relinquish of authorities to this vital domain. Indeed, the best value registered during this period was 13% of GDP in 1989, and the lowest share of 7% in 2008. This may give a proxy to the current status quo where imports swig about 20 billion dollars per annum.

The present diagnosis of Algeria's economy gives an impression that the country suffers from the symptoms of the Dutch Disease; yet literature insists that such disease can be escaped by the

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[1] The share of industrial sector includes, with a higher propensity, activities of the hydrocarbons sector; therefore, any change in their price will affect its monetary value, thus its part in generating GDP due to the dependence of the economy vis-à-vis of hydrocarbons.

adoption of economic rigorous policies as the syndrome affect economic aspect purely, more precisely spending behaviors and/or resources movement[1]. Research, on the extreme side, debate the cases where the endowment of natural resources leads to poor socioeconomic performances like those registered in developing countries. As for knowledge creation and innovation capabilities, the World Economic Forum, in its Global Competitiveness Index, ranks these as less competitive and qualifies them as lagging innovation areas. Thus, over-reliance on natural resources is regarded as a key factor to explain lag performances in these economies.

As for Algeria, one can conclude, when reading international reports ranking (see table2 below), that Algeria occupies the last position, verifying in somehow the findings of resource curse hypothesis. For instance, Algeria was considered as "economically not free" in 2008 as it ranked 102th out of 157 countries included in the report. Worst still, this ranking is in constant decline as it was occupied 157th out of 186 in 2015. As this ranking result from recorded index, understanding

Table 4.2: Algeria raking according to international reports[2].

	Economic freedom[3]	Competitiveness[4]	Governance[5] (a)
2008	102	81	19.4
2009	107	99	17.7
2010	105	83	17.61
2011	132	86	16.52
2012	140	87	17.14
2013	145	110	18.8
2014	146	100	17.64
2015	157	83	17.39
2016	164	87	/
2017	172	87	/

Source: data from multiple reports.
 (a) Governance score is calculated as a standard mean of six pillars of governance used by the World Bank.

what and how it is developed clarifies the given situation.

The index is composed of ten sub-indexes raging from property right to financial freedom. each sub-index registers scores; while the overall score is the mean of them and its movement is interpreted as a rank. Therefore, Algeria's balancing rank reflects its behavior in terms of

Figure 4.1: annual GDP growth as %(1967-2016)   **Figure 4.2: sectoral distribution of GDP (1967-2016)**
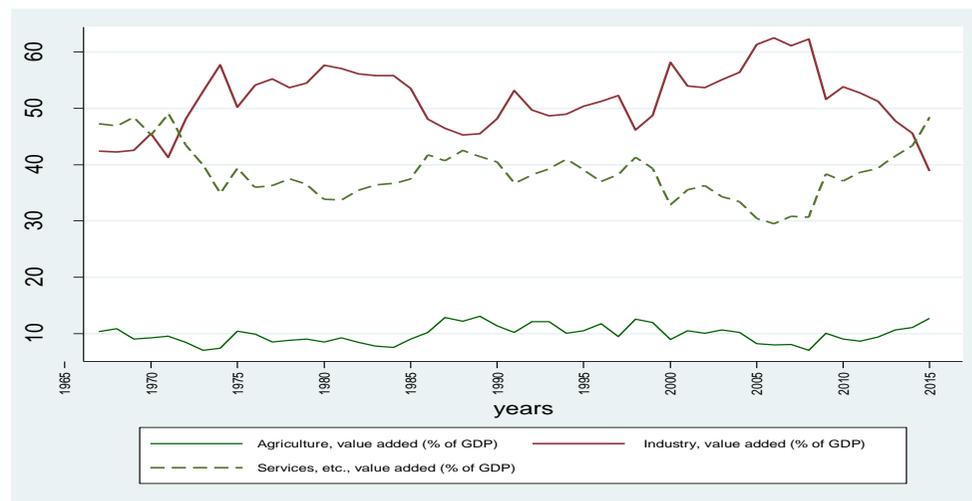
Figure 4.3: influence of industrial sector on GDP growth (1967-2016)
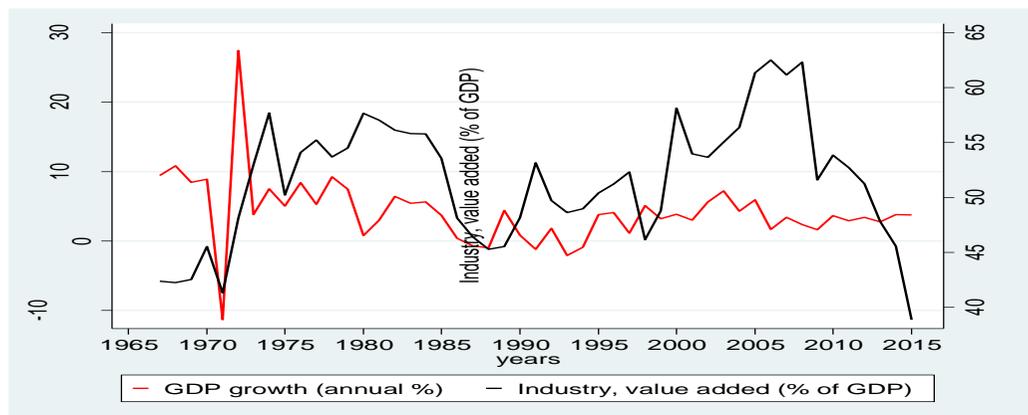
Source: the author, using World Bank Metadata.

economic aspects. However, one problematic issue for Algeria is the fact that its weak institutional conduct vis-à-vis business environment continues to underpin long-term economic development. In addition to political instability and attitude toward foreign investments hamper the integration to the global economy; this can be viewed from limited efforts designed to enhance regulatory efficiency, sustain private sector or propose policies to diversify the economy (Miller and Kim 2017). The spread of corruption plays a remarkable effect on the maintenance of bureaucratic behavior, delaying much more the process of business launching, namely for young entrepreneurs. For these reasons, considering Algeria as the less competitive economy seems logic and its ranking much more representative. According to Global Competitiveness Report published by the World Economic Forum, Algeria maintains the latest places with fewer supports to improvement. While the economic freedom considers Algeria as a repressed economy, competitiveness index enforces this view. For instance, the last report in terms of the most problematic factors for doing business in Algeria, highlights the burden of government bureaucratic as the foremost reason that hampers entrepreneurs to play their full role in the economy; besides, corruption (in its broad sense) hinders the operative and efficient allocation of resources or projects. However, an inadequately educated workforce with insufficiency to innovate is considered as hampers to the positive business environment (Schwab and Sala-i-Martin 2016). Indeed, national attitude toward innovation is low and slow too. Among 138 studied economies, Algerian is grouped with the last quartile and ranked in 112 position. The Quality of scientific research institutions and firms' spending on R&D activities explain such results. Rather clarifications came from the collaboration between university and industry in terms of R&D and assimilated activities. As an evident result, tardiness in innovation and higher education and training is also remarked when comparing Algeria with the Middle East and North African countries.

Since the competitiveness of the economy, as well as its integral status in the global sphere, seems contradictory to its market capacities (in particular the size of the market), reviewing governance indicators bring some answers to the current situation. It allows us to create connection between natural resources and interrelationship among the actors in innovation, as mentioned earlier. Similar to the other indicators we have referred to, the governance situation follows the same pattern as Algeria records a continuous decline in the variously related field. World Bank governance data about Algeria register crash in some vital variables and relative observable degradation in others[1]; only political stability has been increasing since 1998. In contrast,

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[1] An interactive data presentation can be accessed through the following link:
http://info.worldbank.org/governance/WGI/#reports (accessed on 26/05/2017 at 18:59)

government effectiveness, voice, and accountability, after a peak in 2005 have registered a decrease since then. Rule of law and control of corruption, after a decade of relative stability, return to register negative signs especially after 2013. This can be understood when comparing the quality of regulations, which registers an absolute crash since 2005; thereby, the overall score of governance register a decline from 19 in 2008 to 17 in 2015. These behaviors of governance, which have serious results on competitiveness and economic freedom, respond significantly to transitive channels described by Gylfason (2001). Apart from the famous symptoms of the Dutch Disease, excessive dependence on natural resources may result in rent seeking behaviors, which procreate corruption and distort the allocation of resources. In addition, an abundance of natural resources falsifies the real situation, leading government to lose sight for an effective management of economic growth, by the affection of bureaucracy and institutional quality. Nevertheless, the most dangerous channel of resources abundance lies in the tendency to develop the stock of human capital by reducing expenditures on or neglecting the education of the youths. Expenditures on education have many positive externalities at long term including, to name a few: increasing labor efficiency, fostering democracy and improving health and enforcing equality; thus, instituting good governance practices. On the other hand, one may relate education to quality of academia, research institutions or higher education institutions, therefore, expenditures on educations determines the overall status of learning in the country. Additional insights will be presented in the next chapter. In the extreme side, a recent study by Stampini et all (2013) has shown that oil-abundant countries tend to neglect the private sector in their economies. Both as a share of total consumption or investment, this sector participates in a small portion; this is due to the presence of government in the economy and its relation to the extractive oil sector. Namely, this presence of the public sector is exacerbated when ownership of the natural resources returns to the Government, as in Algeria. Moreover, Corruption in the public sector tends to transfer financial resources to the latter, while the private sector suffers from a severe funding shortage and acute obstacles to obtaining loans. However, it is worth at this stage to demonstrate how the private sector manifests in Algeria as a way to understand its relation to other sectors.

ii- The Structure of Industrial Sector

The actual situation of the industrial sector in Algeria cannot be understood without referring to its historical roots, at least since 1970. This is due to the chosen philosophy undertook by the authorities after independence, where great maneuver marginal was given to the state at all levels. In this context, social challenges and development objectives interchanged to affect the contemporary status quo. Further, the industrial sector is not an exception and it followed the

registered ups and downs. Indeed, the industrial sector witnessed considerable shifts similar to the major transformations of the economy, which were changed according to the overall national and international events.

In general sense, one can resumes Algeria's instabilities (at least from an economic angle) around two issues, as mentioned by Talahite (2010), and which are of industrial and financial order. Indeed, the advancement of the industrial sector, according to specific programs, led to the investment of huge sums, which overpasses the country's financial capacity on one hand and tried to respond to political programs on the other hand. This trend created a hegemony of regionalism and a severe disequilibrium in terms of industrial sectors. Yet, covering the planned amounts have been the function of the international price of hydrocarbons as exports rely heavily on this resource; therefore, the whole programs were conditioned by this factor, and a quick look to the development of hydrocarbons markets depicts similar shrinks of industrial investments. Furthermore, the industrial sector was confronted first by the central allocation of resources then by the influence of lobbying groups.

At this stage of analysis, it is useful to introduce the place of industry in GDP as depicted in the table below.

Table 4.3: Sectoral Distribution of GDP (as %)

	1993	1994	1995	1996	1997	1998	1999
Hydrocarbons	21.5	22.7	25.6	28.6	29.6	23.0	27.4
Other sectors of which:							
Agriculture	10.9	9.5	9.7	10.8	9.4	11.1	11.1
Industry	*12.1*	*11.5*	*10.6*	*8.7*	*8.5*	*9.7*	*8.6*
Government services	14	12.7	11.7	12.2	12.5	13.5	12.7
	2000	**2001**	**2002**	**2003**	**2001**	**2002**	**2003**
Hydrocarbons	39.4	34.0	32.8	36.2	33.9	32.5	35.5
Other sectors of which:							
Agriculture	8.4	9.7	9.3	9.6	9.7	9.2	9.8
Industry	*7.2*	*7.4*	*7.4*	*6.6*	*7.3*	*7.2*	*6.6*
Government services	10.4	11.1	11.7	11.1	11.1	11.0	10.5
	2004	**2005**	**2007**	**2008**	**2009**	**2010**	**2011**
Hydrocarbons	38.0	45.1	43.66	45.12	31.1	34.74	36.2
Other sectors of which:							
Agriculture	9.4	7.7	7.556	6.57	9.31	8.44	8.11
Industry	*6.0*	*5.2*	*5.12*	*4.69*	*5.77*	*5.12*	*4.58*
Government services	9.9	8.6	8.53	9.70	11.96	13.2	16.38

Source: IMF Algeria's country reports, different issues.

Figure 4.4: Composition of GDP by Sector of Activity as %
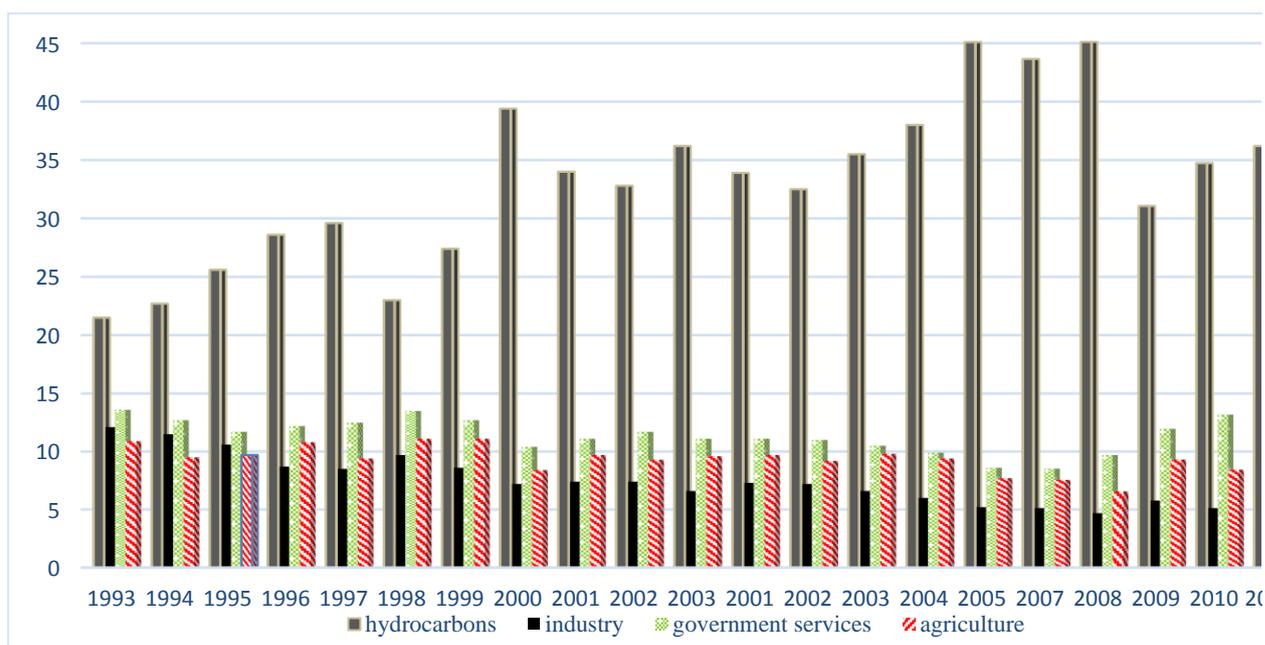
Source: The Author, using IMF country reports for Algeria, different years.

As shown in the figure above, the dominance of extractive sector is clearly presented with a record of about 45% of generated GDP in 2008. Such dominance is permanent at least during this period with a decline in participation share for other sectors, namely the industrial sector. Indeed, the overall share of the industry was equivalent to and overpassed that of hydrocarbons during the periods 1967/1967; 1973/1978 and 1980/1984, then entered a prolonged period of regression since 1990. One way to justify the trend refers to the amount invested and political preferring programs and policies. During the first decades after independence, authorities focused on changing the country's advantage, which was for a long time based on agriculture. Therefore, it was normal that the successive socio-economic programs prefer establishing solid industrial base to the detriment of agriculture (viewed as the source of underdevelopment and at the origin of country's conquest). Indeed, the industrial sector received further investments since 1974 where it passed from 152 million to more than 600 million in 1980; while for the same period, the amount designed to agricultural sector was respectively 600 and 1200. As a result, sectors' share of the GDP varied correspondingly (for the industrial sector it was around 12% in 1979 and 13.3% in 1984, while for the agriculture was 9.5% to decrease to 8.2 in the same years (Djeghloul 1985)).

Yet, the sharp decline in hydrocarbons prices in mid-eighties is considered as a turning point for the country as a whole. The state coverage applied to public enterprises was abolished due to

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the lack of sufficient liquidity, on the one hand, and to the heavy debt burden on the other hand; thence, applying privatization was considered an urgent necessity to correct the status of the industrial sector that should be opened to private investors. Such weak situation has influenced the productivity of the sector, which registers deep recession since 1990. Unfortunately, this deterioration in the participation share of the industry in GDP seems to be permanent as it proliferates for more than 20 years. Evidently, the industrial sector provided 12% of GDP in 1993 to less than 7% in 2003, then dropped down to 4.5% in 2011, according to IMF reports. This status, if combined with the previous increase of hydrocarbons share in GDP, as well a similar improvement in the share of services (government services), presumes the presence of the Dutch Disease phenomenon. However, this hypothesis was rejected by DERBAL & DEKKICHE (2011) who documented the presence of the resource curse theory[1] as we assumed in the previous section of the present chapter. Additionally, the decline of industrial sector in favour of hydrocarbons and government services confirm the dominance and the control of the public sector over the private actors (this remark can also be depicted in figure 2 above where both government services and industry, including hydrocarbons, account for 30% and 60% of GDP; however, an accurate observation should be mentioned here. With reference to figure2, it is easy to notice that the lower the value of hydrocarbon participation, the higher the ratio of the services sector in the GDP. This merely refers to the strong presence of public sector in economic life, considering that the two sectors are public-led sectors (another evidence is that if summing the capital of large public companies such as Sonatrach, Sonelgaz and Air Algerie, it overpasses twice, or more, the capital of private companies presented by the Algerian Business Leader Forum).

Thus, the Algerian industrial sector is highly sensitive to two major factors: it is widely dependent on hydrocarbons revenues and is reliant on public policies. Both of these factors are autocorrelated. Of course, articles 17 and 18 of the Constitution stress that natural endowments belong to national collectively and are treated as public properties[2]. Therefore, revenues from these endowments flow automatically into public budgets. In parallel, public policies, since independence, focus on the creation of heavy and solid industrial body, including steel, mechanic

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[1] According to literatures, there is a distinctive gap between the two phenomena. While the Dutch Disease is a purely economic reaction to a structural change in the economy, resource curse is worse and spreads to cultural, social, psychological and political aspects.

[2] The complete text of the Algerian constitution is available on:

http://www.joradp.dz/HEN/consti.htm (accessed on 29/07/2017 at 18:45 local time).

However, there is a difference in the order of article between Arabic and English version. The article 17 and 18 in English version figure in the article 18 and 19 for the Arabic version.

and metal, electricity and electronics, manufacturing, chemical, plastic, and pharmaceutical. In counterpart, policies have been ignoring other light but basic industries such as wood, cork and paper, leather and shoes, and textiles and clothing. These options led to a decline in the industrial value added since independence, which was 12.6%, dropped to 6.6% in 2005; figure 5 below demonstrates the percentage value added by sectors. The overall value added of the economy (the above part of the figure5) is generated by hydrocarbons for more than 40% as a medium during 2001-2015. The fact is acceptable if considering the amounts invested (local and foreign investments) in the sector and authority considerations. Indeed, we have mentioned earlier that hydrocarbon was considered as a magical and prominent sector for development and revenue generations; therefore, calls for investments was covered either by national public enterprises (namely Sonatrach), by foreign firms, or by the association of both. The present fact is an additional finding of the supremacy of hydrocarbons sector over other activities in the economy; moreover, there is a public dominance over this sector (left part of the figure5). The overall value added demonstrates the presence of four accompaniment sectors. Even their parts do not exceed 18% in best records; these sectors register an increase in their value added. At least during the period 2001-2015, these sectors benefited from financial position of the country that was translated by the launching of rigorous programs for development and economic consolidation. In fact, the commitment of authorities to provide housing creates an unprecedented dynamic activity in the sector of housing (BTPH) to attain 12% in 2015, raising from 7% in 2001. Transport and communication sector expand during this period. Indeed, the consolidation of public retreat from the transport sector, which was conditioned during the period of readjustment, gains further ground by granting exploitation credits for air and land transportation, especially to private actors. The new environment participated in creating a competitive milieu that contributed to the enhancement of the added value for this sector to overpass 11% in 2015. In parallel, opening the telecommunication sector, in particular, mobile telephony, considered as a virgin field at these dates, contributed to the attraction of new foreign operators whose objectives were the dominance of the market. In addition, the integration with the global world necessitates the urgent use of the internet as an indispensable option. Yet a smooth, but a permanent increase of the value added has been observed since 2001. The agricultural sector, too, benefited from the financial ease of the country. The adoption and the launching of PNDA program. The focus of the program was to provide a financial accompaniment, in forms of subsidies, for farmers to incite them to increase production and productivity levels with a view to rapidly improving the contribution of the agricultural sector to the country's food needs.

Figure 4.5: Share of Value Added by Sectors 2001-2015.
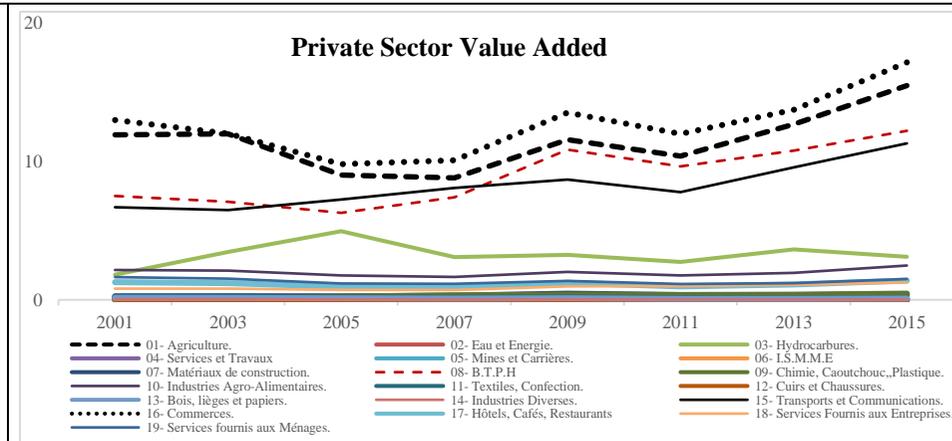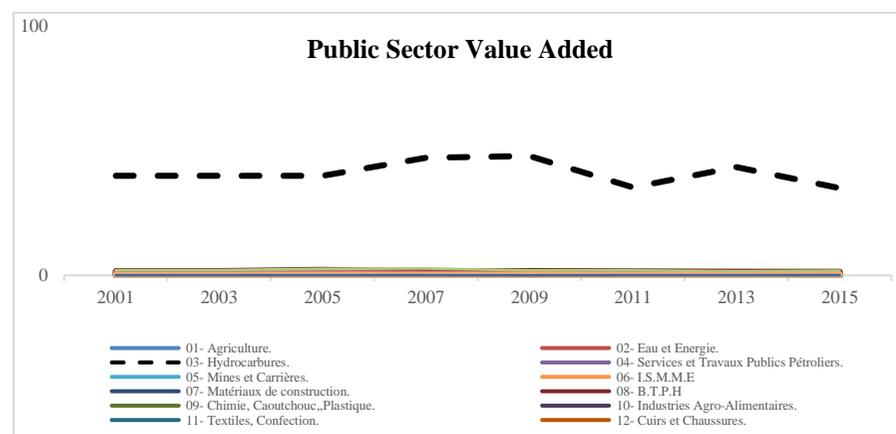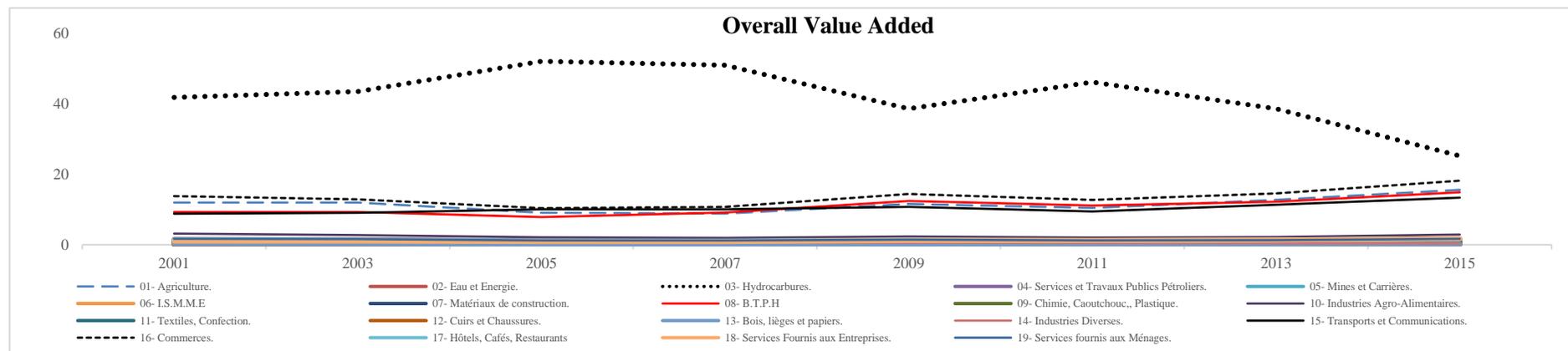
Source: the author, using ONS data multiple years.

The efforts of this revitalization were marked by a process of intensification of production, an extension of cultivated areas. Thus, a jump was observed in the contribution of this sector, which passed the threshold of 15% in 2015. However, we register a remarkable instability of the value added due to expanded national demand and the climate conditions characterized by low rainfall. Finally, trade and similar activities witnessed a significant surge in view of the financial well-being that accompanied the increase in household incomes, and the large and varied demand resulting therefrom. The contribution of trade sector in the generation of revenue was quintupled since 2001. It overpasses 2 million dinars in 2015, comparing to 800000 dinars 2007 and 400000 dinars in 2001.

The up-mentioned accompaniment sectors that are: agriculture, transport and communication, trade, and housing are, in considerable portion, practiced by individuals or private operators as mentioned by the right low part of figure 5 (also are depicted by the medium grouping lines in the upper part of figure 5).

Yet, a quick review of figure 5 shows a dangerous disequilibrium in terms of resource orientation, for public authorities as well the private sector. Public investments are operated in the energy sectors, and some strategic sectors like air and maritime transport. Private sector prefers activities that generate more revenues with fewer efforts, like trade, communication, and transport. However, activities that are of mass demand such as clothing, paper, and leather have relatively a neglected value added which in best share attains 4%. For example, clothing activities contribute with 0.34% in 2001 lessened by half in 2015 to attain 0.18%. This picture concerns both public and private sector, with a substantial shrink in the public sector (from 0.16% in 2001 to 0.013% in 2013). Building materials that should be promoted, due to mega construction projects in both housing and infrastructures, has registered a decline since 2001; this reduction is highly manifested in the public sector where public-led enterprises, active in this domain, registered 0.29% (approximately 34 million dinars) in 2013, decreased from 0.68% in 2001. One reason to explain the reverse situation can be found in the idea that authorities in resource-rich economies tend to be in a financial ease as they dominate the revenues of the energy sector; therefore, they will be independent of other sector in the economy and can cover their need by imports. These governments are less democratic, less open to society and politicians tend to buy social peace. Thus, since heavy projects explain the political will, government to face shortage of material supply tended to import extensively to achieve the planned objectives in detriment of promoting local producers or existing enterprises of the private sector. Such a situation reflected negatively on the return of the construction materials sector, as we have just stated. Another dramatic example

consists of textile and leather sectors. Since structural adjustment, there was a tendency to divorce these two vital sectors. No country will just think of development if its citizens, in addition to reach food auto-sufficiency, feel a permanent lack in clothing and related goods. However, Algerian authorities, in their transitional phase, abandoned textile sector due to weak competitiveness of this sector, while it was necessary to accompany the sector to save hard currency as well as to meet the increasing demand for different products of the sector, especially as the population growth rate is considered high and active for one. However, this option was both be conditioned and welcomed by international financial institutions to the counterpart of providing fund and assistance. Since there, private operators in the sector decreased their activities leading to noticeable loss of the value added for the sector. The enduring activities result from the remaining activists and some artisans. Same observations can be said for leather and wood, which manifest a permanent loss of value added. For 14 years, the contribution of wood did not pass 20 million dinars even there is a constant increase in demand for these products. Expressed as a percentage of overall value added, the wood sector contributes by 0.2% in best cases (0.11% for public sector and 0.1 for private one) with an approximate equivalent loss for both sectors, between 2015 and 2011. For the textile sector, there is a nominal reduction of the share of the public sector, even there was a considerable increase of nominal GDP; indeed, in 2001 value added of the public enterprises active in the field generated about 550 million dinars, while this value dropped to 276 million in 2015. Yet the private sector substituted the state in this domain even its contribution still be insufficient due to increased national demand, however.

By reviewing literature on the Dutch disease symptoms, one can conclude that the theory holds for the Algerian case. Figure 5 shows these sectors as lagging or losing further competitiveness due to local money appreciation (the third grouping line of the upper part of the figure5); however, we know that political and financial authorities in Algerian have opted for sterilizing policies of hydrocarbons revenues, namely by planning of public projects in infrastructures. Unfortunately, such projects feed corruption and led to resource waste and insufficiency of projects and their performance (World and Bank. 1997). According to Locatelli et all (2017), bribery is apparent to be renowned across all sectors. However, one sector attracts further corruption behaviors namely in public works contracts and building activities. Besides, honest corporations functioning in such activities and refuse the paying of bribery risk to lose business due to their point of view vis-à-vis corruption. Further, projects differ in their ability to receive corruption; there are some characteristics that determine the level and the amount of corruption, including project size, government involvement, project complexity, work cancellation and lack of due diligence. Indeed, the more the project is large, the easy is to hide corruption. In addition, public officials use their

power and post to favor some projects especially with the lack of control on these officials. The level of complexity is another factor to hide bribery where mismanagement or poor design are frequent(Locatelli et al. 2017). Hence, such analyses should be integrated to understand the realities of the industrial sector in Algeria and precisely the role of private sector in the promotion of industry and economic performance as a whole.

Indeed, the debate on the private industrial sector in Algeria is as old as the emergence of the sector itself. The industrial private sector was already the subject of fierce controversy in the early 1960s. Some people opposed it to the public sector and saw in it a dangerous competitor or even a threat; others considered its existence as an indispensable complement to the public sector, within a sectoral division of labour in the emerging industry in Algeria. Further, it is true that the development of the private industrial sector is inseparable from that of the public sector, insofar as the dynamics that drive each of the two sectors to participate in the same movement of structuring the whole society.

While in agriculture, the private sector has maintained its dominant position since the independence, in non-agricultural sectors, the relative weight of the private sector stabilized or declined, with varying degrees of intensity depending on the sector, as mentioned above. At least, the image of the Algerian private nonagricultural sector during the first 15 years of independence is relatively simple. It was strongly concentrated in the branches of services (trade) and consumer goods (textiles, plastics processing, cosmetics, and food industries), where investment is light and profits immediate; it used simple technologies that did not require high managerial qualifications or extensive workforce training, it was largely outside the control of the state. On the other hand, public capital is involved in industries requiring very heavy investments such as steel, petrochemicals, mechanical and electrical constructions, and building materials (cement works). The private sector thus, specializes in the sectors of final consumer goods, while the public sector takes over the new branches of intermediate goods and capital goods, for which the capital allocation per worker is comparatively high. Such sectoral specialization has been maintaining to the present time where public sector confirms its presence in heavy industries and the private sector in light primitive activities as mentioned, in exception of some extension to installation activities in the field of electronic devices and cars. On the other hand, explaining the private sector specialization may result from various factors including fund limitation, occupations previously exercised by entrepreneurs and taking profit from economic reforms. The limited access to fund had shaped considerably the orientation of private investments toward activities such as textile, leather and confection products. Besides, according to Abdoun (1986), the occupational background has contributed to the choice of activities. He pointed out that the majority of

entrepreneurs were either traders (retail, even wholesalers) or salaried. According to the trade previously carried out, industrialists can indeed be classified into three categories. The former is constituted by former wholesalers, traders, importers, manufacturers, how exercised these job before independence. The second category includes former merchants (formerly merchants or importers, but after independence) and former employees (but not workers) of the colonial era. The third group includes former workers, who became industrial after independence. The industrial entrepreneurs are therefore either former merchants or employees or, to a lesser extent, former workers. To these factors, economic reforms of the late 1980s and those of 1990s contributed to the reformulation of the private sector, which benefited from unclear earlier reforms such as privatization of public societies and the opening of some activities like transports and communication. In these new fields, earlier operators got an enormous margin of profit due to unspecified regulations or legislations ambiguity that were enforced by political instability.

In general, private industrial sector in Algeria does not go beyond the study realised by (Stampini et al (2013) in which the share of private sector in African resource-rich economies was below the continental median, in terms of investment and consumption, therefore there was a negative impact on their size then on their participative share in GDP and unemployment absorption. Furthermore, industrials circumventing the law and existing regulations; they avoid declaring the actual number of workers to eschew paying the corresponding social security; they also opt for fraud and tax evasion, since they can easily pay corrupt officials and get further tax privileges. In some cases, industrials exploit their industrial façade, in order to obtain hard currency and resale it in the underground market without a real process of conversion or production. Such practices are consistent with the logic of the natural resource curse and the parental system as it is practiced in Algeria since independence.

The current status of the industrial sector, both in terms of participation share in GDP and in terms of specialization, can be understood by two angles: the whole sector reflects earlier choices made by authorities which had preferred investing in heavy industries in detriment of basic light ones. These choices are in itself was conditioned by hydrocarbons sector. However, heavy dependency on such revenues provokes resources wasting since bureaucratic practices and corruption controlled the allocation of projects to selective businessmen. Earlier millionaires of 1980s were either ceased their activities or transferred their assets outside the country namely after 1986 and during 1990s. in counterparts, new "*trabendistes*" millionaires, those who got mega profits from the scarcity of goods, and engaged in smuggling and bartering goods along the borders, tried to launder their capitals (or simply tried to institutionalized them) and introduce them

into the economic cycle during the 1990s. With the new era of restructuration, they found ready atmosphere to penetrate activities such as electronic and electrical appliances. As well, private operators intentionally preferred light industries as high profit is guaranteed; recently most of employers and businessmen prefer direct export of various goods because of the rapid and guaranteed profit from such activities rather than engaging in actual investment in sectors that are considered as pioneer and unexploited such as tourism.

It seems that Algerian industrial sector is under the control of public authorities since there is no real regulation promoting this sector namely the place of private industrials, whose maneuver margin does not fulfill the national aspirations. Thus, authorities still play a decisive role in guiding and directing the national industrial sector, which is supposed to respond to leader's choices, strongly affected by the curse of natural resources.

Yet, industrials, even some official personages explain the failure of industrial sector by the inadequate labour forces and precisely low professional capacity of college graduates. This view puts higher education institutes in the dock, and regards academics as living in the so called "Ivory Tower". Judging the validity of this approach requires considering the formation and the development of the higher education system in Algeria. The Following point deals with this issue.

iii- *Higher education sector in Algeria: from independence to recent era*

The development of nations depends on their scientific, technical and cultural level. As such, the value of the Higher Education and Scientific Research system, its ability to train future generations, is an important strategic issue. The formation and accumulation of high-quality human capital are seen as an important source of economic growth and competitiveness. From the outset, it places educational systems, and in particular higher education and scientific research, in a central position.

During the last fifty years, Algeria made a considerable effort to meet country's new requirements that englobe building and developing a system of higher education and scientific research of sufficient density to cover the entire national territory and all scientific disciplines. This gigantic effort has produced very visible results. Such efforts were, recently, the prominent output the development programs initiated by the Algerian authorities in light of the financial swelling caused by hydrocarbon revenues, and there were approved the establishment of a university or university center in each Wilaya (state), which is referred to as an international precedent. Using number languages, the network of Algerian university accounts one hundred and

sixty) institutions of higher education spread over forty-eight wilayat, covering the entire national territory. This network is made up of fifty universities, thirteen university centers, twenty national superior schools and ten superior schools, eleven teacher training colleges and two annexes ((MESRS 2017, accessed on 08/08 at 14:30 local time). The first quick intuition is the unequal distribution of higher education institutions if considering only the existence of three major regions: east, center, and west. Most of the universities are located in the east with twenty-two universities, two university centers and six superior schools, two annexes, five teachers-training institutes (école normale supérieur). The center, there are seventeen universities, three university centers and sixteen superior schools, three teachers-training institutes, and two preparatory schools. The west region registers eleven universities, seven university centers, seven superior schools, three teachers-training institutes and one preparatory school. In general, the east region has 35 establishments, while in the center there are 41, and 29 in the west.

The speedy growth of the network reflects the authority's engagement in providing free education (viewed as a right and as a duty) to citizens according to article 53 of the constitution (theRepublicofAlgeria 1989) which stipulates:

"The *right for education is guaranteed. Education is free within the conditions defined by the law. Fundamental education is compulsory.*
The State organizes the educational system.
The State ensures the equal access to education and professional training."

This principle is not born in 1989, but earlier it was drawn within the corpus of socialist thinking adopted by authority leaders since independence. in this context, the higher education system is treated as public establishments, which are funded entirely by the state; thus, it is subject to the authority of a government ministry, who prepares and implements government policy on both higher education and scientific research, and reflects government orientations. From this point of view, we can look to this sector in terms of the impact of successive government policies, characterized by contrast and heterogeneity between the different teams that headed the country, with an evident expectation to the presence and persistence of serious problems and challenges for the higher education ecology.

Today's Algerian University is the product of a long process of construction, evolution and reform that began in 1962 when national sovereignty was recovered. The Truly Algerian University appears with the creation in 1970 of the Ministry of Higher Education and Scientific Research and the launching of the important reform of higher education of 1971. The requirements

of the economic development model, which began with the launching of the first three-year plan in 1967, required a major overhaul of the education and training system in general, and of higher education in particular. Indeed, the industrialization scheme, conceived for the development of the national economy, induced important needs in senior management. A new orientation and new missions are defined and assigned to the higher education system where the purpose was to mobilize the full potential of the university for the training of human capital useful for development. The challenge was not to limit itself to the training of those traditionally trained at the university but of responding to all the sectoral demands formulated by the user sectors. These gains had been confirmed, strengthened and rationalized by the law 99-05 of 4 April 1999, which synthesizes the entire regulatory framework produced since independence, and gives it overall coherence. It organizes the structural arrangements needed for the redeployment of the whole system. It opens up important projections for demographic and infrastructural progress (SGG 1999). The Guidelines Act confirms the functioning ideologies of higher education. It sets out the objectives to be attained. It specifies the status of teachers and teachers for all levels of higher education: graduation, post-graduation, continuing education. Article 3 stipulates, for example, that as a component of the education system, the public service of higher education contribute to:

- The development of scientific and technological research and the acquisition, development, and dissemination of knowledge and the transfer of knowledge,
- The raising of the scientific, cultural and professional level of the citizen through the dissemination of culture and scientific and technical information,
- The economic, social and cultural development of the Algerian nation through the training of cadres in all fields,
- Social advancement by ensuring equal access to the highest forms of science and technology to all those who have the skills.

In spite of these reforms, it was necessary to re-modernize the system of higher education through a radical change in the structure of education. Yet, the year 2004 saw the implementation of a new style in the offer of training. Articulated according to three levels, each corresponds to a degree: License-Master and Doctorate (LMD). This new architecture is organized within broad areas covering several disciplines that are coherent from the point of view of professional opportunities and scientific and technical skills. The LMD system overcame the aging regime, which lasted more than forty years, and was practically generalized to all courses of higher education institutions in less than ten years. This rapid shift created, in addition to the conflicts in

the concerned population, blackmails in the system of employment and in the structure and rate of unemployment.

From the above stated, it can be concluded that the main achievement of the reforms is articulated in four points:

1-   *The democratization:* The democratization of access to the education system and to higher education has marked Algerian policy since independence. by the democratization of higher education, the access to tertiary education is guaranteed to a wider number of students from all social categories, regions and localities of the country, and that the distribution by gender does not disadvantage the female element.

2-   *The Algerianisation*: Since the proclamation of independence, the Algerianization of the education system in general and of higher education, in particular, had emerged as a major concern of the authorities. It has resulted in a policy aimed at replacing the foreign lecturers by the massive access of Algerians to the teaching function.

3-   *The Arabization*: Major efforts have been made to make Arabic the main language of instruction in the university cycle. Higher education, which was originally confronted with a large deficit of teachers who mastered the Arabic language, had to be trained by means of an important cooperation from the Arab world. In fact, the rate of Arabization continued to increase in a differentiated way according to the specialties taught

4-   *Scientific and Technical Guidance*: The importance given to the question of economic and social development, needed to implement the industrialization programs and the development of natural resources contributed to the enhancement of scientific and technical guidance. It is with the adoption of the planned economy system that the needs of qualified technical staff had been felt. For example, in 1986-87, the share of students enrolled in science and technology accounted for 72% of the total enrollment, with a clear predominance of technology enrollees (34%).

The adoption of such reforms has made Algeria one of the leading African countries in terms of spending allocated to higher education (Teferra and Altbachl 2004), and create a fruitful dynamic in the tertiary education, in the rate of students' enrolment and educative teams, as well as the network intensification. Indeed, during the first twenty-five years after independence, national planned objectives have largely influenced tertiary education, in terms of enrollment and orientations. While in 1962 the number of students did not exceed 3000, the following 7 years manifested a constant increase of about 1000 students per annum. During the 1970s, there was a

radical jump in the new entrants, which attained the threshold of 57 thousand students; this trend continued to reappear during 1980s to register about 150 thousand students.

Table 4.4: the evolution of students' number 1962-1987

Academic year	N° of students	Academic year	N° of students	Academic year	N° of students
1962-1963	2725	1971-1972	23413	1979-1980	57445
1963-1964	3565	1972-1973	26074	1980-1981	66067
1964-1965	5425	1973-1974	29465	1981-1982	72590
1965-1966	6883	1974-1975	35739	1982-1983	90145
1966-1967	7478	1975-1976	41709	1983-1984	97000
1987-1988	8735	1976-1977	50094	1984-1985	103013
1968-1969	9794	1977-1978	51893	1985-1986	119665
1969-1970	12243	1978-1979	51510	1986-1987	146200
1970-1971	19311				

Source: (Djeghloul 1986).

The increasing number of enrollment during this period reflects the population growth rate and the youth tendency of the population. It was necessary, even logical, to wait 10 years since independence, to see the 18-20 age class emerge normally; this is due to death cases caused by the war and emigration of other youth at the eve of independence, especially those who got the French nationality. Further, the compulsory principle of education that authorities had established, contributed to raise the proportion of students enrolled in universities, in order to meet the shortage of qualified labour force, necessary to push the development wheel of the country at that time, this is why the number had tripled at the end of the 1970s.

In addition to this, we have to add economic and social challenges that the authorities tried to overpass. The shortage in terms of engineers, medicines, pharmacists, technicians and other human capital reshaped the orientation of this future force. As shown in the table below, a high portion of enrollees prefers technology and medical disciplines, with an increasing demand of technological curricula. In general, these two disciplines welcomed 42% of total students in 1979/80; 49.3% during 1982/83, and more than 57% in 1986/87. These results explain the increasing demand due to the observable growth of population, on one hand, and the need to maintain the economy works at levels that meet the population expansion, on the other. However, a deep insight shows a preference of technological background (36.32% in 8 years) rather than medical career (26.69% during the same period). This trend can be explained by the labour market absorption, which reflects the national economic needs of labor force; Another point of view can be understood by the fact that the state had abandoned the medical formation as long as international standards have been reached for providing a doctor for each population group. Consequently, the number of

graduated doctors exceeded the needs of the population (risk of unemployment) which created a case of saturation in this field.

Table 4.5: The Relative Weight of Each Discipline in the Enrollment Structure (%)

	1979/80	1980/81	1981/82	1982/83	1983/84	1984/85	1985/86	1986/87
Technology	18,8	19,4	19,5	18,9	21,5	26,0	31,3	34,4
Exact sciences	10,1	8,8	7,8	8,0	9.1	7,0	6,9	7,2
Medical sciences	23,2	24,9	28,9	30,4	30,2	28,7	24,4	22,8
Biology and earth sciences	9,0	8,2	9,2	10,0	9.0	9,5	9,1	7,9
economics	8,3	8,2	5,6	4,6	4,9	5,4	6,2	7,6
laws; politics and communication	13,2	12,2	11,2	11,6	10,5	10,5	9,9	8,6
social sciences, literature and languages	17,5	18,3	17,8	16,5	14,8	12,8	12,8	11,6

Source: (Djeghloul 1986)

Furthermore, there was a tendency to create a generation of politicians and jurists, depending on the prominent role played by Algeria in the field of international and regional policy, in addition to its active role in the Non-Aligned Movement. Else, the geopolitical location played a significant role in the rehabilitation of students in the field of languages and literature. On the extreme side, few students are going to study economics or those with a tendency to study the geographical and biological environment. the present data show a general decline (except for technology) in the enrolment rate, for example, exact sciences, which begin the 1980s by a rate of 10% of total new students, receives nearly 7% in 1987; same observations can be concluded for the last two disciplines in the table. The reason for these remotes to the economic situation of the country, which was deluded by hydrocarbons revenues. Indeed, since the early 1980s, there had been a general conviction that the planned economy had come to an edge. However, the authorities tended to improve the image by continuing populist policies based on broad support for the population, despite the spontaneous economic warnings that could not be hidden, such as imbalances between supply and demand and the high unemployment rate. Consequently, students hesitated to enroll in disciplines with very low employment rates.

The 1990s saw an increase in student enrollment (238.427 in 1994 to 466084 in 2000, as reported by (ONS 2017), creating difficulties in the way of maintaining an efficient and profitable training. Modifications were made to the organizational scheme by the promulgation of the model statutes of 1983, the abandonment of the modular system, the orientation system becomes quasi-mandatory, the imposition of short cycle courses through severe selection procedures for long

formations duration (CREAD). These modifications led finally to the adoption of LMD system in 2004, with a novel configuration of formations (said to be much more market-oriented) and duration. As a period of transition, the number of students enrolled in this system did not overpass 80 thousand since the first three years, due to the ambiguity surrounding the system. During 2015, almost all new entrees were oriented to first cycle (approximately 800 thousand). The expansion of effectives enrolled in higher education institutions (economically speaking, active labour force) explain in somehow the failure of authorities to provide job to graduates. This might be seen by the rapid increase in the number of students in Master and Doctorate cycles.

Figure 4.6: students enrolled in Master and doctorate cycles. 2004-2015
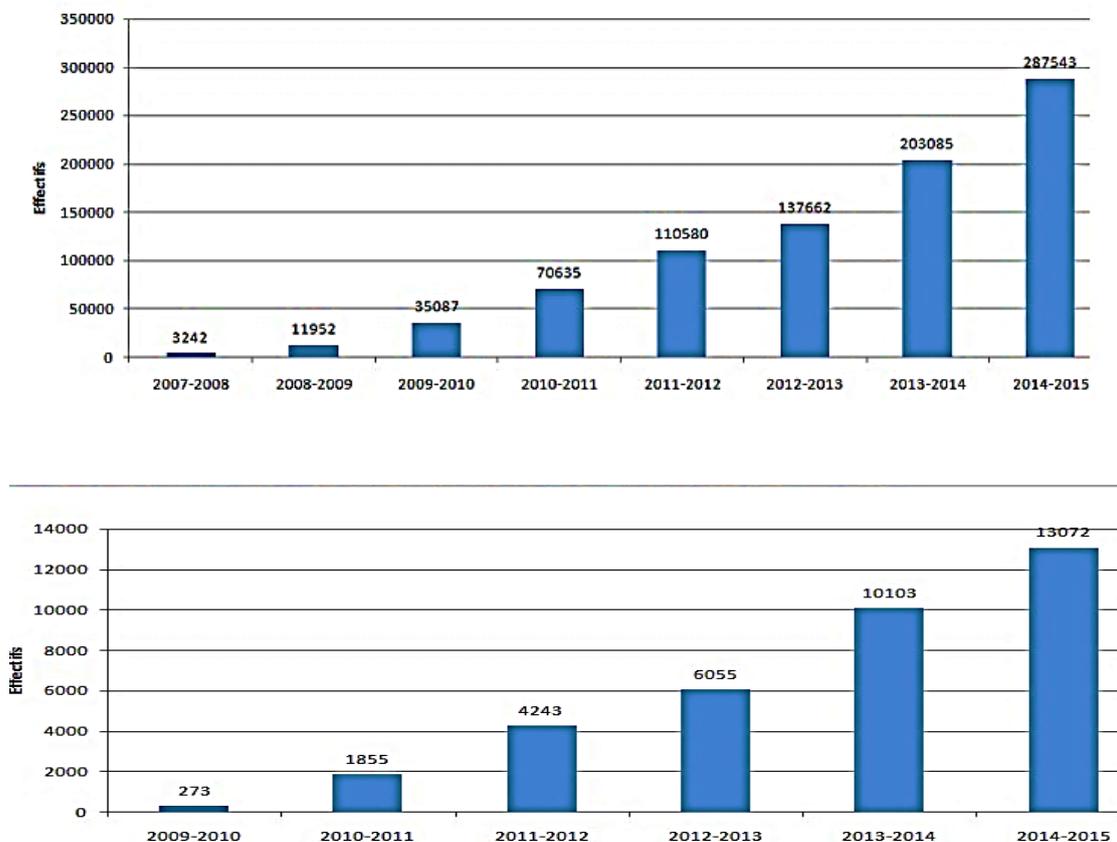
Source:(MESRS 2017) from the link : https://www.mesrs.dz/afficher/-/asset_publisher/nFmcv2fFsM1O/content/agregat;jsessionid=5A305A178623CBB2240404CF07130455#2. Accessed date: 15/08/2017 at 19:49 local time

As shown in the figure above, enrollees in the Master cycle (upper part) has exploded, and roughly, one-third of students, in 2015, continue their academic formation; furthermore, those preparing their doctorate thesis continue to increase from year to year (lower part). What the image

tries to tell is that the authorities, in one hand, provide international organisations with positive data about the higher education status; while on the other hand, summarises the quasi-failure of both, the government and the existing private sector, in absorbing the new job seekers, especially those with high university diplomas. The existing statistics on the structure of unemployment reveals an increase in the number of university graduates looking for a job of about 14.1% of total national unemployment; this gives a number of about 281 thousand graduates (ONS 2016). If we hypothesize that the graduates of 2011 promotion are still looking for a job, then, an intuitive calculation manifests the magnitude of the problem. Indeed, dividing 75688 (2011's graduates) by 281 thousand (unemployed graduates in 2015) gives a share of 27%. Further, the percentage increase to 52% if considering the graduates of 2014[40]. In such a case, the university becomes an option to delay unemployment and is really living in the Ivory tower. The university in this stage registers also a failure to meet its planned objectives and to respond to economic and social needs. This failure is further depicted in the structure of formation, notably in Master cycle, where most of Master cycle is academic-oriented programs in a majority of existing disciplines. That is to say, those who prepare these programs (professors and associate professors) have no, or have weak, network outside their academic milieu, as it will be shown in the present chapter.

   The present picture of the higher education reflects that of scientific research. The ivory tower case depicts the tiny participation share of this sector in the dynamic of the national environment (let us say, the overall Algerian ecosystem). Such remoteness, or more precisely isolation, interprets the public neglect of the prominent role of scientific researches on the development of countries. In this regards (Ghalamallah 2006) states that The low level of research funding (0.20 to 0.30% of GDP), and hence the economic and social status of the researcher and the material working conditions, is mainly compounded by inadequate management of the precious resources, is a key factor to the research current situation. He noticed that the evaluation system itself is weak enough to qualify scientific research. Indeed, activities of research are, in large portion, conducted by the ministry of higher education. These activities are in direct charge of the ministry (CNEPRU) or in charge of it subordinate body, especially The General Directorate for Scientific Research and Technological Development (DGRSDT). This latter structure is designed to coordinate research activities of other entities really implied in researchers such as research centers, research entities and laboratories. Therefore, the research body is structured as shown in the figure below. More precisely, the research agenda was directly being influenced by the law 08-05 of 23 February 2008

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[40] Considering the dynamic at which the employment market works gives a similar reading to the one we have presented

that had determined the principal framework for national scientific research and technological development priorities. The law objectives were to shift the national research system to more excellence for sustainable development. To this end, the DGRSDT was created to ensure the

Figure 4.7: Structure of Scientific Research Activities in Algeria
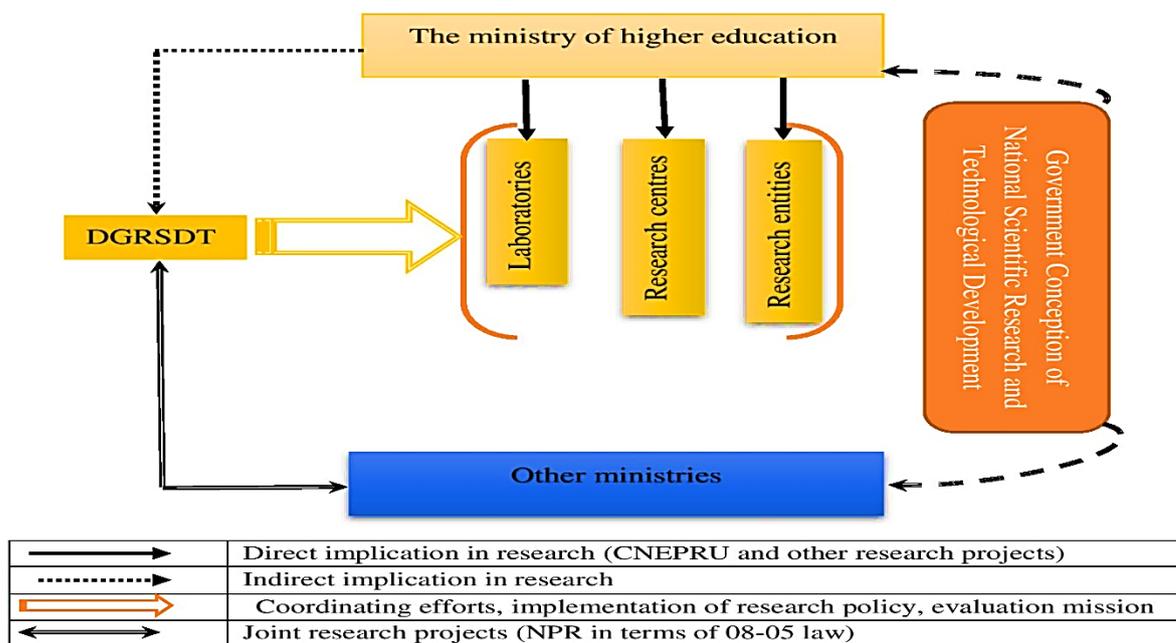
Source : Author own conception.

implementation of the law's guidelines for the evaluation, valorisation, and collaboration of research activities. Accordingly, Benouar (2013) states that the DGRSDT has to mobilize, develop and sustain creativity for the promotion of innovation and bringing together local actors to implement the knowledge-based society.

Executing the 08-05 law resulted in the adoption of 34 National Research Programs (PNR), which reflect the economic and social different needs of the country. Besides, the Directorate, as a preliminary summary of these programs, lists 10 emerging and promising specialties in Algeria such as physics, chemicals, and engineering[41]. However, this list expresses disequilibrium in the ministry research preferences, which also reinforce the problem of social sciences in Algerian higher education. Indeed, there is an exclusion of social science from the national research scene.

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[41] The list includes, in addition to those in-text mentioned: Biochemistry and Molecular Biology; Materials sciences; Environmental Sciences and Ecology; Mathematics; Geology; data processing and Agriculture (DGRSDT 2012).

In spite of these enormous efforts in terms of education and scientific research, the performance of algerian universities is far to meet international standard. According to Times Higher education site, the best algerian unuiversity occupies the >800th position in 2017[42]. This result, justifies the clain of industrial sector about the effivtive role played by universities, not in their innovative capacity but in their principle mission in the formation of adequte labor force which realy respond to labor market.

Conclusion:

The present chapter demonstrated the structure of Algerian authorities, the industrial sector as well as the higher education system. This step was necessary to understand the context in which these three components work, and how and who influence the other. The Algerian authorities, since independence, have been trying to attain economic, social, and educational international standards. The adoption of socialist regime, with the accompanied planned model, resulted in the emergence of solid industrial bases during the first years of planned programs. The industrialised industry was the best available option for the authorities to catch up with developed world; indeed, relaying on heavy industries was affordable by transforming hydrocarbon revenues to productive investments.

Yet, the dependence on natural resource became necessary to cover increased social demand, principally fed by the demographic explosion. At the beginning of the 1980s, the manifestations of the cracking of the socialist system began to unfold, calling for an urgent diagnostic then a restructuration of the functioning system. However, authorities continued in the adoption of populist support policies to keep population calm or to buy social peace. By the mid-1980s, the limits of socialist model came to an end after the remarkable shrink in public revenues with the crash of hydrocarbon price. a structural adjustment, during 1990s, was necessary to keep out the country away from bankruptcy. Unfortunately, reforms have limited results in their socio-economic aspects, due mainly to the failure of privatisation policy, investment regimes and dependency on natural resources.

Indeed, revival of hydrocarbons price, since the last 12 years, contributes to a structural change in terms of governance, where rent seeking behaviours have been multiplied considerably, feeding therefore the spread of economic and political corruption. These behaviours confirm the conclusions of Sachs & Warner, (1995), and Robinson et al (2006) on the negative role of natural

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[42] From the link : https://www.timeshighereducation.com/world-university-rankings/university-tlemcen#ranking-dataset/589595. Accessed date: 16/08/2017 at 20:54 local time.

resource on some resource-rich economies. Such dependency has a permanent negative impact on the economy, even the psychology of the whole society; the industrial body was concentrated around extractive activities. Most of public investments were oriented to develop this industry, participating in somehow discriminative preferential behaviours. The other sectors were administered by the private operators, who look for their own profits (by establishing export-

Figure 4.8: The Algerian Triple Helix Model

Source: Author own conception.

import enterprises). Further, rent seeking mentality overshadowed the economic reality of the country, where projects with huge financial values were attributed to incompetent businessmen, by bribing some officials, or access to political activity.

Continuing dependency on hydrocarbons did not harm the economic environment only. further, it has an equivalent impact on the educational system including higher education quality; this can be understood when we relate creation of political lobbying who want to exclude competent members to access high political positions within the government, since their strict interests will be under risk (Robinson, Torvik, and Verdier 2006).

Therefore, higher education's role in Algeria was reduced to produce calculate number of graduates with less competencies that are required in the labour market. Furthermore, these organisations are still be controlled by the authorities and their legislative statute defines them as public entities which are created to respond to government policies.

The above explanations, hence, give us a fruitful ground to conceptualise a specific model that relies the university, industry and government ecologies in Algeria as shown in figure 8. This figure considers the traditional triple helix model described by Etzkowitz and Leydesdorff; however, it conceptualises the existence of fourth model out of those presented in chapter 2. In

this model, the government still surround and control academic institutions, which are subordinate part of the state. Moreover, the government has an organising mission, and is anticipated to take the lead in initiating plans and offering the resources; therefore, a parental system in practiced on the academic milieu (i.e. academia is seen to be institutionally weak spheres and require strong guidance). The industrial sector, in this conception is independent from government regulations, since the government does not need them, as it is financially dependent due to hydrocarbons revenues. That is to say weak control, even no control, is practiced on enterprises and their activities. On the other hand, industrial sector do not communicate with universities, as the principle aim is to get their part from the rent (generally they do not pay their taxes, or they favourite fraud, made easy by the spread of corruption). Industrials further do not consider to improve their practice by innovative ways since their profits are guaranteed by market ambiguities and policy instability due to violation of hydrocarbons prices. In some few words, university-industry-government interaction in Algeria is so weak and considerably limited. The next chapter, as a complement to the present one, deals with possible factors that hinder the development of profitable partnership among the up-sited actors

CHAPTER IV

Questionnaire Analysis

Introduction:

The figure 4.8 of the previous chapter suggests the presence of a very limited contact, if not to say a lack of collaborative partnership between the university, industry, and government. This situation, as the study has suggested, is due to the dependence on the natural resources sector, with all accompanying negative behaviors regarding the economic, political and even behavioral aspects of the society as a whole. The parental regime practiced since independence has aggravated the natural growth of a society that has become accustomed to direct government assistance in the form of subsidies for goods of widespread consumption, free education as well as healthcare. Hence, individuals are used to be undisciplined in performing business and economic activities. The inability of the industrial sector in respond the increasing national demand, since the 1980s, explains the weak investment. The black decade of the 1990s has disconnected the country from the rest of the world due to political and security instability. The uncertainty, and lack of clarity about promising future for the country, contributed to stimulate the migration movement of intellectuals, who faced the fear of killing or marginalization. This led to deepening the gap already existed between the authorities and intellectuals; hence, the emergence of an almost a total break between higher education and the authorities, which negatively affects the performance of scientific production, and innovation capacity.

The present chapter, in completing and responding to remarks presented in chapter 4, tries to study in deep the possible factors that hinder the creation of a permanent partnership between the university, industry, and government. The analysis is based on questionnaire survey we had distributed among academic milieu (lecturers-researchers), industrialists and government public servants. The chapter is built around 4 sections: First, a brief description of Algerian innovation situation as described by international specialized reports; these reports, in our best knowledge documents a weak collaboration between university-industry ecologies, as we have presented above. In this section, we rely on secondary data published by specialized international non-government organizations, such as   the World Economic Forum, namely in the annual report on the Global Competitiveness Index, and the World Intellectual Property Organisation, in its annual Global Innovation Index report. In a second section, a statistical study of the survey will be performed to justify the reliability of the results and their robustness in dealing with the research aims. This section, therefore, is based on primary data that are generated from the questionnaire. The third section discusses the main findings and tries to deduce results convenient with the thesis hypothesizes about the factors hindering or enhancing the development of U-I-G relationship in Algeria. In the last section, a conclusion is made by referring to the obtained findings, which will

summarise the most important points related the thesis study, and recommendation will focus on future researches on the subject in Algeria.

i-   ***The Algerian Innovation Capacity in View of International Reports:***

Considering the ranking of the Global Innovation Index, published by the World Intellectual Property Organisation, none of the North African economies appear to be innovative in 2017 (WIPO 2017). The in-depth study of Algeria ranks the country with the last quarter (apparently in all published reports), regrouping countries with lower attitude toward innovation. Indeed, the 2017 report classifies Algeria in the 108th place, out of 127 studied economies, that of 2015 was 126 out of 141 countries. The institutional rubric, which describes formal institutions under the institutional theory, consists of two ideas, political environment within which authority bodies work and legislative environment wherein regulations are conceived, produced and executed. The overall institutional ranking represents a weakening environment with no tendency to an amelioration; indeed, Algerian institutions keep almost the last 24th position in 2013, 2015 and 2017, with a decline in government effectiveness and rule of law. This position reflects the political opacity, in particular, the instability in the composition of the executive authority and the conflicting programs of successive governments. Human capital and research heading are intuitive enough to summarise the tertiary education. Obviously, except R&D index, all remaining sub-indexes are under 100th place. An initial superficial look concludes that higher education performs well (or relatively is better at international standard); indeed, human capital and research index registers an amelioration in terms of ranking from 133th in 2013 to 86th in 2017. That is to say, Algeria is in half way to excellence in the creation and formation of human capital if considering the number of students enrolled at universities, which exceed 1.5 million in 2017, according to the Higher Education Ministry (we observe a jump in this sub index from 79th to 70th place between 2013-2017). During the same period, there is an increase in the number of available researchers, too. Unfortunately, the human capital index is a misleading proxy and is reflecting a relatively contrary situation to what is really exist in practice. The available data on enrolled students never mean that higher education is in good position. In the contrary, the free entrance to university guaranteed this wave. Further, universities, as we have demonstrated in the previous chapter, became a place of delaying unemployment for a considerable part of the population. On the other hand, R&D activities give a closer picture of the reality, as we record a

decline in the capacity of the country in these activities in a very sensitive manner (a loss of 25 places from 2013 to 2017).

Table 5-1: Algeria's Innovation Ranking (some selected indexes)

	2017 (Out of 127)	2015 (Out of 141)	2013 (Out of 142)
Overall Ranking	**108**	**126**	**138**
a- Institutions	*103*	*120*	*118*
Political environment	108	120	127
Political stability and absence of violence/terrorism	111	123	129
Government effectiveness	95	106	113
Regulatory environment	106	108	101
Regulatory quality	125	135	113
Rule of law	112	105	136
b- Human Capital and Research	*86*	*82*	*133*
Tertiary education	63	69	94
Tertiary enrolment	70	75	79
Tertiary level inbound mobility	88	91	24
Research and development (R&D)	115	115	91
Researchers	n/a	71	90
Global R&D companies, average expenditure	43	73	70
QS university ranking average score universities	75	95	100
c- Business Sophistication	*119*	*118*	*113*
Innovation linkages	111	129	n/a
University/industry research collaboration	108	102	n/a
Joint venture/strategic alliance deals	107	103	135
Patent families filed in at least two offices	101	132	136
High-tech imports	25	118	75
Research talent in business enterprise	n/a	113	90

Source: the author, using the data from WIPO; retrieved from https://www.globalinnovationindex.org/analysis-economy

Under business sophistication index, three sub-references are of great interests: innovation linkage; research collaboration and high-tech trade. Linkages in the domain of innovation are weak due to the institutional ambiguity that draws clear frameworks about the national view of innovation; therefore, we expect fragile activities of R&D, as reported in the previous paragraph. The innovation linkages register a continuous draw back, falling from 113th place in 2013 to 118th in 2015 and down to 119th degree in 2017. As well, since innovation activities result from a partnership among various actors, looking of university-industry cooperation represents a good alternative to justify the weakening innovation linkages. However, this proxy, too, registers results similar to those published by the World Economic Forum, in the Global Competitiveness Report

as it will be demonstrated below. In general, collaboration between the university and industry has become less important in view of economic and social actors. This can be grasped by the declining rate of 102 in 2015 to 108 in 2017. As an inevitable result, the country tends to increase its demand for high-tech products, while enterprises tend to import talented individual and experiences from abroad. We note that the current analysis is derived from data recorded in table 1 above.

As mentioned above, the results in Table 1 are comparable to the results published by other international organizations, especially the World Economic Forum. The similarities, mainly concern those above cited with more details. For example, the last report on Global Competitiveness Index (2017) classifies Algeria in the 87th position out of 138 included economies, which gives a constant amelioration since 2012 (110th place). However, Algeria still falls behind its neighboring economies of the Middle East and North Africa region; among 12 pillars in only two Algeria registers an advancement, which is: market size and macroeconomic environment; however, these two pillars will fall due to challenges that hit the country since the shrink of hydrocarbons price. In a similar manner to the innovation index, the overall competitiveness of the country shows a decrease compared to 2014. The in-depth examination of the index allows for the disclosure of important data that support those we have explained earlier, regarding the institutional aspect, the quality of higher education and research, and cooperation in the field of innovation. In terms of institutional weaknesses, Algeria is among lagging countries in this field. This may be due to the lack of transparency in making policies (127th/138 in 2017), which increases uncertainty for the private investors who feel unprotected (133). Further, the overall institutional frailty can be explained by the fragility in the general framework of property rights (117th), as well in the weak protection of intellectual property (108th). Higher education, even the moderate increase in the rate of access (78th), fails to create qualified human capital, especially if we consider the quality of programs in the fields of mathematics and science (99th) or the level of management schools (127th). Accordingly, this explains the weak capacity of the country to innovate (112th) which is further negatively affected by the quality of research institutions (99th), spending on R&D activities (113th) and the delicate connection between university-industry (120th). On the other hand, the weakness of the institutions, innovation capacity and the quality of education contribute directly in hindering doing business. Indeed, businessmen consider bureaucracy, policy instability, inadequate of educated workforce and insufficient capacity to innovation as most problematic factors that hamper the business activities in Algeria.

In addition to these results, many studies confirm the very limited partnership between the university and the local private sector (Zuabi 2012). That is to say, the university works separately

from their surroundings (Benouar 2013) and its graduates are said to be far to meet labor market prospects in what concern the quality of the graduate workforce. In a parallel stream, Djeflat (2015) insists on the role of institutions in the limited interaction between the university and the industrial sector in Maghreb Countries, and remarks that less than 5% of SMEs in the country have official contracts with local universities and training centers. The rest have either intermittent and discontinued relations based often on personal ties or no relations whatsoever.

Collaboration among the university, the industrial sector and the government in Algeria appears to be one among weak countries in this domain at regional, continental or international level. Indeed, the experience of some emerging countries in Asian, Eastern Europe, and South America, regardless of their limited available resources, raises series of questions about the status of this relation in Algeria. Despite the geographical characteristics of the country, the country still suffers from social and economic underdevelopment and witnesses a continuous depletion of its capabilities, especially intellectual ones[1]. The registered fiasco may the limited cooperation between the various innovative units as mentioned above. Hence, many questions have to be raised, while the most important consists on the understanding of the factors that led to the imped the creation of cooperation between university-industry-government. The remaining of the present chapter tries to bring some answers, and it constitutes the first academic attempt, in Algeria, to highlight the possible factors that help or hinder the development of triple helix model. This purpose will be addressed through a detailed analysis of a questionnaire distributed to actors in the concerned sectors. The survey will thus be described in detail and will be submited for statistical analyses where appropriate tests will be run in order to determine the ability of the questions to answer the most important hypotheses on which the research was based. Then, depending on the statistical significance obtained, the analysis section focuses on the possible connection between these statistical results and the theoretical aspect presented in the third and fourth chapters. Results, therefore, will be extracted in accordance with the main object of the present thesis. In last stance, summaries of main findings as well recommendations for further studies will be drawn.

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[1] through brain drain and migration of qualified intellectuals, in spite of attempts by the authorities to create a favourable environment to return back these competences and investment them locally; however, these attempts have failed

ii- *Analysis of Survey Results:*

In order to understand the factors that influence a cooperative collaboration between the university and the industrial sector in Algeria, a survey has been conducted in form of a questionnaire distributed among academics and industrialists. Data collected will submit various statistical analysis, both descriptive and inferential statistics, then hypothesis examination will follow. To do so, in what follow three steps are made: questionnaire description, tools used to analyse the questionnaire and the main results.

ii-a   *describing the questionnaire:*

The main purpose of the questionnaire is limited to identifying certain factors that we consider necessary for the development of university-industry collaboration, as presented in the literature review chapter and those exposed in the last chapter. These factors can be summarised into institutional dimension (formal and informal approaches), resource-based dimension, and innovation as a culture and economic development dimension. However, as the questionnaire is supposed to address different communities, we tried to draw questions that fit with respondents' occupation; yet, despite this difficulty, we succeeded in building common questions for both ecologies: academics and industrialists.

In order to reach a significant number of participants, we used Google Forms application, which is freely supplied by Google Company. This tool helps to create fast and efficient questionnaire.it guarantees an instant diffusion of the survey to a wider community and insures rapid answers[1]. The tool allows accessing random samples and thus raising the chance of collecting representative answers. In addition, we relied on our own professional and personal ties in the distribution of the questionnaires thought social media. We relied, too, on El Mouchir directory from the Algerian Chamber of Commerce and Industry that is published on the official web site[2]. The directory is an address book of Algerian companies in the industry, commerce and services sectors developed by the Algerian Chamber of Commerce and Industry. The companies are taken over and distributed in nearly 700 activities and account more than 20900 enterprises.

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[1] The web link for both questionnaires is as follow:

for academics is https://goo.gl/forms/B5AI2s5Xikhs6PAr1.

For industrialists is https://goo.gl/forms/s6zeMH4FzYT9YIHr2

[2] http://elmouchir.caci.dz/index.php

Further, to be accessed by a wider number of the community for both ecologies, we used Arabic language in the drawing of and distribution of the questionnaires. Simultaneously, we built an English version to be included in the study.

The questionnaire designed for academics contains four chapters. The first comprises nine questions covering the academic degree, geographical location of the home university, specialty, administrative tasks and their nature, belonging to a research laboratory, the implication in research projects. The second chapter focuses mainly on collaboration in scientific productions by asking three simple questions: self-production, collaboration with other lecturers, or with other researchers from other sectors. Chapter three, most important one, asks in depth questions that we believe influence the cooperation by proposing fourteen possibilities to be classified according to the degree of agreeing. The last chapter gives the opportunity to respondents to list motivations for conducting collaborative activities with other sectors.

In parallel, the questionnaire designed for industrialists contains three sections. Section one permits to specify the nature, domain of activity of the organisation in which the respondent work; further, it gives them to determine their job according to the educational level. Section two consists of providing information about R&D activities inside or outside the organisation and gives first look at collaboration status. The third section deals with fifteen possible factors that hinder the establishment of bilateral partnership; these factors are classified according to agreeing, from zero to full agreement. The last section consists of classifying motivations according to their importance for respondents.

For nearly six months since the diffusion of the questionnaires on the web, we received answers from both communities. In total, we account 141 replies, among them 100 were filled by academics. However, we proceeded to filter the responses where we dropped 17 cases. The deleting process bases on the completion criterion and results by removing 12 cases from 100 filled by academics, while 5 cases are dropped from 41 replies of industrialists. The analysis will then use the remaining cases of 124 responses. This number is fully acceptable and highly significant to perform statistical analysis, for both descriptive method and inferential approach. Performing descriptive analysis is worth enough to demonstrate psychometric aspects of the respondents and summarises information about the data; the inferential examination helps in making conclusions to be generalised to a wider range of the concerned population. These two steps pf analysis are the material of the second point.

ii-b The Questionnaire Statistical Analysis:

This section will discuss some of the necessary elements for the questionnaire, in terms of population and sample, as well as determining the variables on which the general model was determined.

The population of the study was determined based on those having a direct link related to scientific research and innovation, whether in the public or private sector, regardless of practiced activity: whether industrial, commercial, service or manufacturing. Accordingly, we identified two main samples where we can easily communicate with them and collect needed information; however, these samples are randomly chosen in terms of targeting each sample. By these samples, we refer to academics and industrialists within the country. This means that the study aims to gather the sample's view on what could be, or what respondents can tell, according to the function and the position they are practicing.

Further, questionnaire's variables consist of a set of independent variables and one dependent variable, as it is indicated by the main question of the research. Independent variables are summarised under institutional aspect (Intellectual property framework, lack of specialised organisations, absence of national innovation view) innovation importance (lack of R&D department in enterprises, corporation are not aware of the importance of innovation), social capital (lack of communication between actors, absence of trust) and economic structure (weak industrial body and undiversified economy, and financial independency). Dependent variable focuses on the development of collaboration between actors (number of the cooperative program during the last 3years or looking for consultancy). Therefore, the model testifies if the development of collaboration between university-industry-government is influenced by the institutional framework (a formal and informal aspect of institution) and economic structure. All steps of study will be performed using SPSS software, due to its robustness and reputability in survey analysis.

One further clarification concerns the way we conduct the analysis since the targeted samples differ in their nature and field of activity. Thus, we analyse each questionnaire separately, then we perform an analysis of a unified questionnaire, by targeting common issues from both questionnaires, regarding the hindering factors and motivations. In first lieu, statistical analysis will be performed for academic respondents; then, a similar procedure will be done for the second questionnaire. In the last step, the analysis focuses on shared questions between the samples. These steps, we believe, help us in understanding how each sample, separately, responds to the questions, then how they behave as a whole vis-à-vis the proposed factors.

  a- University-Industry Collaboration: an Academic Point of View:

The questionnaire starts by asking the academic rang of respondents by giving three possibilities: associate professor, assistant professor and professor. The results show that most of respondents are associate professors, by 56.2% of the sample, while professors present roughly 8% of the total respondents; the frequency of assistant professors is 32 cases, about one third of the sample.

Table 5-2: What is your Occupation at Higher Education

	Frequency	Percent	Valid Percent	Cumulative Percent
Professor	7	7.9	7.9	7.9
Associate professor	50	56.2	56.2	64.0
Assistant professor	32	36.0	36.0	100.0
Total	89	100.0	100.0	

Source: questionnaire outputs

This distribution of respondents is worth enough; it gives analysis and results further robustness, since associate professors tend to be active in doing researches, as they still need further efforts to ameliorate their academic career. Assistant professors are confronted by preparing their doctorate thesis. Therefore, the contribution to research activities is inferior to the associate professors. Professors reach the highest grade and tend to limit their activities around supervising young doctors.

In addition, the respondents' geographic zones are divided into five groups, and are distributed as follow:

-   Respondents from the same university with 6 to 9 responses: this group includes Mostaganem and Annaba universities. However, respondents from my home university were the most active vis-à-vis the questionnaire; this sound logic due to active social network we have at the university. This group present about 17% of the sample, with 15 replies.

-   University with 4 respondents: the group encompasses university of Setif 2, Chlef, and USTA. With 12 replies, the group occupies 13.5% of the sample.

-   University with 3 responses: each university present 3.4% of the sample and includes Skikda, Ouergla, Kmiss Meliana, Bloda1, Saida, Adrar and Oran2.

-   With two respondents each, the university in this group occupy 2% of the sample. The group is composed from the universities of: Jijel, El-Oued, Souk-Ahrass, Setif 1, Bouira, Media, Bechar, Mascara, Tlemcen, and Tiaret.

- The last group contains universities from which we received only one response and represent roughly 1% of the sample. The group contains 20 universities and university centres.

the questionnaire received a positive reaction from the academics milieu and was received in 43 universities and university centres throughout the country. Indeed, among 53 universities and university centres that the ministry account, respondents belong to 43 different universities and university centres. This is a second positive point for the questionnaire that increases the confidence about the results we will extract. We stress on the fact that this geographic distribution of belonging is completely random, since we distributed the questionnaire online.

Figure 5-1: To Which University you Belong
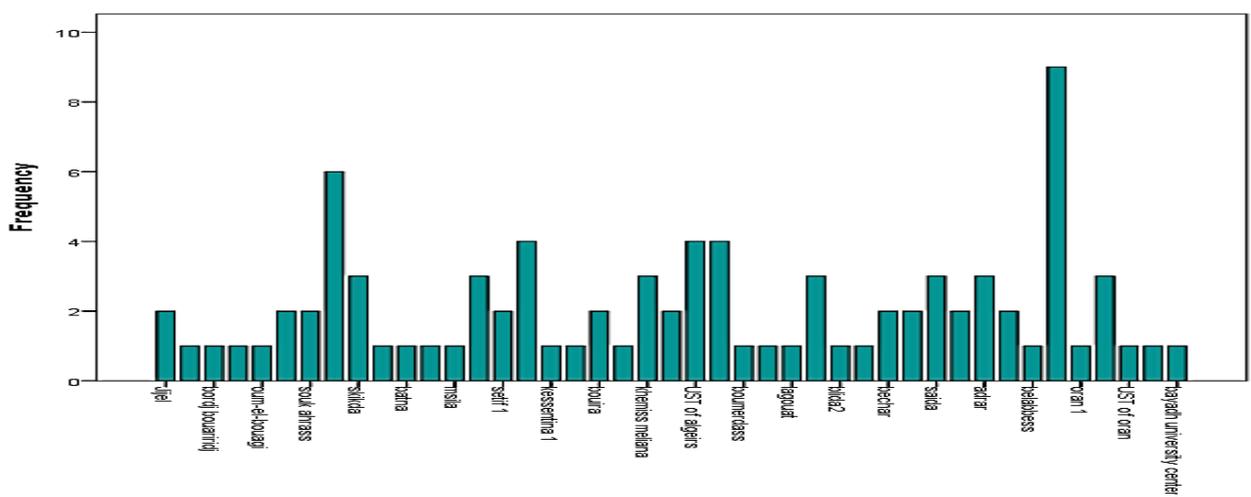
Source: questionnaire outputs

After knowing the position and the location of respondent, we want to know if s/he occupies and administrative task. These tasks allow them to be informed about any activity within their institutions, at least within their faculty. Most of respondents (78, 7%) appear to have not such tasks. The remaining (23. %) are either vice dean (1 observation), department head (3 observations), vice department head (7 observations) and 8 respondents prefer not to identify their task. Further, most of those having administrative tasks are associate professors (9 cases), professors (3 cases) are either leader of a doctoral project, chair the scientific council or committee, president of a university or a vice-rector; while most of assistant professors are vice-department head (4 respondents). However, what these results reveal is so meaningful. Having no administrative functions liberates a considerable time for researchers, which may be invested in

conducting researches, unless they are belonging to a research laboratory or are actually engaged in research projects. These two concerns have been addressed to the sample whose responses give the following outputs.

Table 5-3: Laboratory and research project belonging

	Do you Belong to a Research Laboratory		Are (were) you a Member of a Research Project	
	Frequency	*Percent*	*Frequency*	*Percent*
No	27	30.3	23	25.8
Yes	62	69.7	66	74.2
Total	89	100.0	89	100.0

Source: questionnaire outputs

Although most of lecturers of different rang belong to laboratories and are (were) involved in doing research, approximately one third of our sample neither they belong to laboratory, nor they conduct research. That is to say, 15000 to 20000 lecturers are teachers[1]. Further, among 66 who said having implied in research, 53 lecturers are (were) members of CNEPRU, approximately 80% of the sample, while 11 were members of PNR. The others did not reveal their membership. The tendency to choose CNEPRU projects relies on the following reasons:

- They are the most known type among researchers' community;
- annually opened by the ministry;
- The oldest type of research projects insured by the ministry[2].

However, these research projects are not "effective research projects" in the proper term of the world. Some lecturers consider them as a supplementary revenue given to researchers. Indeed, the financial recompense of the researcher is carried out through an annual report summarizing scientific activities, often limited to a communication or an article. Therefore, this recompense is annually paid and is subject to insurance and social security deductions; the researcher receives 70000 to 120000 Dinar[3] according to his/her research grade.

Yet, for PNR projects, this type was a temporary solution for absorbing pressures that occurred in the Algerian universities at that period, in addition to its inclusion as an important element in

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[1] Considering that, the number of university lecturers in 2017 is about 60000.

[2] Since 1989; see the official bulletin if the ministry of higher education of 1989, 1st semester vis the link: https://www.mesrs.dz/chapitre-1.   or   the   direct   link   for   the   document   on: https://services.mesrs.dz/DEJA/fichiers_sommaire_des_textes/23%20FR.PDF

[3] Using black market exchange rate of 190 DZ for 1 Euro, the amount is about 300 to 600 Euro only.

the five-year program to support economic growth during the 2009-2014. At national level, 5200 projects had been submitted in 2010 and only 2842 among them were definitively admitted in 2011

Figure 5-2: Lecturers' Membership in Research Projects.
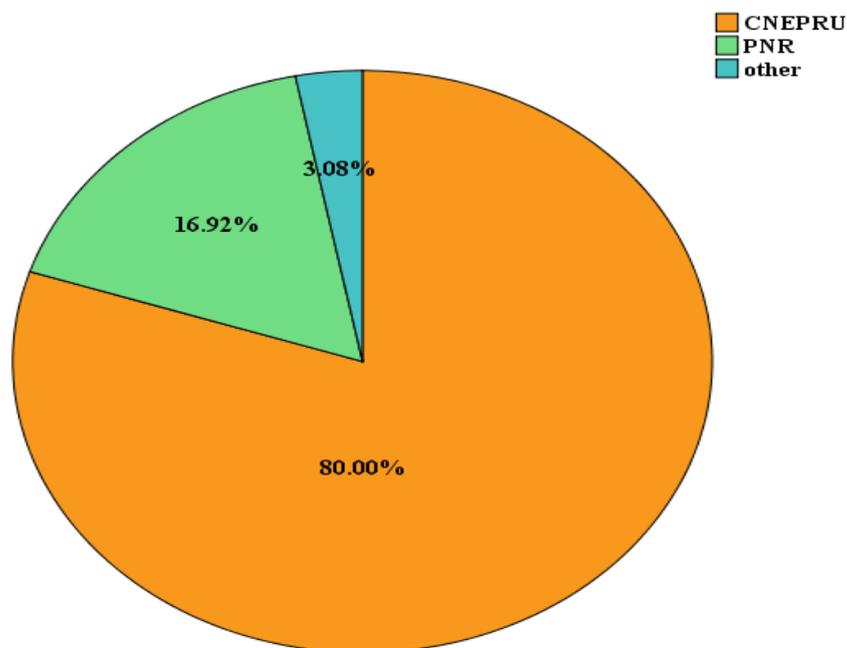
Source: questionnaire outputs

After two years, 2732 projects were evaluated and result by rejecting 235 projects by 2013. However, most of project promoters considered that their contribution was theoretical and did not contribute to ameliorate the socioeconomic situation of the country. The result retained only 312 projects carried out in multi-sectoral perspective with a possible effective impact on socioeconomic dimensions[1]. This showing believes that researchers, as well universities, are far away from engaging in a third mission that international universities undergo; that is to say, higher education institutes, as well as the ministry in charge, are still living in the Ivory Tower era. In this case, universities stay outside its surrounding and behave like deaf and blind man. Its presence is therefore classified to be passive, even negative. In such a case, the innovative capacity of this

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[1] Data are from the DGRSDT web link: http://www.dgrsdt.dz/Fr/?fc=PSE. Accessed on 04/09/2017 at 08:00 local time.

organization is reduced to the level of negligence, while the role within the innovation system is much more limited or unfortunate.

The first seven questions of the questionnaire give us a general look at the distributional level of respondents around the country, their academic background and occupation. However, they clearly draw up a preliminary image on the cooperative efforts done by lecturers-researchers team. For further insights, the questionnaire investigates whether respondents have coauthor in their scientific activities and how this partnership is distributed among fellows from different sectors. The following questions constitute a background to testify the level of cooperation between the university and the outside environment, namely the industrial sector; in addition, it allows us to understand the preferred destination for academic to do their scientific activities.

Asking them whether or not co-authorship with colleagues (communication or article), all respondents selected the positive answer and argue they have co-authorship with other colleagues. Regardless of degree they hold, academics tend to involve other associates from the same milieu in performing their researches. Such behavior allows for the exchange and development of ideas among the participating authors, as well the improvement of their scientific level. For authorship distribution, we gave them four possibilities as shown in the table 5-3.

According to the outputs, most of academics prefer collaborate with colleagues form the same faculty they work. The instant availability and the geographical closeness of co-authors are the

Table 5-4: Academics Co-Authorship.

	Same Faculty of my University		*Colleagues from other Faculties of my University*		*Colleagues from other National Universities*		*Colleagues from Foreign Universities*	
	Frequency	Percent	Frequency	Percent	Frequency	Percent	Frequency	Percent
No	20	22,5	85	95,5	33	37,1	73	82,0
Yes	69	77,5	4	4,5	56	62,9	16	18,0
Total	89	100,0	89	100,0	89	100,0	89	100,0

Source : questionnaire outputs.

prime criteria of the cooperation selection process. Researchers from the same body knew each other well enough to engage in a similar work that improve their career; this is why 77.5% of the sample agree on this option. Neighbouring colleagues from other faculties of home university are less preferred as associate in scientific activities considering that 95.5% of the sample denies having such co-authorship. The proximity of the associate is further based on scientific background rather than geographic criterion. The underlying meaning is that academic research in Algeria does

not have a multidisciplinary aspect or intradisciplinary collaboration. Indeed, even among disciplines with apparent link, such as economics and sociology; economics and psychology; physics and medicine, few are the articles that combine different approaches. That is to say, knowledge production of the Algerian universities is at lowest level due to the absence of multidisciplinary understanding of the research. We believe this is due to the lack of scientific background on the interdependence between various scientific disciplines, and this result from the lack of prerequisite knowledge about the history of sciences, a material completely absents from the education curriculum. On the other hand, colleagues from other national universities appear as a second-best preference for co-authorship of academics; among 89 cases, 63% of them affirm having co-author(s) from outside the home university. However, we believe according to the previous analysis that the associates are of the same disciplines. Finally, less than one-fifth (1/5) of the sample has scientific activities with associate outside the country. Those who said having foreign co-author(s) are either implied in cooperative research programs under the supervision of the ministry, doctorate students benefited from scholarships or co-authors are Algerian academics working abroad; further, co-authorship tend to be French-oriented preference due to various criteria. Thus, it is clear that there is an increasing fear of conducting research whenever the co-author is far away, especially if he belongs to a different scientific discipline, and academics lean to create narrow network, as will be discussed later.

The outputs suggest that all respondents of professor rang affirm the co-authorship with colleagues of the same faculty; this is normal since most of them supervise assistant professors who are preparing their doctorate thesis; further, they (associate professors too) tend to participate in collaborative works with foreigner researchers in comparison to assistant professors who deny completely such association.

The tendency of academics to establish connection with fellows of different sectors in terms of scientific production has given unlike results of the previous one. The results show a feeble association between academics and participants from other sectors. For both, industrial and governmental sector, there is a quasi-absence of cooperation between interested parties, with roughly 98% of the sample denies the existence of participation in the completion of researches with parties from the industrial sector or other economic institutions; this result documents the similar findings of international reports, as mentioned above. Of the 86 responses, 87 cases did not share their articles with members of the industrial sector; while 88 of the total responses deny the preparation of scientific activities with parties from public administrations. The case is reduced with permanent researchers. Despite the domination of the negative answers, which represent

79.8% of the sample, some academics (20% of the sample) prepare articles with colleagues from different research institutes. These double outputs have two different comprehensions. First, we recognize the lack and weakness of cooperation between

Table 5-5: Academics' Collaboration Outside Universities

	Industrial Sector		*Governmental Sector (Excluding Universities)*		*Permanent Researchers from National Research Institutes*	
	Frequency	*Percent*	*Frequency*	*Percent*	*Frequency*	*Percent*
No	87	97,8	88	98,9	71	79,8
Yes	2	2,2	1	1,1	18	20,2
Total	89	100,0	89	100,0	89	100,0

Source : questionnaire outputs.

universities and other research institutes in Algeria, which is the same conclusion reached by Benouar (2013) and Ghalamallah (2006) who raises the problem of interconnection between universities and other research institutions of the same ministry. Combining this result with the previous one about academic co-authorship, the questionnaire identifies a very limited activity of cooperation by academics who prefer collaborate with closer colleagues. The concept of proximity is delicate in this regards since academics refer, when using the term, to discipline belonging, while this belonging is more closely related to geographical proximity. Second, academics understanding of the proximity are further conditioned by the nature of conducted activities. Indeed, among the three proposals, we noticed that academics have actual (relative) cooperation with researchers from national research institutes, and this compared with the industrial sector or other economic entities within the country. We believe that the existing cooperation between academics and researchers focuses on researches of the same scientific discipline.

The evident result of the data is the low level of cooperation between the university and the different actors within the environment. Respondents' reaction on direct questions about university-industry linkage and university-government cooperation has been affirmative to the near-absence of such connectedness. This absence seems to be almost total with government units, with 94.4% of respondents believe there is no relationship between the university and the governmental entities in Algeria. For the existence of liaison between the university and the industrial sector, 85.4% of the sample believe in it presence.

The first two parts of the questionnaire sum up the low level of collaboration between university-industry-government in Algeria, as well as the feeble desire in conducting scientific activities. It, therefore, constitutes a background for arising enquiries about the factors that led to this case. The third part addresses the issues by asking academics to classify a set of possible factors according

to their level of agreeing, from strongly disagreeing to strongly agreeing. In this section, inferential analysis will be performed in order to verify the ability of the questions to answer the research hypothesis.

Before proceeding, it is worthy to notice that statistical analysis of this section will use non-parametric approach. This is due to the approach's appropriateness to questionnaire analysis. Many scholars and specialists (Bordens and Abbott 2014, Stefanowski 2013) suggest the use of non-parametric method when analyzing questionnaires. In addition, the data in this section are of ordinal scale that supports the use of the up-cited method. Finally, as we will see later, our data do not follow a normal distribution, which obliges the use of the non-parametric test during the analysis process.

As mentioned in the presentation of the questionnaire, independents variables are reduced to four categories as shown in the following tables.

Table 5-6 Distribution of Questions to Main Axes.

Institutional Axis	- Weak institutional body. - No clear regulation about IP. - Regulations impose some restrictions. - Insufficient of specialised organizations.	Refers to Institutional Theory
Innovation Axis	- Absence of R&D department in most enterprises. - Industrial sector denies the importance of innovation. - Absence of national view about innovation. - Firm's size.	Refers to Innovation and Resource-Based approaches
Social Capital Axis	- Absence of trust. - Actors do not communication with each other.	Refers to Social Capital theory
Economic Structure Axis	- Weak industrial body and undiversified economy. - weak and non-competitive local enterprises - Universities are financing independent. - Weak private sector.	Refers to Resource Curse diagnostic

Source: the author.

Institutional aspects include questions on intellectual property framework, lack of specialised organisations, absence of innovation view, and are based on institutional theory. Innovation importance, encompassing lack of R&D department, the importance of innovation, refers to innovation and RBV approaches. Social Capital, by looking for communication between actors and trustiness, uses recommendations of social capital theory. The economic structure, which raises questions about the industrial and financial independency, tries to capture the influence of resource curse on the state of knowledge and innovation. However, before carrying on the analysis, it is useful to verify the validity and reliability of the expressions as well of axis. This gives us confidence on the data credibility when generalizing results on the population. The outputs are summarized as follow:

Table 5-7: The Reliability Test

	Number of expressions	Reliability 'Cronbach's alpha'	Validity 'squared root of Cronbach's alpha'
Institutional aspects	4	0,63	0.793
Innovation aspects	4	0,63	0.793
Economic structures	4	0,62	0.787
Social capital	2	0,65	0.806
Total	**14**	**0.634**	**0.796**

Source: the author calculations

The results indicate that there is a high level of validity on all expressions of the section; the squared root of about 80% is statistically sufficient to conclude that the questionnaire measures and determines what the study wishes to reach, since the validity means obtaining of data that can be analysed, and from which results are reliable and objective. The same is valid for each axis where the level reaches 79, 5% for institutional and innovation axis; 79% for economic structure and near 81% for social capital axis. In the same vein, stability means the degree of stability of the obtained results if the questionnaire is redistributed to the same sample with the same conditions. Such stability is very important for analyzing, interpreting and the adopting of the results. The Cronbach's alpha is widely used in statistics to determine the extent of stability. Thus, the more the alpha is great, the more stable is the questionnaire. In our case, Cronbach's alpha is more than 63%, which is statistically acceptable to say that the reliability level of the questionnaire is high at

a level of obtaining results of considerable significance. The reliability is further acceptable for each axis, with more significance for social capital (65%).

The second step in the analysis process is to check for normality distribution of the data. This process determines which type of analysis approach to use. If the data are normally distributed, parametric tests are conducted; while, if this condition is violated, non-parametric tests are suggested. To do so, we are supposed to hypothesis that our data come from normally distributed population, if not we conclude the non-normal distribution of the population. This give us two main hypotheses as follow:

H_0: the sample population is normally distributed (claim);

H_1: the sample population is not normally distributed.

There are different ways to verify normality distribution including Kolmogorov-Smirnov test, the level of skewness and kurtosis and the graphical visualisation. For our data, results for the Kolmogorov-Smirnov test (p>0.05) and the visual inspection of the histogram show that our data are not normally distributed (D=0.112, p=0.007) with a skewness of -0.625 (SE= 0.255) and kurtosis of 0.599 (SE=0506).

Table 5-8 : Tests of Normality

	Skewness	Kurtosis	Kolmogorov-Smirnov			Shapiro-Wilk		
			Statistic	df	Sig.	Statistic	df	Sig.
Mean Academia	-,625	,599	,112	89	,007	,961	89	,009
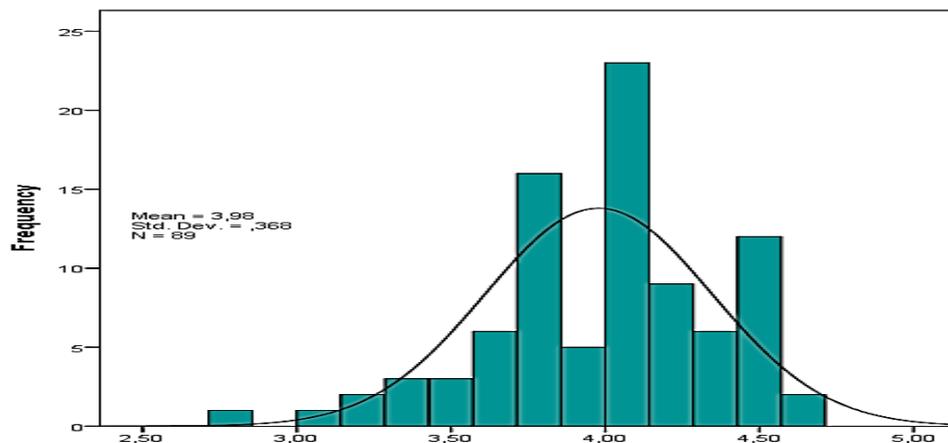
Consequently, we are confident that parametric analysis can bring missleading results, since we are unsing ordinal data wich are not normally distributed. Thus in what follow, the process uses the non-

parametric method in condusting appropriate tests such as Kolmogorov-smirnov test, Mann-whitney U test or Qui-squared test.

At this stage, the analysis will focuse on the academics reaction to the proposed factors which can have direct impact on the development (positive or negative) of partnership between the university and its surroundings, mainly the industrial sector and different governmental bodies within Algeria. Tracking data revales the following results.

For the first axis on institutional impact, most of respondents are either agree or strongly agree that the weakness of the institutional framework has direct effect on the development of U-I collaboration. Indeed, about 58.4% of academics are firmly agree on the passive role played by formal institutions in the promotion of collaboration between local active actors. Their view is more supported by the insufficiency of specialised organisms that advertise, enhance and accompany prominent programs. Generally, there is a consensus that institutional weakness adversely affects the development of cooperation among different actors, as will be argued later in the results discussion section. Further, the table below summarises the academics' behaviours vis-à-vis institutional aspects.

Table 5-9: Academics Reaction to Institutional Axis.

	strongly disagree		disagree		neutral		agree		strongly agree		Mean	Standard Deviation	General trend
	frequency	%	frequency	%	frequency	%	frequency	%	frequency	%			
weak institutional body	0	0	3	3.4	15	15.7	52	58.4	20	22.5	4	0.72	Agree
no clear IP regulation	2	2.2	11	12.4	32	36.0	36	40.4	8	9.0	3.41	0.9	Agree
regulations restrictions	3	3.4	11	12.4	18	20.2	34	38.2	23	25.8	3.7	1.08	Agree
insufficient of specialised organizations	0	0	1	1.1	14	15.7	36	40.4	38	42.7	4.24	0.75	Strongly Agree
General trend	**5**	**1.4**	**26**	**7.28**	**79**	**22.1**	**158**	**44.3**	**89**	**24.9**	**3.84**	**0.5**	**Agree**

Source: Author's calculations using the questionnaire data.

The reaction of academics on the innovation aspects goes in similar stream to the previous aspects. While they are strongly agreed on the absence of national innovation horizon, (61.8%), they stress on the fact of denying the prominent role of innovation by most local enterprises, in this regard, they strongly agree (52,8%) on this fact and remark that national enterprises are not aware about the importance of innovation in terms of growth and revenue generation. Corporations do not attach particular importance to the role of innovation, which is widely depicted by the absence of R&D departments. This fact is a third stance where academics strongly agreed on (49.4% of total respondents). On the other hand, academics agree on the role of firm's size, while this effect is of limited impact on the enhancement of innovation within enterprises. Only 13.5% of the sample considers the positive impact of the size, while most of them (34.8%) prefer not to react to the question. In general, the overall orientation of the respondents tends to agree in considering that innovation is not valued as a chief factor within enterprises as either inputs or outputs that cannot be overlooked. The following table recapitulates main trends of academics about the second axis.

Table 5-10: Academics' Behaviours about Innovation Factor.

	strongly disagree		disagree		neutral		agree		strongly agree		Mean	Standard Deviation	General trend
	frequency	%	frequency	%	frequency	%	frequency	%	frequency	%			
absence of innovation view	0	0	1	1.1	4	4.5	29	32.6	55	61.8	4.55	0.63	Strongly Agree
industrial sector denies the importance of innovation	0	0	2	2.2	5	5.6	35	39.3	47	52.8	4.42	0.7	Strongly Agree
absence of R&D department	0	0	4	4.5	12	13.5	29	32.6	44	49.4	4.26	0.86	Strongly Agree
firm's size	4	4.5	17	19.1	31	34.8	25	28.1	12	13.5	3.26	1.06	Agree
General trend	**4**	**1.1**	**24**	**6.74**	**52**	**14.6**	118 **33.6**		158 **44.4**		**4.12**	**0.5**	**Agree**

Source: Author calculation using the questionnaire data

On the third axis, designed to verify the impact of economic structure in the conduct of cooperation between actors, academics point of view tends generally to agreeing such influence. About 42% of the total estimated responses agree that Algerian economic structure, past and present conduct, affect in somehow the establishment of beneficial relationship between actors. Additional 24.4% of responses strongly admit the link between economic structure and the existence of cooperative network. The agreement is well observed with the first expression about economic diversity and industrial presence. In this regard, about two third of the sample endorse the view that weak industrial sector is at the origin of weak cooperation between the university and the industrial sector; further, the reliance on few sources limits the occasion of setting up a convergent policy between different parties, in order to promote the desired economic sustainability. In addition, more than 50% of academics five years program either are agree or strongly agree that private sector does not play a remarkable role in the local economic life. Table 5-10 shows that 37 academics, out of 89, the primitive status of private sector characterised by traditional activities of commerce, defines its relation with the surrounding environment. The industrial ecosystem in Algeria lacks organisation and orientation to be able to participate in the generation of job and diminishing of imports. Table 5-10 below depicts the distribution of academics' responses regarding the impact of economic structure.

Table 5-11: Academics Behaviours to the Impact of Economic Structure

	strongly disagree		disagree		neutral		agree		strongly agree		Mean	Standard Deviation	General trend
	frequency	%	frequency	%	frequency	%	frequency	%	frequency	%			
undiversified economy	0	0	6	6.7	24	27.0	46	<u>51.7</u>	13	14.6	3.74	0.79	Agree
Weak private sector	3	3.4	14	15.7	24	27.0	37	41.6	11	12.4	3.43	1.01	Agree
Non competitive enterprises	1	1.1	5	5.6	22	24.7	40	44.9	21	23.6	3.84	0.89	Agree
universities are financially independent	2	2.2	6	6.7	12	13.5	27	30.3	42	47.2	4.13	1.03	Agree

General trend	6	1.7	31	8.71	82	23.0	150	42.1	87	24.4	3.78	0.58	Agree

Source: Author calculation using the questionnaire data.

Finally, we record a strong agreement of academics it what concern social capital dimension. In this rubric, 96 of estimated responses (about 53.9%) demonstrate strong responsiveness to social capital components. A specific focus was put on the lack of communication among actors, while 67.4% of the sample strongly agrees about the role of communication in facilitating the formation and the development of cooperation among actors within the innovation ecosystem in Algeria. The lack of communication does not permit the creation of attempts that help to understand the authenticity of each party, which in turn allows providing a comprehensive overview of the needs and requirements of involved parties. In this case, firms do not expose their requirement that graduates must acquire. Universities, on the other hand, are incapable to offer typical graduate, which fit labor market conditions. In addition, both, industrial sector and universities cannot conceptualize public need and will not able to direct their resource to satisfy society's need. Since each party acts in isolation, the Government will not be able to determine the level or location, as well the nature of infrastructures and resources to be provided. This case is further similar to laissez-faire model of the triple helix where each actor denies the role of cooperation in the promotion of its status and less profit will be generated. In addition, academics refer the low level of cooperation to the lack of trust between actors. As mentioned in chapter 3, trust constitutes a key variable in the settlement of social capital among groups. Trusting others facilitates the easy conduct of activities, while it generates current of future benefits. Lacking of trust devastates existing relationships and hinders the formation of new ones; this is why academics strongly agreed in this context (about 40.4% of the sample). Further clarification on the subject will be added in the discussion section. Summary about academics' response to social capital components is listed in the table below.

Table 5-12: Academics Reaction to Social Capital Components

	strongly disagree		Disagree		neutral		agree		strongly agree		Mean	Standard Deviation	General trend
	frequency	%	frequency	%	frequency	%	frequency	%	frequency	%			
Absence of trust	3	3.4	9	10.1	9	10.1	32	36.0	36	40.4	4	1.11	Agree
Lack of communicatio n	0	0	0	0	2	2.2	27	30.3	60	67.4	4.65	0.52	Strongly Agree
General trend	**3**	**1.69**	**9**	**5.06**	**11**	**6.18**	**59**	**33.2**	**96**	**53.9**	**4.33**	**0.64**	**Strongly Agree**

Source: Author calculation using the questionnaire data.

Reviewing separately how academics react to each of the four axes on the possible factors that affect the development of collaboration in Algeria, facilitates the conception of the overall trend. With 39% of total estimated responses, academics agree, in general manner, on the axes with an extra focus on institutional impact. Economic structure is then considered as second important variable. However, both of innovation and social capital components are equally valued, with 33% of estimated responses.

Reaching this point of analysis is enough at this stage. For the purpose of consistency and clarity, we postpone dealing with testing process to the final stage. However, to give the study some equilibrium, looking at the reactions of individuals working at government and industrial, vis-à vis the questionnaire axes seems of great value before proceeding to the common reaction. This is what the next point deals with.

b- *University-Industry Collaboration: An industrial Point of View*

The questionnaire designed for industrial members differs slightly to the previous one due to the different in terms of occupations and milieu of work; however, the general environment within which they exist has a direct effect on their functioning. Whether it was institutional, economic or social connection, industrial sector will behave, at some extent, in similar ways to the university

since they belong to the same ecosystem. Consequently, we succeed to keep some necessary expressions equivalent to those addressed in the first questionnaire.

The questionnaire began by specifying organization's sector belonging and it field of activity. Respondents occupation within the organization was the third question. Yet, the outputs came as follow:

Figure 5-3: Sectoral Belonging of Organization   Figure 5-4 Organizations' Activity
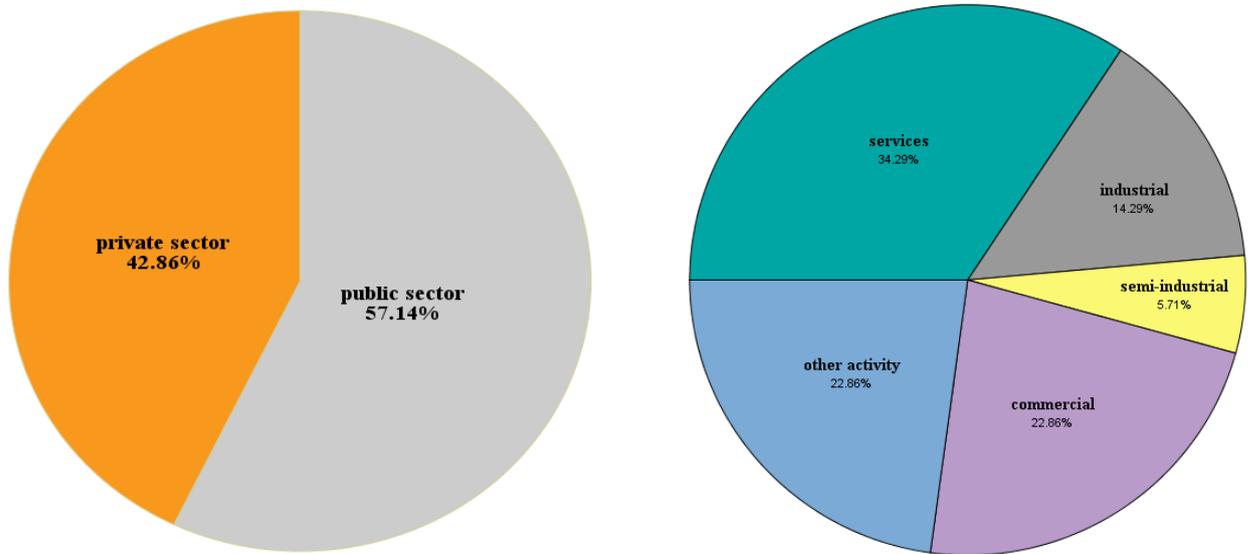
Figure 5-5: Respondent Occupation
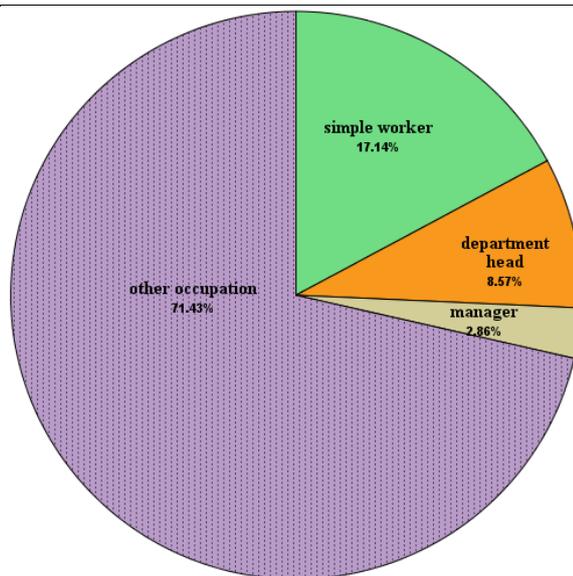
Source: the questionnaire outputs.

As figures show, most of organisations belong to public sector with more than 57% of sample saying they are working is state-owned enterprises; while more than one third of them are of private nature; see figure 5-3 above. The present distribution is acceptable for both reasons: first, this output reflect the actual situation of the economic structure, which is affected by the adopted economic thought since the independence. Second, the output gives the analysis some robustness, due to relative unbiasedness toward a specific sector. In parallel, organizations of the public sector provide service activities, with a percentage of 50% of total enterprises. 13% are active in industrial activity, 10% are purely commercial entities, while 20 % are of different activities. Private enterprises, on the other hand, tend to focus activity in commerce (40%), while services or industrial activities are of less attraction (13.3%); other enterprises (26.7%) provide various activities. In general sense, figure 5-4 summarizes the distribution of organizations according to their activity. Actually, there are about 12 enterprises (both sectors converged) providing service activities, 8 entities active in commercial activities, 7 organizations carry on industrial or semi-industrial activities; however, 8 corporations provide various activities. In addition, figure 5-5 depicts the respondent occupation within the organization. The results show that respondents denied revealing their occupations; more than 70% of the sample did not specified their job nature among the proposed ones. Yet, 12% occupy high position, of either manager or head of department; finally, 17% are simple employees.

From the second and third expression, we noticed a fear of respondents to reveal simple information about their home employers or about themselves. This observation brings important information about the level of trustiness toward academics and researchers on one hand, and about the difficulty in gathering data, on the other.

On educational background of total employees where respondents work, results show that most of them are university graduates, generally holding a Bachelor's degree or a Master; some employees hold post-graduation diploma of Magistère or Doctorate degree. Other educational background of employees, according to respondents, is secondary level while there is a consensus that few workers have a primary education level. Consequently, almost all organizations have employee staff of high qualifications, with an acceptable training degree.

Table 5-13: Educational Level of Organization Employees

	Primary		Secondary		Tertiary		Graduation (licence/master)		Post-graduation (magistère/doctorate)	
	Frequency	%	Frequency	%	Frequency	%	Frequency	%	Frequency	%
No	33	94.3	21	60.0	7	20.0	4	11.4	21	60.0
Yes	2	5.7	14	40.0	28	80.0	31	88.6	14	40.0
Total	35	100.0	35	100.0	35	100.0	35	100.0	35	100.0

Source : the questionnaire outputs.

One of strong expressions in the current questionnaire consists of whether or not the organization is equipped by a R&D department. The outputs confirm the absence of such vital structure in most of local enterprises. Indeed, about 83% of the sample said their organizations lack such department. Further, among 29 respondents who deny the presence of R&D department, 12 enterprises are active in the private sector; however, R&D departments are present in enterprises involved in industry or service activities. This occurrence, we believe, depends on the firm's size, as will be explained in the discussion section. On the other hand, asking respondents to express their opinion on the existence of collaboration between their organization and universities, show that most of them affirm such partnership, a shocking result if comparing the academics point of view. Indeed, 71% of the sample positively reacts to the collaboration issue. However, a deep look at the type of cooperation helps to understand the respondents' tendency to emphasize the existence of a cooperative relationship between the industrial sector and university. The results are presented in table 5-14.

Table 5-14: Types of University-Industry Collaboration

	Disagree		Neutral		Agree		Mean	Standard Deviation	Trend
	Frequency	%	Frequency	%	Frequency	%			
Receive Students	3	8.6	7	20.0	25	71.4	2.63	0.65	Agree
Financial Support to Conferences	10	28.6	12	34.3	13	37.1	2.02	0.82	Neutral
Real Participations by researches	18	51.4	14	40.0	3	8.6	1.57	0.65	Disagree
Ask for Expertise	22	62.9	12	34.3	1	2.9	1.4	0.55	Disagree
Employees Training at The University	20	57.1	13	37.1	2	5.7	1.49	0.61	Disagree
Financial Support to Projects Related to Organisation's Activity	23	65.7	11	31.4	1	2.9	1.37	0.55	Disagree
Participation in Bilateral Projects	21	60.0	12	34.3	2	5.7	1.46	0.61	Disagree

General Trend	**117**	**47.76**	**81**	**33.06**	**47**	**19.18**	**1.71**	**0.28**	**Disagree**

Source: author calculation using the questionnaire data.

As shown in the table, most of responses focus on the first type of cooperation, which limit to the reception of students to conduct a period training at their enterprises. No types are supported by the organizations. The disagreement is widely observed in terms of providing financial support to researches that have relative link to enterprise's activity. In addition, most of organisations ask of helps outside universities, and further neither they tend to engage in bilateral projects with higher education institutions nor they participate by researches in conferences or seminars organised by universities. This why we conclude that there is so limited contact between the industrial sector and university, which is more consistent with academics' view, as well international reports. Additional important result is that industrial sector prefers demand expertise from specialised consultancy bureaux or local enterprises active in the same field of activity; they tend to escape demanding expertise from universities whether they are located inside or outside the country. This tendency, we believe too, depends on firms' size. Similarly, enterprises when it is necessary send their employees for perfection or training courses to public institutions in ministries that have equivalent domain of activities; otherwise, the training is guaranteed inside the enterprise.

Table 5-15: Distribution of Questions to Main Axes.

Institutional Axis	- Weak institutional body. - No clear regulation about IP. - Insufficient of specialised organizations.	Refers to Institutional Theory
Innovation Axis	- Absence of R&D department in most enterprises. - Industrial sector denies the importance of innovation. - Absence of national view about innovation. - Universities are not capable to innovate. - enterprise's activities do not allow such cooperation	Refers to Innovation and Resource-Based approaches
Social Capital Axis	- Absence of trust. - Actors do not communication among them.	Refers to Social Capital theory

Economic Structure Axis	- Weak industrial body and undiversified economy. - Universities are financing independent. - weak and non-competitive local universities: ■ weak training at university ■ limited capacity to university's output ■ universities focus on theoretical aspects rather than practical ones	Refers to Resource Curse diagnostic

Source: the author.

The evident perception from the above analysis suggests the presence of electrified milieu between industrial sector and university. Knowing the possible underlying reasons, from industrial point of view, brings additional insights to track the real factors for such low level of cooperation. In doing so, 15 expressions, to be classified according to the agreeing level, were proposed to respondents. These expressions summarize the four axes in a similar way to those proposed to academics. Therefore, institutional aspects are conceptualised around three expressions instead of four in the academics case. Innovation axis is structured around five expressions; in this axis, we added university's ability to innovate. Respondents are asked to express their view on whether universities consider the act of innovate as a resource, similarly to physical and financial capital. Expression on firms' size is remodelled to facilitate the understanding for respondents; therefore, it does not address directly the size but further the type of practiced activity. Economics structure axis contains three expressions instead of four for the first sample. "Weak and non-competitive enterprises" expression was modified by an equivalent expression on the weakness and non-competitiveness of local universities, where we add three sub expressions on training, graduates' skills and experiences, and programs content. A detailed description of the four axes is summarized in the table 5-15 above.

The outcomes show a tendency of respondents to be agree on the four axes. With an overall mean of 4.04 and 44.48% of total estimated answers, respondents tend to agree on the 15 expressions, with a concentration on expressions that concern innovation axis. This mean that enterprises as well as local universities do not include innovation in their planning and strategies since innovation still not treated as a resource, the same as other types of capitals. Reason for this can be attributed to economic structures, which is manifested by the lack of diversification and weakness of industrial body. However, we can refer to the absence of R&D departments as main key in the lack of innovation tendency for enterprises. In addition, respondents agree on the role

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of institutions impact in determining the development of university-industry collaboration in Algeria. However, they strongly agree on the importance of social capital in harnessing partnership.

Table 5-16: Institutional Axis Outcomes.

	Disagree		Neutral		Agree		Completely Agree		Mean	Standard Deviation	Trend
	Frequency	%	Frequency	%	Frequency	%	Frequency	%			
Weak of Institutional Aspects	2	5.7	8	22.9	21	60.0	4	11.4	3.77	0.73	Agree
No Clear Laws on Property Rights	0	0	16	45.7	16	45.7	3	8.6	3.63	0.65	Agree
Insufficient of Organisations	0	0	6	17.1	18	51.4	11	31.4	4.14	0.69	Agree
General trend	**2**	**1.9**	**30**	**28.57**	**55**	**52.4**	**18**	**17.14**	**3.7**		**Agree**

Source: Author Calculation Using the Questionnaire Data.

Yet, in deep analysis of axes may reveal further observations. In this regard, the results of the institutional axis show that the weakness of institutional body is the foremost factor that hinders the emergence of partnership between the industrial sector and higher education institutions. That is to say, government does not play it role in establishing a clear legal framework that facilitates cooperation between them. This weakness could be read through the insufficient number of specialised organisations that frame effective cooperation between the industrial sector, universities and various research institutes. That is why in a third stance, respondents considered that government disengagement might clearly be grasped by the absence of national view about innovation; this is a further argument that explain the lack of active specialised organisations such as sciences parks. Table 5-16 summarizes the results for institutional aspects.

Table 5-17: Innovation Axis Outcomes

	strongly Disagree		Disagree		Neutral		Agree		strongly Agree		Mean	Standard Deviation	Trend
	Frequency	%	Frequency	%	Frequency	%	Frequency	%	Frequency	%			
*Absence of Innovation View	0	0	0	0	2	5.7	13	37.1	20	57.1	4.51	0.61	Strongly Agree
*Universities Capability to Innovate	1	2.9	0	0	6	17.1	22	62.9	6	17.1	3.91	0.78	Agree

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	Freq	%	Freq	%	Freq	%	Freq	%	Freq	%	Mean	SD	Trend
*Absence of R&D Department	0	0	0	0	2	5.7	25	71.4	8	22.9	4.17	0.51	Agree
Nature of *Enterprise's Activities	1	2.9	2	5.7	13	37.1	12	34.3	7	20.0	3.63	0.97	neutral
*Denying the Role of Innovation	0	0	2	5.7	3	8.6	23	65.7	7	20.0	4	0.73	Agree
General Trend	**2**	**1.14**	**4**	**2.29**	**26**	**14.86**	**95**	**54.29**	**48**	**27.43**	**4.04**		**Agree**

Source: Author Calculation Using the Questionnaire Data.

Results for the innovation axis are quite similar to the previous one; table 5-17 registers the reaction of respondents to the 5 expressions. First, due to their knowledge background, respondents are not sure whether the type of activity can really affect the innovative capacity of the organisations (in contrast to academics who agree on this point). Nevertheless, they are remarkably agreed that the absence of R&D departments in enterprises affect in passive way the drawing of common policy on innovation among actors. The same reaction is observed for the denying of positive role of innovation on revenue generation or development plan of enterprises. Finally, they are strongly agreed about the negative effect of the absence of national horizon on innovation; this can be attributed to the passive role of government in mobilizing regulations and setting up laws that frame a clear strategy for promoting innovation and knowledge status in the country.

Table 5-18: Economic structure Axis Outcomes

	Completely Disagree		Disagree		Neutral		Agree		Completely Agree		Mean	Standard Deviation	Trend
	Frequency	%	Frequency	%	Frequency	%	Frequency	%	Frequency	%			
Undiversified Economy	0.0	0.0	4	11.4	15	42.9	14	40.0	2	5.7	3.4	0.77	Agree
Financial Independency	0.0	0.0	1	2.9	5	14.3	10	28.6	19	54.3	4.34	0.84	Agree
Weak Training	1	2.9	4	11.4	4	11.4	17	48.6	9	25.7	3.82	1.04	Agree
Graduate Skills	1	2.9	2	5.7	8	22.9	17	48.6	7	20.0	3.77	0.94	Agree
Program Content	1	2.9	0	0.0	6	17.1	20	57.1	8	22.9	3.97	0.82	Agree
General Trend	**3**	**1.71**	**11**	**6.26**	**38**	**21.71**	**78**	**44.57**	**45**	**25.71**	**3.86**		**Agree**

Source: Author Calculation Using the Questionnaire Data.

The weakness of institutional body, in the case of Algeria can be traced to the economic structure. This later is characterised by the dominance of hydrocarbons sector as discussed in the

previous chapter. However, relying on such resources has a negative channel on other sectors and different aspects of economic and social environment; a famous negative effect is reflected by the exclusion of other sectors in the generation of wealth. An average mean of 3.4 indicates that respondents agree on the fact that a diversified economy facilitates the spirit of collaboration and improvement of innovation level. On the other hand, respondents agree that since the university receive it financing from the government, it will be less oriented to cooperate with it external ecosystem, by integrating the economic and social needs in programs. In this regard, respondents strongly agreed of the link between collaboration behaviour and financial sufficiency of actors. On the other side, organizations refuse to send employees for training at universities, since these later propose outdated programs and passive curricula. In a similar vein, enterprises, complains from incompetent graduates, whose skills are under job market requirements, on one hand and reflect the programs quality as well training capacity at universities, as shown in the table 5-18.

Outcomes on social capital axis, presented in table 5-19, reveal a strong agreeing of respondents on both expressions. Therefore, they consider the quality of trust as foremost variable that either hinder or enhance the level of development between possible actors. The absence or weak level of trustiness reflects the degree of communication. Lacking trust reduces the occasions of meeting that helps in the understanding of other position and needs. In contrast, low level of communication discourages the creation of trust. Therefore, there is a reciprocal link between trust and communication, which influence and be influenced by the each other.

Table 5-19: Social Capital Axis Outcomes

	Strongly Disagree		Neutral		Agree		Strongly Agree		Mean	Standard Deviation	Trend
	Frequency	%	Frequency	%	Frequency	%	Frequency	%			
Trust	2	5.7	1	2.9	5	14.3	27	77.1	4.57	1.01	Strongly Agree
Lack of Communication	1	2.9	1	2.9	11	31.4	22	62.9	4.51	0.82	Strongly Agree
General Trend	**3**	**4.26**	**2**	**2.86**	**16**	**22.86**	**49**	**70**	**4.54**		**Strongly Agree**

Source: Author Calculation Using the Questionnaire Data.

The overall and sub-axes results are statistically reliable at a level to conclude the validity of the questionnaire in measuring what the study aims to demonstrate. The squared root of Cronbach's alpha of over 90%, which is statistically enough for the 15 expressions to nominate

the factors that influence partnership between actors. Further, Cronbach's alpha of 0.82 insures that results are constant and tend to reappear if the questionnaire is redistributed to the same sample within the same conditions. Yet, normality test shows that our sample are not normally distributed, with a Kolmogorov-Smirnov value of 4.4%, lower than the significance level of 5%; consequently, non-parametric approach is convenient for the testing.

c- University-Industry Collaboration: An Overall Look

The first look at both questionnaires illustration some similarities in terms of results and data characteristics. Generally, expressions of both questionnaires are statically reliable, considered as ordinal scale and follow non-normal distribution; additionally, both of questionnaires are convenient for non-parametric testing. From this point of view, we proceed to merging both questionnaire and extract similar expressions which in turn be subjected to necessary statistical tests. However, we try to keep the four axes of variables. This process is summarized in table 5-20 where we refer to common expression by bold sentences. In doing so, ten expressions dispatched among the four axes have been retained. The remaining expressions, highlighted by an *italic* style, serve as supporting arguments for further clarification. Table 5-20 bellow summarizes.

The ten expressions with the equivalent axis are as follow:

- The Institutional axis includes the following expressions:
- Weak institutional body;
- No clear regulation about IP;
- Insufficient of specialized organizations.

- The innovation encompasses expressions of:
- Absence of national view about innovation and invention;
- Industrial sector is not aware about the importance of innovation as a key source of growth and revenue;
- Absence of R&D department in most enterprises.

- The economic structure axis regroups:
- weak industrial body and undiversified economy;
- Universities are sufficiently independent in term of financing.

- Expression on social capital axis are:
- absence of trust;
- Actors do not communication with each other.

The combination of both samples gives us a total number of respondents, equivalent to 124 cases. Furthermore, at this level of analysis, we will introduce the dependant variable, which is

represented by the development of collaborative activities between actors during the last 3 years. In doing so, we will able to testify whether the factors described by the questionnaires affect the development of partnership between the three strands. Indeed, if institutional framework is clear enough, organizations tend to reduce or share research costs with other organizations; while financial shortness for research institutes provoke them to engage in research programs to cover its spending. In addition, a diversified economy will tend to improve its governance status by establishing transparency, strengthening institutional base and promoting collaboration culture. In this regard, results, as presented in table 5-21, show an overall agreeing for the proposed factors.

This agreement strengthens for the first and last axes. In general, approximately 80% of the respondents positively react to the described factors, while half of them demonstrate a strong agreeing (this tendency is more manifested in the social capital aspect with 58.47% of total responses. On the other hand, manifestation of agreeing is well present for the institutional aspects with 48% of responses). In depths look to how respondents react to each axis brings further clarification to the weight of each of them[1].

For the first axis, there is almost unanimous agreement that insufficiency in specialized organizations has a most negative impact on the establishment of collaboration between actors. This may be explained by the fuzzy regulations about the intellectual property, which in turn reflects the weakness of formal institutional body. For the second axis, respondents strongly agree on all expressions for this section; however, greater focus was made on the expression about the absence of national view of innovation. About 60% of respondents argue that the absence policies reflect the non-valuation of innovation as source of growth or revenues for industrial sectors. . This claim is further supported by the absence of R&D in most local enterprises in public and private sector as well. We notice that the non-valuation of innovation as key resource concern not only enterprises, but further formal institutions (i.e. public authorities by mean of weak institutions) and higher education organizations. Therefore, underestimate innovation activities hampers the establishment of unified vision on national innovation policy in this regard. For the third axis, a strong agreeing was observed about the financial dependency of universities. This means that the more universities are financially independent, the less they tend to engage in cooperation with external environment. In addition, agreeing, with less intensity, was the reaction of respondents on the economic diversification status and its role in promoting positive cooperation among concerned parties. Indeed, non-diversification of economic activities leads to

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[1] Summary of results is presented in appendix1.

reduced opportunities for cooperation between productive entities themselves or with other active entities in the economy. .This may be due to the lack of competition between enterprises, which find themselves in the monopoly position that eliminates the spirit of competition and cooperation. The situation is exacerbated if the economy suffers from weak institutions and the spread of economic corruption. In the same vein, strong agreeing was the reaction of respondents for the expressions on social capital. Furthermore, half of respondents agree that this fact contributes to or results from the absence of trust. Indeed, since parties do not trust each other, less occasions will happen to encourage their communication; while on the other hand, lack of communication will limit the understanding of each other's comportment, which in turn limits the trust building.

Therefore, trustiness and communication are interrelated factors that enhance the level of homogenous as well heterogeneous parties.

Table 5-20: Questionnaires' Common Expressions.

	Academics	industrialists
Institutional Axis Refers to Institutional Theory	- **Weak institutional body.** - **No clear regulation about IP.** - **Insufficient of specialised organizations** - *Regulations impose some restrictions.*	- **Weak institutional body.** - **No clear regulation about IP.** **Insufficient of specialised organizations.**
Innovation Axis Refers to Innovation and Resource-Based approaches	- **Absence of R&D department in most enterprises.** - **Industrial sector denies the importance of innovation.** - **Absence of national view about innovation.** - **Firm's size.**	- **Absence of R&D department in most enterprises.** - **Industrial sector denies the importance of innovation.** - **Absence of national view about innovation.** - **enterprise's activities do not allow such cooperation** - *Universities are not capable to innovate.*
Social Capital Axis Refers to Social Capital theory	- **Absence of trust.** - **Actors do not communication with each other.**	- **Absence of trust.** **Actors do not communication among them.**
Refers to Resource Curse diagnostic	- **Weak industrial body and undiversified economy.** - **weak and non-competitive local enterprises** - **Universities are financing independent.** - *Weak private sector.*	- **Weak industrial body and undiversified economy.** - **Universities are financing independent.** - **weak and non-competitive local universities**: ■ weak training at university ■ limited capacity to university's output ■ universities focus on theoretical aspects rather than practical ones

Source: the author.

Table 5-21: Overall Trend of Both Samples[51]

	Strongly disagree		disagree		neutral		agree		Strongly agree		Mean	Standard Divination	Trend
	Frequency	%	Frequency	%	Frequency	%	Frequency	%	Frequency	%			
Axis 1	2	0.54	17	4.57	90	24.19	179	48.12	84	22.58	3,88	,47	Agree
Axis 2	0	0	9	2.42	28	7.53	154	41.4	181	48.66	4,36	,51	Strongly Agree
Axis 3	2	0.81	17	6.85	56	22.58	97	39.11	76	30.65	4,07	,58	Agree
Axis 4	6	2.42	9	3.63	13	5.24	75	30.24	145	58.47	4,39	,65	Strongly Agree
Overall trend	**10**	**0.81**	**52**	**4.19**	**187**	**15.1**	**505**	**40.73**	**486**	**39.19**	**4.13**	**.34**	**Agree**

Source : author calculation using the questionnaires
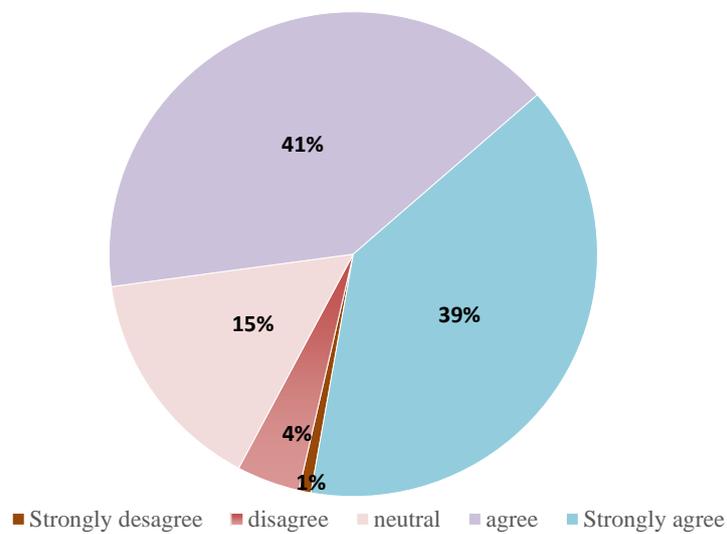
On the other hand, asking respondents to react to the development of collaborative activities between their organizations and other national entities, during the last three years, demonstrates a common disagreement about the issue. Both academics and industrialists stressed on the fact that the organization to which they belong did not communicate with other organizations, either under

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[51] We attract reader's attention that the reliability statistics for the sample is about 74, 7% (presented by the Cronbach's Alpha). This give us a confidence on the obtained results

research programs or asking for consultancy. Further, responses from industrial sector stressed on the full absence of any kind of collaboration where 50% of respondents strongly disagree about the engagement in research projects or seeking of consultancy. Academics, even they deny such collaboration, tend to be uncertain whether or not their universities signed contracts with industrial sector (about 20% of academics prefer not respond to these two questions in comparison to industrialists who were much more confident in their responses). Table 5-22 summarises the reaction of the two samples on the development of partnership among their organizations (a dependent variable)[52]

Table 5-22: Development of collaboration among actors during the last 3 years

	strongly disagree		disagree		neutral		agree		Mean	Standard Diviation	Trend
	Frequency	%	Frequency	%	Frequency	%	Frequency	%			
last 3 years signing cooperative programmes	56	45,2	45	36,3	20	16,1	3	2,4	1.76	0.81	Disagree
last 3 years seeking consultancy	59	47,6	37	29,8	26	21,0	2	1,6	1.77	0.83	Disagree
General Trend	**72**	**40,9**	**50**	**28,41**	**39**	**22,2**	**15**	**8,52**	**1.78**	**0,68**	**Disagree**

Source: author calculation using the questionnaires.

d- Hypothesis testing

Since the questionnaire was designed to heterogeneous samples in their initial missions and objectives, tracing whether there is similarities or differences in the responses will therefore bring further confidence for the results. Indeed, resemblances in the general trend or expression-to-expression response suggest a consensus between the two samples on the various factors that contribute to the development of (positive or negative) culture of cooperation between actors. While the difference of views means that both samples are not agreed in this regard. Given that the two samples were randomly chosen, identicalness in the answers adds more confidence about the proposed factors; that is to say institutions, social capital, the perception of creativity and the structure of the economy can be relied upon to explain the development of cooperation between University-Industrial-Government at least in Algeria.

In addition, we will test whether axes affect each other and which one is more influential. This process is of great importance especially for policy-makers when designing policies to enhance

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[52] The alpha of Cronbach for the expressions on the development of collaboration was 75.9% meaning that those questions are statistically relevant to test what they are elaborated for.

such collaboration. A dashboard will be available for them to regulate the extent of partnership by correcting and modifying the damaged axis. Finally, we will test whether the development of collaborative activities was explained by the intentional factors in the questionnaire. This step supports the first test. Indeed, if we remark an increase in scientific activities that gather at least two of the three actors, we consider that the development of partnership among University-Industry-Government can be explained by the previously cited factors that are summarized in the four axes.

However, for consistency purpose, we prefer starting to test for consistency in groups' responses. By doing so, we will be statistically confident that the proposed factors really affect the development (positively or negatively) of collaboration between the three strands. The convenient tests at this stage are Mann-Whitney U test and Kolmogorov-Smirnov test. The reasons behind running such tests are previously stated. Yet we may stress that our data are qualified as ordinal input and follow non-normal distribution[53]. These two qualities, we believe, are sufficient to conduct non-parametric procedures.

The Mann-Whitney U test supposes the holding of four assumptions: first, the variable should be valued as continuous or ordinal. Second, the independent variable should consist of two categorical and independent groups. Third, the independence of observations. This means that no relationship exists between observations in each group or between groups themselves. Last, determining whether the distribution of scores for both groups have the same shape or **a** different shape**;** this will determine how you interpret the results of the test[54]. Our data fit with all of these assumptions; the Likert scale is considered in statistics to be an ordinal entry. The two groups are those of academics and industrialists. The shape of the groups is widely different (the Kolmogorov-Smirnov test for normality of the two groups is respectively as follow: 0.002 for academics (with a skewness of -0.673) and 0.200 for industrialists (with a skewness of 0.184))[55]. This means that we are going to test whether there are differences in the distributions of the two groups. Therefore, our hypotheses are stated as follow:

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[53] See appendix 2 for normality test distribution with equivalent histograms

[54] If the two distributions have a **different shape**, the *test is used to **determine whether there are differences in the distributions of the two groups***. However, if the two distributions are the **same shape**, the test is used to *determine whether there are differences in the medians of your two groups.*

[55] See appendix 2

The null hypothesis: there is no tendency of the ranks of one sample to be systematically higher or lower to those of the second sample. This means there is no tendency of ranks of respondents from academics (industrialists) to be significantly different from those of industrialists (academics).

The alternative hypothesis: the alternative hypothesis states that the ranks of respondents from one sample are systematically different from those of the other. Differently stated, the value from the two samples are clustered at an opposite ends when combined (Richardson 2015)

Yet, our hypotheses are two-tailed, non-directional hypothesis because they indicate a different but in no particular direction. The statistical grammar of the both hypotheses can be presented as:

H_0: the distribution of scores for the two groups are equal;

H_A: the mean ranks of the two groups are not equal.

Using the ranked reading comprehension test scores, the Mann-Whitney U results indicated no significant difference between the two samples in their responses (*U = 1402,5; Z = -0.867; p = 0.387 > 0.05*). The average rank for academics (*M_{ac} = 64.24*) was closer to the mean rank for industrialists (*M_{in} = 58.07*); moreover, no effect size was detected for these results (*r= 0.7%*)[56]. Therefore, we can state that the data support our hypothesis on the factors that affect the establishment of collaboration between U-I-G in Algeria. However, when conducting the test for individual factor, we failed to reject the null hypothesis for three factors, which are:

- absence of trust: *U= 993.5, Z= -3.413, p= 0.001<0.05*,
- ignoring the importance of innovation role: *U= 1037.5, Z= -3.198, p= 0.001<0.05*;
- Weakness of economic structure and industrial body: *U= 1189, Z= -2.215, p= 0.027*.

Falling to reject the null hypothesis, in our case, does not mean respondents are not agree on these factors; however, their conception of the issue differs according to their intellectual and experimental variation. For example, the average rank of industrialists is about 79, while that of academics is 56. This huge gap in the mean rank may be explained by the way each sample understand the term "trust". Industrialists look to the term in its *popular sense* without any technical consideration; academics give "trust" its scholarly dimension; indeed, 77% of industrial sample were strongly agree on the effect of "trust" on collaboration, in comparison to 40% of academics who were in the same level. In the similar vein, academics due to their intellectual

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[56] With a value of 0.007, this means that less than 1% in the change of rank is due to respondent groups. For further understanding of the effect size, reader may refer to (Cao, Manteiga, and Romo 2016), (Linebach, Tesch, and Kovacsiss 2014) and (Richardson 2015)

background are highly sensitive to the important role of innovation as a key factor in promoting collaborative activities; in contrast, industrialists are less sensitive to the critical role of innovation within the organization they work. This image is well captured in the categorical analysis of responses for this question where 53% of academics tend to agree strongly on the importance of innovation, while 20% of industrialists share an equivalent behaviour. Same remarks can be concluded for the economic structure; for example, 43% of industrialists neither agree, nor disagree in comparison to 27% for academics. On the other hand, academics, benefiting from their access to knowledge, agreed on the effect of industrial body and economic diversification on the elaboration of partnership within U-I-G; industrialists, with 40%, are less aware about the impact of varying economic activities on the creation and enhancement of cooperation.

After having statistical evidence to rely on these factors, we want to test whether these factors, grouped under the four axes, are related to each other. This process will demonstrate their consistency to the designed study, for example whether the institutional aspect affects or be affected by the economic structure and social capital. Correlation between these axes, thus, is of crucial importance since it will determine which axis has remarkable and considerable impact on the conduct of other axes. The existence of correlation gives additional statistical reliability on the studied factors and their ability to address the main research question.

Since we are working with nonparametric entries, choosing suitable statistical test permit for a good visualisation of our data. In this regard, Spearman rank-ordered test is used to check for the presence or absence of correlation between our axes. Yet, relying on this test is due to some characteristics that govern our data. First, as demonstrated for the Mann-Whitney test, our data violate the main assumption of using parametric methods, since they are not normally distributed (the Kolmogorov-Smirnov test for normality of the two groups is respectively as follow: 0.002 for academics (with a skewness of -0.673) and 0.200 for industrialists (with a skewness of 0.184))[57]. Second, the data entry is related to ordinal variable due to Likert scale, which used to order sample's degree of agreeing, from strong disagreement to strong agreement. As such, the Spearman's rank order correlation coefficient (i.e., Spearman's rho) was performed to address the question previously delineated.

As any statistical test, two hypotheses are set. The spearman's *null hypothesis* states that there is no association between studied variables; the *alternative hypothesis* therefore affirms such correlation. In our study, the null hypothesis supposes that the four axes are mutually independent.

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[57] See appendix 2

Autonomy means that each axis does not fit the other one, and therefore we cannot rely on the proposed factors, taken together, to understand the development of cooperation between university, government and the industrial sector. On the other hand, if dependency exists among axes, our factors thus will have a statistical proof to explain the status of collaboration among the three strands. The statistical presentation of the both hypotheses can be written as:

H_0: *there is no association between the four axes, this mean that they are mutually independent;*

The alternative hypothesis should be as:

H_A: *there is an association among axes; they are mutually dependent in either positive or negative direction*

However, since we are dealing with four variables, it is useful to express the null and the alternative hypothesis for each axis as follow:

H_{null}: *a) There is no association between institutions and social capital;*
- *b) There is no association between institutions and innovation;*
- *c) There is no association between institutions and economic structure;*
- *d) There is no association between social capital and innovation;*
- *e) There is no association between social capital and economic structure;*
- *f) There is no association between innovation and economic structure.*

$H_{alternative}$: *a) There is an association between institutions and social capital;*
- *b) There is an association between institutions and innovation;*
- *c) There is an association between institutions and economic structure;*
- *d) There is an association between social capital and innovation;*
- *e) There is an association between social capital and economic structure;*
- *f) There is an association between innovation and economic structure.*

A series of Spearman rank-order correlations were conducted in order to determine if there were any interrelationship between institutions, innovation, social capital and economic structure. A two-tailed test of significance indicated the presence of moderate to medium relationship between economic structure and the remaining items; these results are expressed as follow[58]:

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[58] Detailed results can be checked at the appendix n° 3

- A medium relationship between economic structure and institutions, *r (124) = 0.524, p<0.05*. Therefore, the more institutions are strong, the better economic structure will.

- A moderate relationship between economic structure and social capital, *r (124) = 0.40, p<0.05*. That is to say, the pre-established social norms and their spread among actors will positively affect the structure of economic activities.

- A moderate correlation between innovation and economic structure, *r (124) = 0.31, p< 0.05*. yet, even this weak correlation we are, however, statistically confident that as industrialists consider the role of innovation in their acts, the more economic structure will go flourished, and vice versa.

Similarly, a two-tailed spearman test was performed to weight the relationship between institutions and the two axes. The results showed a moderate correlation with social capital, *r (124=) =0.32, p<0.05*; that is, as the spread of social capital is in the country, as the quality of institution is; and the stronger the institutions are, the better social capital is enforced. Further, the quality of institutions affects, even this effect is limited, the willing of actors to adopt innovative thought, *r (124) = 0.30, p<0.05*. Finally, we failed to find statistical evidences that correlate social capital to innovation, *r (124) =0.024, p>0.05*; however, this will not affect our understanding, as we shall demonstrate in discussion section.

Therefore, we are statistically confident that the four axes complete each other, on one hand, and that these correlations affect the development of university-industry-government partnership in Algeria, o the other hand. Furthermore, results indicated that institutions-economic structure is the most correlated value followed by economic structure-social capital correlation; the final outputs are summarised in table 5-23 bellow:

Table 5-23: Strength of Cross Correlation

Cross-correlation	*Strength*	*p-value*
Economic structure-institutions	0.524	0.000<0.05
Economic structure-social capital	0.392	0.001<0.05
Institutions-social capital	0.32	0.015<0.05
Economic structure-innovation	0.31	0.019<0.05
Institutions-innovation	0.20	0.029<0.05
Social capital-innovation	0.024	0.789>0.05

Source: Spearman's rho results, using the questionnaire data.

Therefore, we are enforced to reject the fourth alternative hypothesis above and conclude that there is no sufficient statistical evidence showing correlation between social capital and

innovation. For the other hypothesis, we found a statistical significance of correlations. Discussion section will deal with these results in detail.

Finally, we want to test the overall correlation between the dependent variable, labelled "DEV" and independent variables, labelled "Respondents". The dependent variable gathers the two questions on the development of cooperation during the last 3 years; the independent variable regroups the ten questions of the questionnaire. Since we are working with ordinal data with violation of normality distribution assumption, a convenient test in this case would be Spearman's rho. The formation of the null and alternative hypotheses is pronounced as follow:

H_0: *there is no significant relationship between the development of collaboration during the last three years with the proposed factors;*

H_1: *there is a correlation between the development of collaboration and the proposed factors.*

Results from the test indicate a moderate correlation between the two tested variables, r (124) = 0.479, p = 0.019<0.05. That is to say, a least 48% of the variation in cooking of consultancies from industrial or the signature of cooperative programs might be explained by the designed factors. Differently stated, the more institutional values are presented, the more environment would favourite the signature of novel program. However, this is also coordinated with the quality of economic structure and the way actors perceive the importance of innovation within their strategies. Finally, the role of communication between actors will facilitate the detection of needs and requirements for cooperation; the next section discusses the impact of each axis on the development of collaboration between university, industry and government, at least in Algeria.

iii- Discussion of Results :

The previous statistical outcomes give the research the required arguments to discuss them in relation to the main research questions and hypotheses. Hence, it is worthy to recall our hypotheses that direct the study, in addition to the main question of the thesis. In chapter 1, we specified that our aim is to determine the factors that have an impact on the development of cooperation between university industry and government in Algeria. We have exposed four hypotheses, including institutions, innovation, social capital and economic structure. In chapter III, a detailed description of the importance of each factor on the development of cooperation among heterogonous actors had been made.

The innovation theory tells us that innovation is a mandatory factor for economic development and necessitates to be seriously implicated within the strategic development of societies and firms. In this regard, two approaches of innovation had emerged to summarise the link between innovation and cooperation. The level at which one of these approaches is implemented refers to the degree of cooperation among the three actors. These approaches are innovation process and innovation system. Many studies, for example Teece (1992), De Faria et al (2010) and Zeng et al (2010), demonstrated that firms which consider innovation as a key factor tend to cooperate in innovative activities through inter-firm networking, cooperation with intermediate establishments or collaboration with specialized research organizations. They are further implied with a national system. Indeed, the process that arranges from problem identification to commercialization pushes firms to use internal and external available resources as well as collaborating with homogenous and heterogeneous organisations or institutions. Furthermore, in a highly competitive environment, the innovation process represents a determinant activity to guarantee endurance and steadiness especially in the actual epoch that is characterised by a robust complexity and hostile competitiveness. Firms or organisations that neglect to design their innovation processes face high likelihoods of segregation or disappearance. That is to say, innovation is viewed, at micro, miso and macro level of analysis, as a main resource for the performance of firms and the country as a whole. The RBV approach states that firms, which respect VRIN, are better situated in a competitive environment as they update their resources' mixture through cooperative activities. However, enterprises and other organisational structures that deny the role of innovation are less exposed to engage in collaboration with other structures.

Our results show that both samples are aligned with this regard. There was strong agreeing that most of local enterprises are not occupied with R&D department; such fact reflects clearly the marginalisation view that firms recognise for innovation. Indeed, academics are more illuminated at this point, due to their degree of education and knowledge access. While industrialists are passive in this regard, academics strongly agree that denying the role of innovation constitutes one element to delay the emergence of cooperation among firms and universities; these later are for industrialists less capable to innovate despite the availability and renewal of human and intellectual capital they hold. Further, industrialists consider the nature of activities, firms engage in, as a source in neglecting the value, rareness, inimitability, and non-substitutability of innovation and so they never plane their innovation process which entails the engagement with external actors. A complement view was delivered by academics who confirmed that firm's size also affects the consideration of innovation as a paramount resource. All of these weaknesses were alimented by

the absence of national view about innovation. Except for the 08-05 law on orientation and five year programs of scientific research and technological development, there are no public policies that frame a prospect of Algerian innovation system; this can easily be depicted by the absence of an elaborated scheme in academic research or in official pubic reports, due to the lack of effective institutional framework.

These results confirms that local environment, encompassing industrial sector, higher education institutes and government organisations ignore innovation as key resources for economic and social development. The actual environment, within which these strands act, affects the implementation of cooperative activities of all sorts. This includes institutional quality, the spread of social networks and the economic structure of the country, as we will demonstrate in the following paragraphs. Indeed, since local enterprises have a moderate size and mostly are implemented in the traditional tertiary sector with a limited exposure to competition; therefore, they normally tend to neglect the resource view of innovation and disregard to plane their innovation process. This means they are not under market pressure to undertake collaboration with prominent actors in the domain of knowledge creation, especially with higher education institutes. On the other hand, universities and other research structures are less motivated to engage in mutual research collaboration with the industrial sector; this fact is well summarised in the types of university-industry collaboration or in the co-authorship previously demonstrated. Indeed, almost all respondents from the academic group declare they do not and did not have any contact with industrialists when elaborating their research papers; even, a quarter of them reject having an exchange with colleagues from other research organisations. The types of Masters accepted at universities can extract another explanation. The data on accepted Masters at universities are of academic type. professional Masters as less favoured by the ministry. One can refer to the master of management of hospital structures, which was transferred to academic master instead of the original proposition. The fact shows that there is no demand by students to such type of masters, due to the ambiguity of legislation to their integration in market labour. Further, this fact also describes, the reluctant to send employees for training at universities, owing to offered training qualities, and lack of trust and communication.

Similarly, industrialists declare that the most common link with universities they can agree on is receiving students during their "end-of-studies internship". However, there is a quasi-disagreement on the financial supports of research having relation to enterprises' activities; training of employees at universities or asking for expertise.

What does it mean can be understood under the umbrella of denying the role of innovation and then programming their process trajectories, and this for industrial sector as well as for higher education organizations (at least universities in the present study). The reasons that pushes enterprises to look for expertise outside universities, for example, or what make universities keeps away from sharing research projects with industrial sectors, has multiple rationales. The most important one is the neglect of planning for innovation, on one hand, and lack of conception about innovation as a key resource for the development of organisations within their internal and external environment. However, declining the role of innovation by most actors, in Algeria, would be read within a global environment. This includes the state of social capital, the institutional system and the economic structure of the country since independence.

The institutional aspects, as the theory suggests, are classified under formal and informal institutions and which are best described by regulative, normative and cultural-cognitive pillars (North 1990). The role that institutions play in shaping the behaviour of various actors, and especially in the innovation systems as being rigidities and obstacles that retard, or being supportive mechanisms for innovation, has been widely accepted by scholars, specialists and policy makers. They help coordinate actions between diverse actors in society, within and outside a specific network. Accordingly, Charles & Johnson (1997) states that:

"The pattern and the content of communication and interaction in the economy is affected by its institutional set-up. Since we regard innovations as mainly resulting from interactive learning processes, it follows that institutions affect innovations. In fact, it is difficult to imagine innovations that are not to some extent formed by the institutional set-up."

In this regard, denying the role of innovation by most actors in Algeria may find its roots within the institutional settings. Indeed, both samples were agreed that the weakness of institutional aspect-formal aspects- contributes to delaying the emergence of cooperation between higher education institutes and industrial sector. According to the 2017's index of economic freedom, published by the heritage foundation, the weakness of formal institutional aspects continues to hamper the overall conduct of the economy as well the country. In addition, the world economic forum, by the global competitiveness index report of 2017-18, supports the previous conclusion in considering institutions as restrictions for economic and social recovery. This is reflected by the insufficiency of specialised organisations that ensure the promotion of bilateral collaboration. Therefore, there is a remarkable weakness in framing policies for property rights and their protection. Oukil (2009, 2008), in this regard, summarises that the institutional weakness that is behind the lack of innovation policies in most Arab countries engender the lack of entrepreneurial

initiatives. That is to say, more there are institutional barriers less are the opportunities of establishing collaboration between actors. Differently stated, innovation flourishes where property rights are protected and strengthened; in the same manner, controlling corruption and good judiciary system have a remarkable impact on the rate of innovation. Indeed, these observations were validated by the study of Oluwatobi et all (2015) who found out that an improvement in the quality of institutions, especially government effectiveness and regulatory quality, in Africa [including Algeria] will advance the rate of innovation and thus enable catch up with advanced economies.

    Our results showed a similar understanding of the active of institutions in promoting innovation activities and collaborative efforts. About 50% of all respondents agreed that weakness of Algerian institutions hampers the setting-up of collaborative occasions. This includes opacity around intellectual property and relative rights, insufficiency of organisations devoted to facilitate the spread of partnership culture in the domain of innovation among actors. Yet, one can understand why the number of inventions is weak in Algeria. According to a report, published by the General Directorate of Scientific Research and Technological Development (GDSRTD) about the intellectual property in Algeria, the number of registered *inventions* during 2015 was 200 realised by 73 national research organisations. Research institutes under the supervision of higher education ministry contribute by about 174 inventions[59], while the remaining 26 were realised by 7 research centres and entities outside the academia milieu. The report concluded that 58 out of 95 higher education institutions and research centers that are related to the higher education ministry are passive in this domain (DGRSDT 2016). We notice that the increase in registered inventions from 2011 to 2015 was of order 110 only. The weak production, therefore, reflects the shortage of formal specialised organisations, which are represented by the Algerian National Institute of Industrial Property (INAPI), and National Office of Copyrights and Related Rights (ONDA); however, these institutions are charge by the registration and the protection of industrial, artistic or musical properties and not the promotion of innovation activities. In addition, academics consider that legislations prohibit them to engage in a second occupation that can create an effective contact with the industrial and economic sector[60]. Articles 44 and 181 of the Algerian

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[59] This finding documents our results in pages 129-131 of the current chapter about the collaboration preference for academics.

[60] See, for example, articles n° 44 and 181, section 6 from general status of the public service of Algeria: law n°44 of 16 July 2006.

law on public service status are very clear in this regards. While the last article considers gathering two occupations at the same time among highest violations, Article 44 prohibits completely this action and the delinquent risks to lose his job**.**

The lack of specialised organisations is another argument that explains the ignorance of innovation as a prominent resource for organisations of all kind in Algeria. The lack of devoted organisations limits the innovative and cooperative incentives since the risk of opportunistic practices increases. The spread of cooperation, as demonstrated in chapter 3, necessitates a clear institutional framework that guarantees duties and rights for every participant. According to Gardner et all (2009) if occasions for competition or cheating are restricted [through organisations], then actors can only increase their own success via increasing the success of their group. Accordingly, any instrument that aligns procreative interests or contains competition inside groups will favor higher levels of cooperation.

In the absence of such formal restrictions, cooperation may flourish if actors know each other and engage in a network of social contacts that form informal institutions. In a general sense, informal institutions refer to socially common rules, generally unprinted, that are created, communicated and enforced outside of formal canals. A convenient term to summarise the previous definition is social capital. Since in modern understanding, innovation that results from the combination of various forms of capital is an interactive social process that necessitates both formal and informal interactions between several actors cooperating through social networks. That is to say, higher levels of R&D, human capital, entrepreneurship and social capital positively correlate with higher levels of innovation. Therefore, social capital is not only vibrant for the operative functioning of societies, but it also has a positive influence on innovation in the knowledge economy. This means that economic actors facing low levels of social capital suffer large costs of transaction, bargaining, and decision, as well as a lack of coordination (Doh and Acs 2010). Social capital, as scholars define it, designates the norms and social relations that facilitate certain actions of actors within a social network; it is mainly composed by trust and the spread of communication (which aliment associational activities, membership, and civic norms). Trust is the core value for social exchange and communication; any entities either people, companies, and organizations need to have shared trust if they want to rise their effectiveness and productivity by decreasing monitoring time and cost. In that sense, Dakhli and De Clercq (2004) consider trust as a driver of innovation at the macro level and classify it into generalized trust and institutional trust. First type denotes the trust shared within a society, which reduces uncertainty and facilitates

interaction and communication. Institutional trust refers to the trust vis-à-vis organizations and institutions. If organizations and institutions contribute to exchange and communication and protect actors against breach of contract, people tend to cooperate with actors in other organizations and institutions. Therefore, both types of trust are considered as a proxy for social capital that fosters innovation as well as cooperation between actors. In Algeria, weak social capital hampers the setting up of collaboration between both ecologies of academia and industry. Institutional trust is regarded by both samples as one factor that handicaps a mutual engagement amidst researcher and local firms; however, industrialists demonstrated a very strong agreement in this regards. This response may explain the limited contact with the university, which is restricted to receiving students only (see page 141 of the present chapter). In general sense, country's specific results, obtained by the World Value Survey version 4 (2015), demonstrated that 85% of the Algerian interrogated sample were very careful in dealing with people, meaning that the spread of trust among the society is very limited. Further, results of the version 6 (2016) showed that people neither trust universities, nor they trust firms. On the other hand, both reports showed that individuals tend to trust their relatives, while the level of trustiness decreases with the degree of kinship. Consequently, mutual trust is weak between individuals and between individuals and organisations, and further is week among organisations.

   The reduced state of trust within the Algerian society must be linked to the near history of the country. The so-called "Black decade", named after the civil war of the 1990s, reshaped the way individuals behave against each other. This includes, when, where and how they meet. The desocialization was strengthened by the lack of communication practice between people. It is argued that social capital is promoted through collaborative learning that is insured by communication. This characteristic facilitates the flow of necessary information, which are needed for mutual acceptance. Enabling listening culture helps in understanding others and being focused on planned goals while respecting other's opinion as valid (one way of learning). As a result, communication strengthens, produces, stocks and disseminates trust among individuals, between individuals and organisations or between organisations themselves. Therefore, the absence of, or the weak level of communication is a proof of fragile social integration that demotivates cooperative culture through the society. In this regards, our samples were strongly agreed that the lack of communication between academics and individuals from industrial sector is behind the week level of collaboration between these ecologies. Tow third of them refer to the lack of communication as a major feature that diminishes the occasions of cooperation; the lack of communication or its feebleness leads to the construction of a solid and isolated barrier that

separates the parties from each other. Likewise, half of the respondents approve that this point contributes to or results from the absence of trust. Indeed, since parties do not trust each other, fewer occasions will happen to reassure their communication; while on the other hand, lack of communication will limit the understanding of each other's comportment, which in turn limit the trust building. Consequently, trustiness and communication are interconnected aspects that improve the level of cooperation between academia and enterprises in Algeria.

Up to now, we have verified the last three hypotheses. The results showed that the innovation ecosystem in Algeria lacks a solid institutional framework. The quality of generalized and institutional trust reflects the social capital network of individuals as well as organisations. Unconsciously, individuals bring their level of trust to their work place, and thus effect and be affected by the quality of trust other individuals bring too; this generalized trust, if combined with institutional trust, results in very limited trust between organisations. Evidently, cooperation between higher education institutes and enterprises is rather determined. The isolation of each actor limits the exchanges of ideas and the mobility of competences, which are restricted by the regulations. In addition, the institutional and regulative gap that provides a conducive environment for cooperation also has a role in reducing the rapprochement between the university and national corporations, as we have already pointed out. In this regard, the absence, even the lack of regulative, normative and cognitive forms of institutions disfavors the emergence of partnership activities in the Algerian innovation ecosystem. Moreover, these actors deny the benefit of innovation for their existence and survivor. We have noticed that most enterprises are not occupied with a R&D department; this may due, as respondents confirmed, to the nature of carried activities, mainly centered on the commerce in final goods or providing traditional services. Universities, for their part, tend to restrict their focus on providing theoretical learning, and consider the research activities as a financial burden that must be disposed of[61].

However, understanding why innovation is not considered as important element by universities, firms and authorities in Algeria, is highlighted in the last axis. The respondents were agree that the economic structure has a determinant influence on the creation of cooperation culture within the country. This includes undiversified economic activities, weakness of industrial sector, marginal role of private sector (including the marginal role of small and medium size enterprises or industries), non-competitive enterprises at global level and financial independency of higher education institutes (such independency reflects the quality of graduates skills, content of learning

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[61] Examples of this case are those related to PNR and CNEPRU projects

programs). Moreover, the financial independence of public firms in addition to government supports has limited the occasions of mutual contacts between public-private sectors, and between industrial sector and higher education institutes. As a result, no need has been delivering to promote innovative activities among these three actors. However, what make public enterprises and universities independent in their financial needs can be traced to the nature of country's revenues.

It is evident that great bulk of revenues is generated from hydrocarbons exports, where about 60% of these revenues aliment the government budget. This fact renders the public sector the dominant actor due to its participation shares in every socio-economic activity. Yet, public led-economy with dependency over energy exports was at the head list for severe critics of various researches. The aims were to testify the claims of the so-called "*Dutch Disease*" as an explanation of country's weak economic performances. Other researches verified the *resource curse* assumptions about oil rents and the quality of governance and institutions. Both effects, assembling together, explain the limited capacity of economic diversification in Algeria, due to difficulty in managing oil wealth. Such difficulty rises when relating these resources to institutions. as Benramdane (2017) and Ghecham (2013) pointed out, institutional settings hamper a serious engagement in varying economic activities due to the existence of constraints that disable and delay the process of industrialization. In this regards, one can relates the economic structure axis-being presented by the dominance of oil rents- with the institutional axis as such that the lack of specialised institutions is due to the willing of those in power to benefiting from oil revenues. The rentier state theory advances that in such case, the state does not rely on taxation for income and thus are released from democratic obligations to their taxpayers (Sandbakken 2006). This means that the ruling party does not need a healthy economy to finance itself (Akacem and Cachanosky 2016) which affects directly the quality of institutions in the country. In addition, Robinson et all (2006) and Torvik (2009) stated that resource dependency affects differently the incentives and the size of public and private sectors in the designed country. In an environment where property rights are not well defined, natural resources possibly will excite rapacity, rent-seeking, and further damaging and/or non-profitable activities, generating in turn adverse externalities for the rest of the economy. This will squeeze the private sector.

Conversely, public sector represents a considerable share in the economy, since the latter represents the playing field for politicians. Yet, this sector is characterized by major inefficiencies because politicians lead to increase the extent of patronage in order to stay in power. This fact will aliment corruption, rent seeking and the clientelism behaviors.

What these remarks add to the present study can be viewed from the lack of researches designed to link the resource dependency and the innovation capacity. To our best knowledge fewer are the researches in this area and further are very limited when referring to Algeria. An earlier work that related, unintentionally, energy revenues to innovation willingness was established by Van Wijnbergen (1984). The focal idea was that natural resource revenues (oil in the study) might reduce national revenues via a learning-by-doing channel. By discovering oil, individuals spend part of the value on consuming non-traded goods. Demand for these categories accrues, drawing resources out from traded sectors, which affect negative the production for these sectors. Squeezing traded sector means less occasions for learning by doing (viewed as a path to innovate), due to lack of competitiveness. In addition to this study, Torvik (2009) incorporated the impact of elites and lobbying that seek to preserve their advantages by blocking technological and institutional developments. This blocking augments if natural resources constitute the essence of public revenues. In addition, volatility in natural resources revenues will depress growth and innovation. With a continuous volatility in energy prices, local enterprises face liquidity pressures and thus are incapable of bearing costs of innovation projects, especially in a poor institutional environment, as Van der Ploeg and Poelhekke (2009) concluded. The limited capacity of some resource-rich economies to diversify their industrial bases arises with the increase of rent seeking behavior. The underlying mechanism assumes that natural resources rents surge the extent of entrepreneurs involved in rent seeking and decreases the number of entrepreneurs engaged in productive activities (Torvik 2002).

The increase of rent seeking comportment will harm further the quality of governance and institutions, which in turn derive resources out of productive sector, and therefore less opportunity to engage in innovative path. In our case, these observations may result in the failure to formulate explicit policies in the field of scientific research and innovation, marginalizing the role of researchers, providing annual programs of universities that work to achieve and succeed them regardless of actual consequences on the economy and society as a whole. An argument on these outcomes is delivered by Saad (2018) who stressed on the controlling role of government over all activities, including the control of higher education institutions that are called to respect the guidelines of authorities. In a resource-rich country, the corrupted public authority will disadvantage any opportunity of collaboration since rent seeking behaviors, as well as politician elite groups and lobbies, use resource rents to stay in power. Therefore, there is a very limited transformative capacity, from natural resource sector to the remaining sectors in the country, due to the fragile nature and slightness of the learning procedure. Djeflat and Lundvall (2016) in this

context, refer to the Algerian giant company and how it fails to fund adequately the learning and the innovation process. They argument this view as follow:

"The *hydrocarbon sector has not been irrigating knowledge throughout the rest of the economy partly as the interactive learning, innovation and competence building did not take place throughout the economy. While the hydrocarbon sector contributed massively to financing investments plans and programmes throughout the period, it failed to fund adequately the learning and the innovation process. Internally, the budget for R&D activities remained dismal. Externally, thus no initiative was taken to constitute an equity funds and venture capital. It must be added though that government policy did not help in the face of a fragmented and non-existent NIS. Finally, corruption has contributed to strengthen the resorting to foreign suppliers of technological products and services at the expense of local 'infant' engineering services*."

Therefore, economic structure of the country has contributed to limiting the contact between various sector in the domain of innovation and knowledge creation. Driouchi (2014) consider natural resources as a curse to the expansion of knowledge economy in the resource-rich Arab countries. Even the channel is not yet empirically approved; the negative impacts can be transmitted, as we have seen, mainly through the quality of institutions and governance. Rent seeking and elites' willing to stay on power provoke the nomination of unqualified persons at high key positions. No doubt, corruption expands and ramps to different sectors in the country. This includes expansion of public sector, especially when natural resources' extraction enters within the jurisdiction of government dominance or constitutes its main activities. As a result, the politicians of the ruling party finance the public sector in counterpart of obeying their policies or nominating individuals at the head of key public positions. In addition, the government applies lower taxes to citizens, because most of its revenues from mineral exports; this reduces the likelihood of accountability from representatives of citizens.

Conclusion:

The questionnaire demonstrates a strong link between collaboration and the quality of local institutions. Both of samples confirmed this link. For academics, the spread of governance has a remarkable impact on the establishment of partnership of bilateral or trilateral parties. Indeed, about 58.4% of academics are firmly agree on the passive role played by formal institutions in the promotion of collaboration between local active actors. Their view is more supported by the insufficiency of specialised organisms that advertise, enhance and accompany prominent programs. Industrialists, too, agree on the role of institutions impact in determining the development of university-industry collaboration in Algeria. However, they strongly agree on the

importance of social capital in harnessing partnership. The weakness of institutional body is the foremost factor that hinders the emergence of partnership between the industrial sector and higher education institutions. That is to say, government does not play its role in establishing a clear legal framework that contributes to bringing closer and facilitating cooperation between them. Such weakness reflects the insufficient number of specialised organisations that frame effective cooperation between the industrial sector and universities; that is why in a third stance, respondents considered that government disengagement could clearly be grasped by the absence of national view about innovation. This is a further argument that explains the lack of active specialised organisations such as sciences parks. Therefore, we can conclude that institution really affect the development of U-I-G collaboration at least in Algeria.

The reaction of academics on the innovation aspects goes in similar stream to the previous aspects. With 61.8%, academics stressed on the denying of prominent role of innovation by local enterprises. In this regards, they were strongly agree (52, 8%) on this fact and remark that national enterprises are not aware about the importance of innovation in terms of growth and revenue generation. Corporations do not attach particular importance to the role of innovation, which is widely depicted by the absence of R&D departments. This fact is a third stance where academics were strongly agree on (49.4% of total respondents). On the other hand, academics agreed on the role of firm's size, while this effect is of limited impact on the enhancement of innovation within enterprises. Only 13.5% of the sample considers the positive impact of the size. However, industrialists were not sure whether the type of activity could really affect the innovative capacity of the organisations. Nevertheless, they are remarkably agreed (71%) that the absence of R&D departments in enterprises affects in passive way the drawing of common innovation policy among actors. The same reaction is observed for the denying of positive role of innovation on revenue generation or development plan of enterprises. Finally, they are strongly agreed on the negative effect of the absence of national horizon on innovation; this can be attributed to the passive role of government in mobilizing regulations and setting up laws that frame a clear strategy for promoting innovation and knowledge status in the country.

In a third stance, the impact of economic structure on the conduct of cooperation between actors, academics point of view tends generally to agreeing such influence. About 42% of the total estimated responses agree that Algerian economic structure, past and present conduct, affect in somehow the establishment of beneficial relationship between actors. Additional 24.4% of responses strongly admit the link between economic structure and the existence of cooperative network. The agreement is well observed with the first expression about economic diversity and

industrial presence. In this regard, about two third of the sample (devised as 51.7% agreeing and 14.6% strong agreeing) endorse the view that weak industrial sector is at the origin of the lack of cooperation between the university and the industrial sector. Further, the reliance on few sources limits the occasion of setting up a convergent policy between different parties, in order to promote the desired economic sustainability. In addition, more than 50% of academics were either agree or strongly agree that private sector does not play a remarkable role in the local economic life.

Weakness of institutional body, in the case of Algeria can be traced to the economic structure. This later is characterised by the dominance of hydrocarbons sector as discussed in the previous chapter. However, relying on such resources has a negative channel on other sectors and different aspects of economic and social environment; a famous negative effect is reflected by the exclusion of other sectors in the generation of wealth. An average mean of 3.4 indicates that respondents agree on the fact that a diversified economy facilitates the spirit of collaboration and improvement of innovation level. On the other hand, respondents agree that since the university receive it financing from the government, it will be less oriented to cooperate with it external ecosystem, by integrating the economic and social needs in programs. In this regard, respondents strongly agreed of the link between collaboration behaviour and financial sufficiency of actors. On the other side, organizations refuse to send employees for training at universities, since these later propose outdated programs and passive curricula. In a similar vein, enterprises, complains from incompetent graduates, whose skills are under job market requirements, on one hand and reflect the programs quality as well training capacity at universities.

Finally, we record a strong agreement of academics it what concern social capital dimension. In this rubric, 96 of estimated responses (about 53.9%) demonstrate strong responsiveness to social capital components. A specific focus was put on the lack of communication among actors, while 67.4% of the sample strongly agrees about the role of communication in facilitating the formation and the development of cooperation among actors within the innovation ecosystem in Algeria. The lack of communication does not permit the creation of attempts that help to understand the authenticity of each party, which in turn allows providing a comprehensive overview of the needs and requirements of involved parties. In this case, firms do not expose their requirement that graduates must acquire. Universities, on the other hand, are incapable to offer typical graduate, which fit labor market conditions. In addition, both, industrial sector and universities cannot conceptualize public need and will not able to direct their resource to satisfy society's need. Since each party acts in isolation, the government will not be able to determine the level or location, as well the nature of infrastructures and resources to be provided. For industrialists, Outcomes on

social capital axis reveal a strong agreeing of respondents on both expressions. Therefore, they consider the quality of trust as foremost variable that either hinder or enhance the level of development between possible actors. The absence or weak level of trustiness reflects the degree of communication. Lacking trust reduces the occasions of meeting that helps in the understanding of other position and needs. In contrast, low level of communication discourages the creation of trust. Therefore, there is a reciprocal link between trust and communication, which influence and be influenced by the each other.

SUMMARY
AND
CONCLUSIONS

Introduction

This section summarises the findings of this research, linking them together and locating them within previous research on the factors that contributes to the implementation of cooperation between University, industry and the government in the developing countries, by referring to Algeria as case study. The chapter also discusses the policy implications of the findings, describes the limitations of the research and provides some suggestions for further research in the field. In first stance, we review the research objectives and questions. The overarching research question, which guided this research, and the three operational research questions of this thesis are addressed. The following point combines and summarizes the findings and explains the main contributions of the thesis. Point three discusses the theoretical contribution of the study policy, which can be drawn from the findings. The limitations of the research and suggestions for future research are discussed in the last stance.

i- Research objectives and questions

The significance of this research study comprises of an examination of the complex relationship between university, industry and government in Algeria. It attempts to present a broader picture on the conduct of National Innovation System within the Algerian ecosystem. This ecosystem, which is charcterised by a heavy dependency on resource extraction and exports and weak innovation capability. This paradigm is regenerated in some resource rich developing countries where knowledge economy is fragile. One can refers to this fragility to the very limited contact between higher education institutes and industrial sector in the domain of research and development or to the overlapping model of the triple helix when the government controls both sectors. However, comparing results from various national and international reports calls for deeper understanding of the possible factors that limit the emergence of effective collaboration between the three strands. Therefore, the research sought to provide and answer the main question that is articulated around the reasons for weak cooperation in terms of innovation and R&D in Algeria. The research topic was to understand the development of University-Industry-Government relationship within the context of developing countries in general and particularly in Algeria. Referring to this country as a case study represents our interest to understand the actual

circumstances that surround and guide the national ecosystem. We focus on this country for further raisons. This includes our belonging and origins; as an Algerian, we found ourselves under the obligation to study various aspect of this country especially the socio-economic aspect. In addition, most of existing studies are done by foreign researchers or institutions. Such studies lack precisions and validities due to the miss understanding of the actual reality of the country and trying to apply the results of international studies on this country, which reduces the credibility of the results. Hence, the study, which is being conducted by researchers from within the country, is more realistic and credible, considering that the researcher tries to translate the reality within a framework that corresponds to the country's reality. Third, through this study, we try to expand our previous research study on the impact of resource dependency on various aspects of the country. Studies on knowledge management and innovation focus on institutional readiness, governance quality, planning for innovation by local enterprises, the spread of trust and communication as well as the spread of social capital norms. However, little attention has been made on the relationship between resources abundance and innovation capacity in developing countries. In this context, the thesis main question was:

What are the factors that affect the collaboration between university-industry-government in developing countries and in Algeria precisely?

Three sub questions were generated to address the previous one. These questions that address the state of trilateral collaboration in Algeria were:

How these actors are structured?

Are they presenting one of the model described in the literature?

And at where level the cooperation between these actors can be measured?

The underlying theoretical framework we conducted refers to the main research hypotheses. The thesis hypothesised that weak institutional aspects have a decisive role in framing an overall conduct on innovation policy within the country. Indeed, researches on innovation systems consider that institutions affect significantly the comportment of partnership. The theory of institution, in this stream, involves regulatory, normative and cultural measures that prompt, implement, and bound social and economic actions. In addition, the study stressed on the importance of innovation as both process and system in the implementation of collaboration between parties. In this regards, innovation theory brought insights on the implication of innovation at earlier stage of planning for enterprises and authorities. These planning refer to the process path that local enterprises undergo to strengthen their competitiveness. The authorities, in a parallel action, plan for national system, which favours local environment for better collaboration. Accordingly, the thesis hypothesised that these planning, in companion of good

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institutional reputation will spread social capital culture. We have seen that innovation results from combinations of physical forms of capital in conjunction with elusive forms of capital, characterized by disorderly and sustained interactions occurring between firms and diversified sets of actors. Finally, we hypothesized that the countries' economic structures affect the positive implementation of triple helix culture in Algeria. This indeed refers to the heavy reliance on natural resource exports, which according to resource curse literature and rentier state theory affect the quality of institutions and governance. The following point summarises the main findings.

ii- Summary of Main Findings

In general, the results presented from the analysis in chapter five claim the validity of the research hypotheses. For example, the questionnaire proves a robust connexion between collaboration and the institutions. About 58.4% of academics are decisively agree on the inactive role played by formal institutions in the advancement of partnership among local active actors. Industrialists, else, agree on the impact of institutions in defining the progress of university-industry collaboration within the country. In addition, both are intensely agree on the importance of social capital in binding partners. The faintness of institutional body is the leading feature that delays the development of partnership between the industrial sector and higher education institutions. That is to say, government does not play its role in creating a clear legal agenda that contributes to bringing closer and facilitating cooperation between them. Such weakness reflects the inadequate number of dedicated organisations that frame effective cooperation between the industrial sector and universities; that is why in a third stance, respondents considered that government disengagement could clearly be grasped by the absence of national view of innovation.

The results showed that both samples deny the role of innovation, which reflect the neglecting of innovation process and system in the country. Indeed, academics were strongly agree on this fact and mention that national enterprises neglect the importance of innovation in terms of growth and revenue generation, which is depicted by the absence of R&D departments. Industrialists were too agree that the absence of such departments negatively affect the drawing of common innovation policy between actors. They are strongly agreed on the damaging effect of the absence of national horizon on innovation; this can be attributed to the submissive role of government in mobilizing guidelines and setting up laws that frame a clear strategy for promoting innovation and knowledge status in the country.

Similarly, the results showed a strong agreement on the impact of social capital in establishing collaboration in Algeria. A specific focus was put on the lack of communication among actors, while 67.4% of the sample strongly agrees about the role of communication in facilitating the

formation and the development of cooperation among actors within the innovation ecosystem within the country. In such case, industrial sector does not expose it requirement that graduates must acquire. Universities, on the other hand, face shortness in providing typical graduates with required qualifications. Besides, both sectors cannot conceptualize the public needs and will not be able to direct their resource to satisfy social needs. The results argue that respondents consider trust as the chief variable that affect positively or negatively the development of collaboration between actors. The absence or weak level of trustiness mirrors the degree of communication. Lacking trust reduces the occasions of meeting that helps in the understanding of other position and needs. In contrast, low level of communication discourages the creation of trust.

The findings further confirm the link between economic structure and the collaboration. About 42% of the total responses agree that Algerian economic structure affects the establishment of advantageous association between higher education institutes, local enterprises and national authorities. Further, about two third of the sample endorse the fact that weak industrial sector is at the origin of the lack of hybrid model of triple helix in Algeria. The reliance on resources extraction has an undesirable conduit on other sectors, through the exclusion of other sectors in the generation of wealth. An average mean of 3.4 indicates that respondents agree on the fact that a diversified economy facilitates the spirit of collaboration and improvement of innovation level. On the other hand, respondents agree that since the university receive it financing from the government, it will be less oriented to cooperate with it external ecosystem.

iii-Theoretical Contribution of the Study

The current thesis has a considerable theoretical contribution. It aligns with the existing literatures on the factors that indorse collaboration between the university, the industrial sector and the authorities to promote innovation capacity. The thesis confirms that lack or weakness of formal institutions is considered as a problematic factor to deal with. Developing countries, in general and Algeria in particular, suffer from inadequate institutional status not only for promoting innovation and for knowledge economy, but it overcomes most social life including political, economic, cultural aspects. In Algeria, denying the role of innovation by most actors in Algeria finds its roots within the institutional settings. We have seen that both samples were agreed that the weakness of institutional aspect contributes to postponing the appearance of collaboration between higher education institutes and industrial sector. The weakness of formal institutions continues to obstruct the whole behaviour of the economy, as well the country. This is echoed by the deficiency of specialised organisations that guarantee the advancement of mutual collaboration. Therefore, there is a notable weakness in framing policies for property rights and their protection. That is to say,

the more there are institutional barriers less are the occasions of founding partnership between actors. Differently stated, innovation flourishes where property rights are protected and strengthened. In the same manner, controlling corruption and good judiciary system have a remarkable impact on the rate innovation can expand. Our results displayed a comparable understanding of the active role of institutions in encouraging innovation activities and collaborative efforts. According to a GDSRTD report, there is a very limited number of registered inventions during the current decade. The weak capacity of invention reflects the deficiency of specialised organisations, which are represented by INAPI and ONDA. The lack of devoted organisations limits the innovative and cooperative motivations since the risk of opportunistic practices increases. The spread of cooperation requires a clear institutional context that promises responsibilities and rights for every contributor.

The thesis also agree with literatures that focus on the role of social capital in the promotion of collaboration activities. In this regards, innovation results from the combination of various forms of capital, which are the outcome of a social process that demands both formal and informal interactions between several actors cooperating through social networks. Therefore, a developed level of R&D, human capital, entrepreneurship and social capital positively correlate with higher levels of innovation. Social capital is not only vibrant for the operative functioning of societies, but it has an affirmative stimulus on innovation. Economic actors facing low levels of social capital suffer large costs of transaction, bargaining, and decision, as well as a lack of coordination. In Algeria, fragile social capital impedes the setting-up of partnership between both ecologies. Institutional trust is regarded as one factor that handicaps a reciprocal engagement amidst researcher and local firms. Moreover, the lack of, or the weak level of communication is an additional proof of delicate social integration that discourages cooperative values within the country. The isolation of each actor limits the exchanges of ideas and the mobility of competences, which are constrained by the regulations. The absence of regulative, normative and cognitive forms of institutions disfavors the emergence of partnership activities in the Algerian innovation ecosystem.

Yet, the novelty of the thesis resides in the attempts to link innovation capacity to the resource curse hypothesis. Theories of rentier state and resource curse state that countries heavily dependent on natural resources will face various kind of problems at political, societal and economic level. The abundance of natural resources tends to expand the size of public sector, which controls almost all aspects of the society. As researches demonstrated institutional settings hamper the engagement in varying economic activities due to the existence of constraints that disable and delay the process of industrialization. Further, in an environment where property rights are not well defined, natural

resources probably will stimulate greediness and rent-seeking behaviours. In addition, Torvik incorporated the impact of elites and lobbying that seek to preserve their rewards by obstructing technological and institutional progresses. This blocking amplifies if natural resources constitute the essence of public incomes. Further, instability in natural resources revenues will reduce growth and innovation. The limited capacity of some resource-rich economies to diversify their industrial bases arise with the intensification of rent seeking comportment. The underlying mechanism assumes that natural resources rents surge the size of entrepreneurs involved in rent seeking and reduce the number of entrepreneurs involved in productive activities. The increase of rent seeking attitude will damage further the quality of governance and institutions, which in turn derive resources out of productive sector, and therefore less opportunity to engage in innovative activities. In a resource-rich country, the corrupted public officers will handicap any occasion of collaboration, since rent seeking behaviors, as well as politician elite groups and lobbies, use resource rents to stay in power. Consequently, there is a restricted transformative capacity, from natural resource sector to the remaining sectors in the country, due to the delicate nature and weakness of the learning procedures. Therefore, economic structure of the country has contributed to prevent the interaction between various sector in the domain of innovation and knowledge creation in the sense to consider natural resource as a real curse to the expansion of the triple helix culture in Algeria.

iv-Limitations of the Study and Directions for Further Researches

The study contributes to the theoretical and empirical literatures that try to understand the development of university-industry-government partnership in developing countries. By referring to Algeria as the case study, the thesis underlines the prominent role of institutions and social capital in the development of the triple helix culture. Further, it highlights briefly the various channels that link natural resource to knowledge economy and innovation status. In addition, the use of questionnaire to examine the possible factors is also a contribution to the existing literatures. However, it faced some limitations. One problematic issue that faces most researchers in Algeria is the provision with reliable information and data that fit better with research question. In our case, we faced passive reaction with both samples. For more than six months, we received less than 200 replies from our colleagues; even we had expected to receive more than this number. Further, we have e-mailed the GDSRTD to provide us with all possible contracts that have been signed with non-academic sector; unfortunately, we did not receive any replay up to now. This however endorses our results that even colleagues from the same sector have very limited contact among them and therefore explains lower level of communication between academics. On the

other hand, we have addressed a considerable number of enterprises via El-Mouchir[62] platform and we did not select a specific sector to focus on. Industrialists had filled only less than 50 replies during six months. In addition, we restricted our research to people from universities only; that is to say, we omitted to address researchers working at research organisations. However, these limitations offer fertilized ground to further researches in this field of study. There is a notable missing in the study of the Algerian innovation system in general and the state of knowledge economy in particular. Algeria as a largest country in Africa must be leader in this domain, since the economy still in needs of big push to an effective departure. One can study the opportunities that the innovation system can offer to the country. This may be done through the empirical investigations of innovation systems models or the triple helix approach. Similarly, further researches may focus on an essay to model resource curse with knowledge economy. The rentier state approach with resource curse theory did not address the possible transitive channels that the dependency on natural resources have on the implementation of knowledge economy. This fact is further observed in resource-rich Arab countries, where there is a remarkable paradox between the dependency of hydrocarbons, lack of governance and kleptocracy, political instability, less economic growth and low levels of innovation capacities.

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[62] See the following link : http://elmouchir.caci.dz/

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APPENDIX

Institutional axis results	Strongly desagree		disagree		neutral		agree		Strongly agree		Mean	Standard Divination	Trend
	Frequency	%	Frequency	%	Frequency	%	Frequency	%	Frequency	%			
Weak institutional body	0	0,0	5	4,0	22	17,7	73	58,9	24	19,4	3,94	,73	Agree
No clear regulation about IP	2	1,6	11	8,9	48	38,7	52	41,9	11	8,9	3,48	,84	Agree
Unsufficient of specialised organizations	0	0	1	,8	20	16,1	54	43,5	49	39,5	4,23	,74	Strongly Agree
General Trend	**2**	**0.54**	**17**	**4.57**	**90**	**24.19**	**179**	**48.12**	**84**	**22.58**	**3,88**	**,47**	**Agree**
Source : author calculation using the questionnaires													

Appendix 1 : Questionnaire Outcomes : detailled results.

Innovation axis results	Strongly desagree		disagree		neutral		agree		Strongly agree		Mean	Standard Divination	Trend
	Frequency	%	Frequency	%	Frequency	%	Frequency	%	Frequency	%			
Absence of national view about innovation and invention	0	0,0	1	,8	6	4,8	42	33,9	75	60,5	4,54	,63	Strongly Agree
Industrial sector is not aware about the importance of innovation as a key source of growth and revenue	0	0,0	4	3,2	8	6,5	58	46,8	54	43,5	4,31	,73	Strongly Agree
Absence of R&D department in most enterprises	0	0	4	3,2	14	11,3	54	43,5	52	41,9	4,24	,78	Strongly Agree
General Trend	**0**	**0**	**9**	**2.42**	**28**	**7.53**	**154**	**41.4**	**181**	**48.66**	**4,36**	**,51**	**Strongly Agree**
Source : author calculation using the questionnaires													

Economic structure axis results	Strongly desagree		disagree		neutral		agree		Strongly agree		Mean	Standard Divination	Trend
	Frequency	%	Frequency	%	Frequency	%	Frequency	%	Frequency	%			
Weak industrial body and undiversified economy	0	0,0	10	8,1	39	31,5	60	48,4	15	12,1	3,70	,799	Agree
Universities are sufficiently independent in term of financing	2	1,6	7	5,6	17	13,7	37	29,8	61	49,2	4,20	,986	Agree
General Trend	**2**	**0.81**	**17**	**6.85**	**56**	**22.58**	**97**	**39.11**	**76**	**30.65**	**4,07**	**,581**	**Agree**
Source : author calculation using the questionnaires													

Social capital axis results	Strongly desagree		disagree		neutral		agree		Strongly agree		Mean	Standard Divination	Trend
	Frequency	%	Frequency	%	Frequency	%	Frequency	%	Frequency	%			
Absence of trust	5	4,0	9	7,3	10	8,1	37	29,8	63	50,8	4,16	1,11	Strongly Agree
Actors do not communicate with each other	1	,8	0	0	3	2,4	38	30,6	82	66,1	4,61	,62	Strongly Agree
General Trend	**6**	**2.42**	**9**	**3.63**	**13**	**5.24**	**75**	**30.24**	**145**	**58.47**	**4,39**	**,65**	**Strongly Agree**
Source : author calculation using the questionnaires													

Table : Overall Trend Of Both Samples												
	Strongly desagree		disagree		neutral		agree		Strongly agree		Mean	Standard Divination	Trend
	Frequency	%	Frequency	%	Frequency	%	Frequency	%	Frequency	%			
Axis 1	2		17		90		179		84		3,88	,47	Agree
Axis 2	0		9		28		154		181		4,36	,51	Strongly Agree
Axis 3	2		17		56		97		76		4,07	,581	Agree
Axis 4	6		9		13		75		145		4,39	,65	Strongly Agree
Overall trend	**10**	**0.81**	**52**	**4.19**	**187**	**15.1**	**505**	**40.73**	**486**	**39.19**	**4.13**	**.34**	**Agree**
Source : author calculation using the questionnaires													

Appendix 2

Normality test with equivalent histograms

Descriptive			Statistic	Std. Error
	respondent's groups			
mean of respondents	academia	Skewness	-.673	.255
		Kurtosis	-.003	.506
	other	Skewness	.184	.398
		Kurtosis	.008	.778
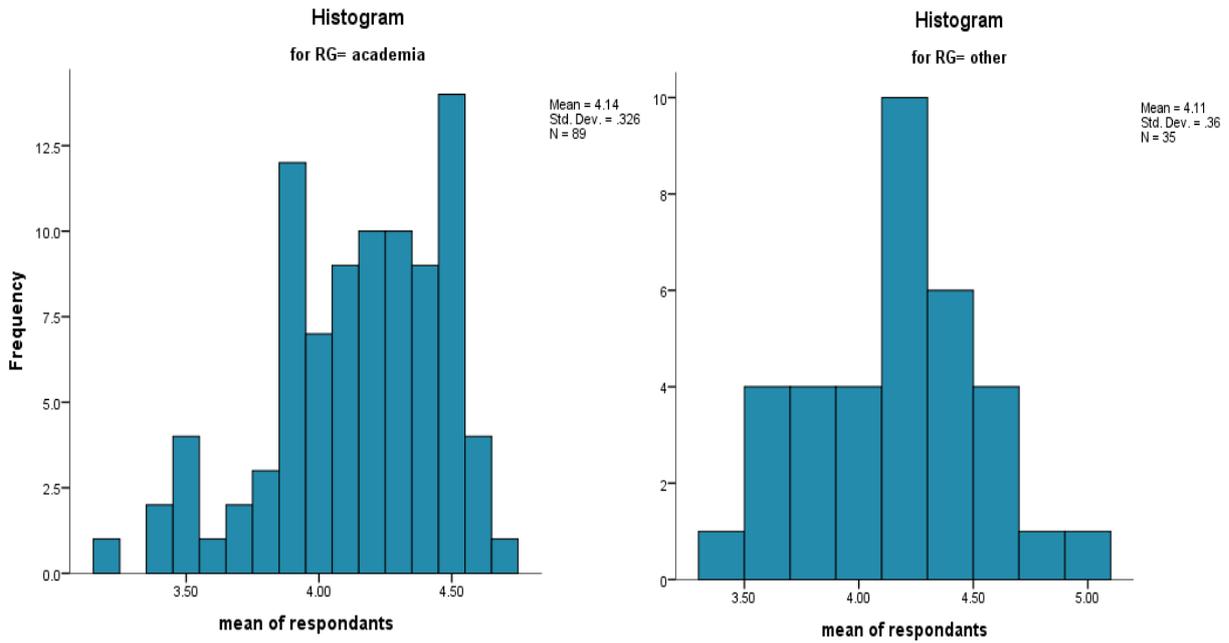
Tests of Normality		Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	respondent's groups	Statistic	df	Sig.	Statistic	df	Sig.
mean of respondents	academia	.111	89	.009	.946	89	.001
	other	.122	35	.200[*]	.971	35	.481
*. This is a lower bound of the true significance.							
a. Lilliefors Significance Correction							

mean of respondants

meanDEV

Descriptives			
		Statistic	Std. Error
mean of respondants	Skewness	-.395	.217
	Kurtosis	-.112	.431
meanDEV	Skewness	1.194	.217
	Kurtosis	.983	.431

Tests of Normality						
	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
mean of respondants	.103	124	.002	.972	124	.011
meanDEV	.210	124	.000	.859	124	.000
a. Lilliefors Significance Correction						

Appendix 3

Mann-Whitney Test

Ranks

	respondants groupes	N	Mean Rank	Sum of Ranks
social capital	academia	89	58.44	5201.50
	other	35	72.81	2548.50
	Total	124		
institutions	academia	89	63.84	5682.00
	other	35	59.09	2068.00
	Total	124		
innovation_RBV	academia	89	66.87	5951.00
	other	35	51.40	1799.00
	Total	124		
economic structure	academia	89	63.35	5638.00
	other	35	60.34	2112.00
	Total	124		

Test Statistics[a]

	social capital	institutions	innovation_RBV	economic structure
Mann-Whitney U	1196.500	1438.000	1169.000	1482.000
Wilcoxon W	5201.500	2068.000	1799.000	2112.000
Z	-2.093	-.684	-2.208	-.439

Asymp. Sig. (2-tailed)	.036	.494	.027	.661

a. Grouping Variable: respondants groupes

Two-Sample Kolmogorov-Smirnov Test

Frequencies

	respondants groupes	N
social capital	academia	89
	other	35
	Total	124
institutions	academia	89
	other	35
	Total	124
innovation_RBV	academia	89
	other	35
	Total	124
economic structure	academia	89
	other	35
	Total	124

Test Statistics[a]

		social capital	institutions	innovation_RBV	economic structure
Most Extreme Differences	Absolute	.211	.083	.323	.073
	Positive	.211	.034	.011	.034

	Negative	-.017	-.083	-.323	-.073
Kolmogorov-Smirnov Z		1.057	.414	1.619	.365
Asymp. Sig. (2-tailed)		.214	.996	.011	.999

a. Grouping Variable: respondants groupes

Tests of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
mean of respondants	.103	124	.002	.972	124	.011
meanDEV	.210	124	.000	.859	124	.000

a. Lilliefors Significance Correction

Nonparametric Correlations

Spearman rho correlation results (between axes):

			social capital	instituti ons	innovatio n_RBV	economic structure
Spearman's rho	social capital	Correlation Coefficient	1.000	.219[*]	.024	.292[**]
		Sig. (2-tailed)	.	.015	.789	.001
		N		124	124	124
						124

institutions	Correlation Coefficient	.219[*]	1.000	.196[*]	.424[**]
	Sig. (2-tailed)	.015	.	.029	.000
	N	124	124	124	124
innovation_RBV	Correlation Coefficient	.024	.196[*]	1.000	.211[*]
	Sig. (2-tailed)	.789	.029	.	.019
	N	124	124	124	124
economic structure	Correlation Coefficient	.292[**]	.424[**]	.211[*]	1.000
	Sig. (2-tailed)	.001	.000	.019	.
	N	124	124	124	124

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

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

Hypothesis Test Summary

	Null Hypothesis	Test	Sig.	Decision
1	The distribution of absence of trust is the same across categories of respondants groupes.	Independent-Samples Mann-Whitney U Test	.001	Reject the null hypothesis.
2	The distribution of absence of trust is the same across categories of respondants groupes.	Independent-Samples Kolmogorov-Smirnov Test	.002	Reject the null hypothesis.
3	The distribution of actors do not communication with each other is the same across categories of respondants groupes.	Independent-Samples Mann-Whitney U Test	.554	Retain the null hypothesis.
4	The distribution of actors do not communication with each other is the same across categories of respondants groupes.	Independent-Samples Kolmogorov-Smirnov Test	1.000	Retain the null hypothesis.
5	The distribution of weak institutional body is the same across categories of respondants groupes.	Independent-Samples Mann-Whitney U Test	.109	Retain the null hypothesis.
6	The distribution of weak institutional body is the same across categories of respondants groupes.	Independent-Samples Kolmogorov-Smirnov Test	.919	Retain the null hypothesis.
7	The distribution of no clear regulation about IP is the same across categories of respondants groupes.	Independent-Samples Mann-Whitney U Test	.312	Retain the null hypothesis.
8	The distribution of no clear regulation about IP is the same across categories of respondants groupes.	Independent-Samples Kolmogorov-Smirnov Test	.657	Retain the null hypothesis.
9	The distribution of unsufficient of specialised organizations is the same across categories of respondants groupes.	Independent-Samples Mann-Whitney U Test	.381	Retain the null hypothesis.
10	The distribution of unsufficient of specialised organizations is the same across categories of respondants groupes.	Independent-Samples Kolmogorov-Smirnov Test	.907	Retain the null hypothesis.
11	The distribution of absence of national view about innovation and invention is the same across categories of respondants groupes.	Independent-Samples Mann-Whitney U Test	.661	Retain the null hypothesis.
12	The distribution of absence of national view about innovation and invention is the same across categories of respondants groupes.	Independent-Samples Kolmogorov-Smirnov Test	1.000	Retain the null hypothesis.

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

Hypothesis Test Summary

	Null Hypothesis	Test	Sig.	Decision
13	The distribution of industrial sector is not aware about the importance of innovation as a key source of growth and revenue is the same across categories of respondants groupes.	Independent-Samples Mann-Whitney U Test	.001	Reject the null hypothesis.
14	The distribution of industrial sector is not aware about the importance of innovation as a key source of growth and revenue is the same across categories of respondants groupes.	Independent-Samples Kolmogorov-Smirnov Test	.009	Reject the null hypothesis.
15	The distribution of absence of R&D department in most enterprises is the same across categories of respondants groupes.	Independent-Samples Mann-Whitney U Test	.148	Retain the null hypothesis.
16	The distribution of absence of R&D department in most enterprises is the same across categories of respondants groupes.	Independent-Samples Kolmogorov-Smirnov Test	.057	Retain the null hypothesis.
17	The distribution of weak industrial body and undiversified economy is the same across categories of respondants groupes.	Independent-Samples Mann-Whitney U Test	.027	Reject the null hypothesis.
18	The distribution of weak industrial body and undiversified economy is the same across categories of respondants groupes.	Independent-Samples Kolmogorov-Smirnov Test	.238	Retain the null hypothesis.
19	The distribution of universities are sufficiently independent in term of financing is the same across categories of respondants groupes.	Independent-Samples Mann-Whitney U Test	.385	Retain the null hypothesis.
20	The distribution of universities are sufficiently independent in term of financing is the same across categories of respondants groupes.	Independent-Samples Kolmogorov-Smirnov Test	1.000	Retain the null hypothesis.

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

«Understanding the Development of University-Industry-Government Partnership within the Context of Developing Countries: The Case of Algeria»

Abstract:

Collaboration became the predominant aspect of economic life. Countries that promote partnership among various actors in the local ecosystem are the world leaders or are among emerging economies. Further, the characteristic of such collaboration is strongly favoured in innovative programs that lead to the contribution of local authorities, industrials and higher education institutes. Yet, developing economies still struggling for catching-up, know a weak level of connectedness among these three strands. One reason for this case is the long-standing period of war (colonisation and civil war) which was intensified by the abundance of natural resources. The research tries to look for further factors that hamper the development of university-industry-government partnership in developing economies by referring to Algeria as a case study. The main result, which was obtained by a statistical analysis of a questionnaire, demonstrates that institutions, the place of innovation as a resource as well as social capital dimension of actors have a decisive role in the weak level of collaboration in Algeria.

Key words*: Triple Helix. Innovation System Linked Ecologies Democratic Competitiveness Collaboration.*

« Comprendre le développement du partenariat entre Université-Industrie-Gouvernement dans les pays en développement : le cas de l'Algérie »

Résumé :

La collaboration est devenue l'aspect prédominant de la vie économique. Les pays qui favorisent le partenariat entre les différents acteurs de l'écosystème local sont les leaders mondiaux ou font partie des économies émergentes. En outre, la caractéristique d'une telle collaboration est fortement favorisée dans les programmes innovants qui mènent à la contribution des autorités locales, des industriels et des instituts d'enseignement supérieur. Pourtant, les économies en développement qui cherchent à rattraper leur retard, connaissent un faible niveau de connexion entre ces trois éléments. Cet état de fait peut s'expliquer par l'instabilité économique et politique qui caractérisent un certain nombre de ces pays. L'abondance des ressources naturelles a certainement aussi contribuée à cette situation. Notre travail tente de trouver d'autres facteurs qui entravent le développement du partenariat université-industrie-gouvernement dans les économies en développement. Dans ce cadre, nous avons étudié le cas de l'économie algérienne. Le résultat auquel nous sommes arrivés, montre que d'une part, les institutions, l'innovation et d'autre part, la dimension du capital social des acteurs, expliquent en grande partie le faible niveau de collaboration en Algérie.

Mots clés*:Triple Helices. System D'innovation. Ecologies Liées. Compétitivité Démocratique. Collaboration*

« محاولة فهم تطور الشراكة بين الجامعة-القطاع الصناعي-الحكومة في الدول النامية: دراسة حالة الجزائر »

الملخص:

أصبحت عملية التعاون العنصر المهيمن للحياة الاقتصادية. فالبلدان التي تعطي قيمة أكبر للشراكة بين مختلف الجهات الفاعلة في النظام البيئي المحلي هي التي تقود العالم أو هي من بين الاقتصادات الناشئة. وعلاوة على ذلك، فإن سمة هذا التعاون ترتكز في البرامج الابتكارية التي تفضي إلى مساهمة السلطات المحلية، الصناعات ومعاهد التعليم العالي. على العكس من ذلك، فإن الاقتصادات النامية التي لا تزال تكافح من أجل اللحاق بالركب، تعرف مستوى ضعيفا من الترابط بين هذه الفروع الثلاثة. وأحد أسباب هذه الحالة هو فترة الحرب الطويلة (الاستعمار والحرب الأهلية) التي أتسعت بسبب وفرة الموارد الطبيعية. وتحاول الأطروحة البحث عن المزيد من العوامل التي تعوق تطور الشراكة بين الجامعات والصناعة والحكومات في الاقتصادات النامية من خلال الإشارة إلى الجزائر كدراسة حالة. وتظهر النتائج الرئيسية التي تم الحصول عليها من خلال تحليل إحصائي للاستبيان أن المؤسسات ومكان الابتكار كمورد فضلا عن البعد الاجتماعي لرأس المال من الجهات الفاعلة لها دور حاسم في ضعف مستوى التعاون في الجزائر.

كلمات مفتاحية: المروحة الثلاثية. نظام الابداع. البيآت المترابطة.التنافسية الديمقراطية. التعاون