Global Institute for Sustainable Prosperity

Working Paper No. 113
July 2016

Paradigm Shift in Sustainable Economic and Ecological Development: *The Case of Tunisia*

Sonia Ben Slimane

Professor of Entrepreneurship and Innovation, Novancia Business School, Paris, France

Jerry Courvisanos

Research Scholar, Global Institute for Sustainable Prosperity

Associate Professor of Innovation and Entrepreneurship, Federation Business School, Federation University Australia

Hatem M'henni

Professor of Economics, Higher School of Business, ESCT, Manouba University, Tunisia

Paradigm Shift in Sustainable Economic and Ecological Development:

The Case of Tunisia[*]

Sonia Ben Slimane
Professor of Entrepreneurship and Innovation,
Novancia Business School, Paris, France

Jerry Courvisanos
Research Scholar, Global Institute for Sustainable Prosperity and
Associate Professor of Innovation and Entrepreneurship,
Federation Business School, Federation University Australia
&
Hatem M'henni
Professor of Economics,
Higher School of Business, ESCT, Manouba University, Tunisia

Abstract

The aim of this study is to identify the conditions that are necessary for a paradigm shift in economic and ecological development in both public and private efforts to support and enhance the development of new potential niche of sustainable and innovative sectors. Thus, by exploring the new modes of coordination and cooperation between the actors, the ultimate aim is to build an ecological sustainability model of innovation that would emerge from which political economy policies can be combined with niche investments that are developing in new sectors related to sustainability, which can be applied to the Tunisian case in the transition from autocratic to democratic power. The final aim is to build a viable economic model of innovation for Tunisia in order to support and enhance the development of sustainable sectors while responding to social and economic constraints. A conceptual framework is set out to guide the policies that can create a socially and ecologically sustainable prosperity that provides employment for all. The empirical results in this study show a positive relationship between the national efforts to integrate the sustainable development issue with economic growth. At the same time, the results show a negative relationship between carbon emission damage on environment and economic growth, implying there have been effective sustainability efforts despite heavy use of traditional fossil fuels for energy. The results are only tentative with this evaluation suggesting that the use of more specific indicators is required. Further, there is a need in the short-term for more efficient use of non-renewables, while a medium-term focus on a transition (or paradigm shift) to renewable energy sources.

Keywords: eco-innovation; transition phase; paradigm shift; innovation systems

JEL Codes: F63, O33, Q55

[*] An earlier version of this paper was presented at the *Innovation Forum VII,* 9-11 June 2016, Cité des Sciences et de l'Industrie, Paris, France.

Introduction

The question of economic growth in developing countries has become critical since the Arab Spring. The literature related to developing countries is widely associated with technological transfer and innovation since the strong wave of Foreign Direct Investment (FDI) promised significant benefits by the international institutions in terms of reducing the technological gaps, with the expectation of social and economic development (Blomström *et al.* 2001; Peri and Urban 2004; Drine 2012). Thus, the economic development literature's focus on technological transfer since the late 1980s' wave of FDI aims to address this expectation of social and economic progress (Blomström and Wolff 1994; Bertschek 1995; Ozturk 2007). In this field, just a few empirical studies have shown the effects of the FDI on the innovation and thus the economic progress of developing countries (Haddad and Harrison, 1993; Blomström *et al.* 1994; Li and Lui 2005; Farkas 2012, Ben Slimane and Zouikri 2016). The trajectory of robust economic development has become an acute issue since the aftermath of the Arab Spring uprisings of early 2011.

For the Arab case, Tunisia is considered one of the most efficient, and thus attractive, countries for FDI since it is characterized by its neoliberal economic reforms, with liberalization of trade, financial incentives and the privatization process (UNCTAD 2014). Tunisia was the nation where the Arab Spring began with the self-immolation of Mohamed Bouazizi on December 17, 2010. Since the Arab Spring, in Tunisia two constraints to economic development have emerged. The first is social. This is related to the need for a new strategy supported by the populous in response to the high level of unemployment. The second is economic. This is derived from the decrease of FDI due to rising uncertainty with continued high unemployment. Together these two constraints severely limit the ability for innovation to prosper in this country (M'henni and Arvanitis, 2012).

The post-uprising period cannot be analyzed with a standard neoliberal economic growth model of innovation that has failed in a dynamic perspective (Aitken and Harrison 1999; Sadik and Bolbol 2001) and does not lead to technological catch-up in the innovation race (Courvisanos 2012, 227). Moreover, the question of building new models of innovation based on sustainability is becoming critical to these countries since it needs to take into account social constraints and long-term economic aspects. Some authors argue that innovation does not lead to a better quality of life, which is related to the sustainable development. This is because these authors see innovation as a source of unsustainable economic growth with degradation of environment mostly due to technology-push (Kalaora 2005; Zawislak and Marins 2007). On the other hand, the concept of sustainable development as defined by the Brundtland Commission is an essential innovation development tool that "…meets the needs of the present without compromising the ability of future generations to meet their own needs." (WCED 1987, 8) This Brundtland approach contains within it the capacity for ecologically-based innovation to overcome the two constraints of social and economic development in Tunisia. This integration, if applied in the case of the Arab Spring countries, can potentially reconcile the social and economic constraints. For the case of Tunisia, this is an important starting point to build a new model of innovation; one such as considered in this study. Significantly, the Tunisian national strategy already in operation provides a strong positive indicator for sustaining the development of new ecological sectors that need investment and knowledge, and which could also reduce the level of unemployment (OECD 2015).

The choice of the case of Tunisia is motivated by the political and social revolution of the Arab Spring uprising itself in a country that by African standards is highly educated and economically efficient, as well as the instability during five years following the uprising. Consequently, the main question that arises is related to the economic model to be adopted in the future with regards to economic and social situations that have suffered from political instability. The question of the eco-sustainable model of innovation is also motived by local endeavor in the past five years in important sectors such as energy and water. These sectors yearn for new forms of innovation and the adoption of new technologies. Thus, the research question can be stated as: How to build in Tunisia a viable economic model of innovation to support and enhance the development of sustainable sectors while responding to the social and economic constraints?

I. Literature Review: Search for an Alternative Innovation Model

Any alternative economic development model that is dynamic and based on innovation must begin with Schumpeter (1942) in which innovation through creative destruction provides a structural change path away from recent crises, and sets up technological and economic regimes that are long-term sustainable. Given the current financial, economic and ecological crises, standard innovation models derived from neoclassical economics are inadequate as they have not overcome the various lock-in mechanisms that dictate the paths of innovation which contributed to the current set of crises (Courvisanos 2012). It is impossible to achieve the required paradigm (or regime) shift to sustainable development in innovation under conditions that have created the existing "lock-ins" (Kemp *et al.* 1998), or what Barker (1993) calls "paradigm effects".

From a Schumpeterian perspective, innovation has a technological driver component that leads to tangible investment, which creates capital accumulation that leads to an identified secular economic growth path (Verspagen 1993). Thus, technological innovation is the commercial implementation through tangible investment of new technical knowledge. This knowledge is derived from intangible investment in scientific or engineering developments on specific Research and Development (R&D) activities or in the course of day-to-day production and marketing activity (Sahal 1981 42). The chain of innovative activities ranges from epoch-making major new technological innovations (like the microcomputer chip) to minor marketing-based product innovations (like modifying a car model by adding fins to its rear).

For Schumpeter (1939), the entrepreneur responds to waves of optimism and pessimism to create clusters of inventions, which then are diffused through the bunching of physical investment: the "clust-bun" effect (Courvisanos and Verspagen 2002). This leads to investment cycle patterns and the development of a trigger mechanism to significantly increase the rate of investment in incremental innovation by the established large corporation on the basis of a specific basic (or radical) innovation already created leading to an economic upturn. At the bottom of the investment cycle there is a need for an innovative trigger to shift the economy out of crisis with a severe "vicious circle" effect. The innovation trigger initiates a "virtuous circle" effect, which results in investment rising as basic innovations are diffused. This increases the amplitude of the expansion phase of the investment cycle, raising innovation intensity and shifting the economic trend trajectory upward (Toivanen *et al.* 1999).

There are two problems that arise with this Schumpeterian explanation. First, the politically conservative Schumpeter sees no active role for demand or any public policy demand

stimulus in the upturn from cyclical troughs (Medearis 1997). Despite public demand stimuli by Germany's war preparations and USA's New Deal in the 1930s, Schumpeter (1939) places active stimulus purely on the innovation supply-side "impulse." Rothbarth (1942), in his review of Schumpeter (1939), identifies that this supply-side impulse also needs a Keynesian 'adaptation mechanism' of funding for investment. However, the need for profits to fund investment in a very uncertain and depressed economic environment is a major stumbling block to the innovation path. From a Keynesian effective demand perspective, entrepreneurs make their investment decisions into innovation in the short period. This perspective comes from John Maynard Keynes's contemporary Post-Keynesian pioneer Michał Kalecki (Harcourt 2006, 160-4), in which the long-run economic growth path is "…a slowly changing component of a chain of short period situations" (Kalecki [1968] 1991, 435). Kalecki regards short period innovation promotion as crucial, arguing that the "...influence of this factor is analogous to that of an increase in aggregate profits which in the course of a given period makes investment projects generally more attractive than they were at the beginning of this period." (Kalecki [1954] 1991, 334) Through this process of innovation, together with innovation-induced profits (or other financial instruments), a dynamic secular growth path is generated. Thus this path, permitted by innovation, which generates profits through investment in innovation, is the short period effective demand sequence that allows further innovation and investment in the next period.

The second problem is the source of the innovation impulse as outlined by Schumpeter himself (Schumpeter 1942). Dominant firms are so significant to national economies that governments need to support them, resulting in a State-supported mendicant capitalism. Schumpeter's apocalyptic vision has echoes in the Global Financial Crisis (GFC) of late 2008 with companies like General Motors no longer able to effectively innovate and compete (Wells 2010). Neo-Schumpeterians have addressed this second problem by recognizing that the market fails and interventionist innovation policies need to be both active and positive in the direction of encouraging variety, fostering experimental behavior, supporting new developments, focusing on system building, enhancing diffusion, promoting learning organizations and their skills training, as well as assisting to influence expectations through broad-based grants, tax concessions, mentoring, and supporting small business services (Witt 2006). Many examples of success in this interventionist innovation approach can be noted: war-based economies, reconstruction from major devastation (e.g. the Marshall Plan), national sports-based academies, regional clustering around universities and technology parks (Smith 1998; Lee 2013).

The lack of an aggregate demand element in neo-Schumpeterian economics has long been recognized, but only limited research has been conducted in this area. Freeman and Perez (1988) made a tentative attempt to integrate the neo-Schumpeterian perspective of paradigm shift with Keynesian demand accumulation, but not much has been developed since. To this 1988 model, Perez (2002) has made further significant supply-side refinements using historically related periods called "installation" and "deployment." This model begins with invention and the early attempts at installing the new innovation with financial entrepreneurs who are prepared to support R&D in a highly uncertain situation. Perez (2002) then explains how deployment of technological systems and paradigm shift arise only after all the minor improvements (endogenous innovation) are squeezed out of the old systems and paradigms by "monopoly capital" entrepreneurs who want to protect existing capital stock and delay the new paradigm taking over. There is also "log jam" in endogenous innovations based on the new paradigm which compounds the latter's slow initial adoption. This occurs when established powerful

capitalists, with much old capital stock, cannot justify the entire shake-up of industries, since not enough interrelated clusters have been formed. In some way (*via* collapse of speculative bubbles or insufficient effective demand), recessions send the old capitalists to the Marxian "dustbin" of history. New capitalists' reactions against uncertainty of profits come from competitive pressures and growing inefficiencies of old capital stock. This induces adaptation, deployment and diffusion of innovation, creating a new technological trajectory, establishing a strong investment upturn. At the same time this upturn re-establishes the conditions for a new phase of steady development. A paradigm shift occurs when the new adapted technological systems pervade the whole economy. This is a very sophisticated path to renewal, but it lacks a political economy perspective with effective demand remaining in the background and the lack of a social democratic role for the State (Jessop 1993).

For all the potency of the neo-Schumpeterian innovation path identified above, there is a strong supply-side element to the innovation drivers. Market demand fails to register, leading to the problem of effective demand and how this limits any innovation path. From this critique emerges the most critical factor; the lack of market power as a crucial element in the innovation process, despite the occasional reference to market concentration strength as a negative influence on innovation. It is to these elements of effective demand and market power, combined with elements from the neo-Schumpeterian models, that a conceptual framework is developed below, which generates an economic and ecological sustainable innovation path.

Economic development needs to embrace ecologically sustainable innovation (or eco-innovation) for the future by taking the regional opportunities and addressing local constraints that are specified. Such an approach is crucial since the three pillars of sustainable development are social, economic and ecological. Thus the development of new investment strategy in the sustainable development domain raises the question about new behavior in terms of public policies, in terms of investment and in terms of practices to implement scientific and ecological innovation. This eco-innovation approach requires an alternative theoretical framework to the neoclassical approach, with an accompanying empirically based innovation strategy.

II. Conceptual Framework

Paradigm shift of a development path only succeeds if the specifics of an eco-sustainable framework can be clearly enunciated and its vision seen to be practically achievable. This requires the synthesis of ecological and economic objectives so that profits are, through continual regressive inference (or iterative feedback), effectively and proactively invested in innovation that transforms society *via* an ecologically sustainable development path. The process requires co-evolution by the private and public sectors. An overall investment planning strategy is the essential adaptation mechanism that allows for eco-innovation to flourish. Three criteria sets up this framework, as detailed in Courvisanos (2005): (i) sustainable ecological rules (or conventions) with specific ecologically-based targets, e.g. temperature rises under 2 degrees and 350 parts per million carbon dioxide emissions, (ii) perspective planning that is readjusted as the development process moves through time with clearer perspective and less uncertainty, and (iii) cumulative effective demand built on creating stronger market demand though transition management from niche markets to critical mass. What is required to implement this framework is a broad-based strategy for public and private organizations and institutions towards a dual ecology/economic outcome. Then, if

successful at the nascent level, cumulative causation with much less crises-prone economic activity can lead the country to enhance ecological outcomes over time.

The eco-sustainable framework set out in this section provides a comprehensive approach to how an investment strategy can be introduced into an economy like Tunisia, in order to achieve the stipulated goal of an innovative, competitive and ecologically sustainable environment. Only a few Western European countries, notably The Netherlands and Denmark, have been prepared to go down this path of an "instrumental planning" process (Lowe 1976) with public programs such as national strategic environment plan, short-term targets and target groups, private sector cooperation, voluntary conformity, and citizens' group input. Such a plan needs to be backed by the threat of regulation and withdrawal of support policies like subsidies (see Wallace 1995, 43-61). From the experience of these European plans, what is crucially missing is the ability to promote innovation through technological succession. This is where investment planning in concert with a co-evolutionary strategy between public and private sector can provide the necessary link to new sustainable technologies. A co-evolution strategy of technologies and industry structures requires a strong link between the techno-economic and political systems as they evolve in instrumental plans with private practice and public policy together.

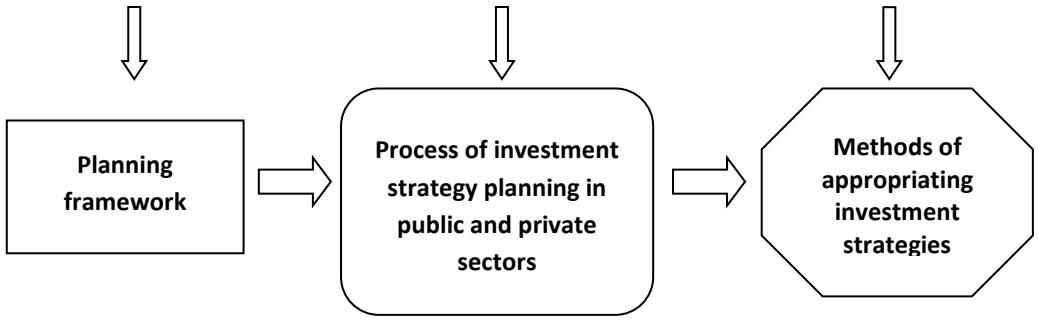
Figure 1 sets out the eco-sustainable framework that aims to deliver such instrumental plans with the operational aspects in the grid **(**on the top), and the investment planning process in the flowchart (below). The left column has the three pillars (or elements) of the eco-sustainable planning framework. The centre column sets out the criteria for sustainable development required in both public and private sector investment planning within the specific country's institutional and cultural domains. The right column shows specific implementation strategies for innovation that support the investment plan. The bottom row is a flowchart that indicates how one column should interact with the next in the planning process. The flowchart is a practical procedure for a coherent planning process with a cohesive framework for investment that allows specific strategies to induce eco-innovation. Supporting implementation strategies operate as separate entities in different places around world. In the application of this framework to Tunisia, such strategies are discussed in detail as set out in the section below.

III. Application to Tunisia

To explore the possibility of building technological regime shift in the transition phase of developing economies, Tunisia is used as the case study. It has the knowledge base (e.g. level of education) and institutional infrastructure (e.g. R&D/innovation system) to make paradigm shift possible. Following the theoretical construct based on the conceptual framework above, empirical research is conducted on existing public policies supporting innovation and private sector innovation capacity. Exploration is conducted through, secondary data (UNCTAD 2013, 2014; World Economic Forum 2013; World Bank 2010, 2015; OECD 2015) and local data from institutions supporting scientific research and technological innovation, and economic support for investment, particularly National Institute of Statistics (2016) and Ministry of Higher Education and Scientific Research [MHESR] (2016). Using these data sources, an evaluation is conducted on common parameters and test current innovation policies in Tunisia for sustainable development. The results would assist in evaluating the current efforts in Tunisia and thus to propose adaptive tools to support a regime change of the national system of innovation in Tunisia based on sustainable and ecological development.

Figure 1: The Eco-sustainable Framework

Eco-sustainable Framework	Investment planning criteria	Supporting implementation strategies
Ecological rules	• Sustainable long-term carrying capacities • Resource-saving new capital stock	Develop and communicate appropriate sustainability rules
Perspective planning	• Iterative flexible *ex-ante* planning • Bottom-up monitoring and evaluation	Establish, monitor, evaluate and adapt environmental policies
Cumulative effective demand	• Strong niche market base • Experience from current eco-sustainable innovation-based users	Co-evolution techniques to developing and managing sustainable user-needs



1. Main features of the Tunisian case study

This case study is conducted on Tunisia to demonstrate the effects of including the environmental concerns in economic activities in a country where the sustainable development paradigm has already seen some preliminary signs of being embraced by governments, scientists and intellectuals. From this analysis of Tunisian policies, key proposals can be formulated to ensure that in the long-run continued economic growth can also be ecologically sustainable.

Tunisia is characterized by three main initial features that are specific. The *first* feature concerns the performance of the country in term of growth. Tunisia is considered as one of "the leading performers" in the group of emerging economies with a sustainable 5% growth rate/year between 1995 and 2010 (World Bank 2010). In 2007, among the MENA (Middle East and North Africa) group of countries, Tunisia's GDP/capita (in constant USD) was higher than that of Egypt (3.1%) and Morocco (2.1%). This performance is explained by the engagement of the Tunisian Government in structural reforms since the mid-1980s that have been managed to ensure the development of the country. The reforms center on: maintaining macroeconomic stability in the face of external shocks, improving the business climate to attract FDI, diversifying the education system, gradually opening up the economy, and deepening its integration with Europe following trade agreement signings in 1995.

The *second* feature is the engagement of the country in the integration of environmental issues into economic growth since the mid-1990s. Indeed, Tunisia "…has a solid record of environmental and resource management and effective use has been made of limited endowments of land, water and energy resources" (World Bank 2010). In concrete terms, the following policies have been implemented:

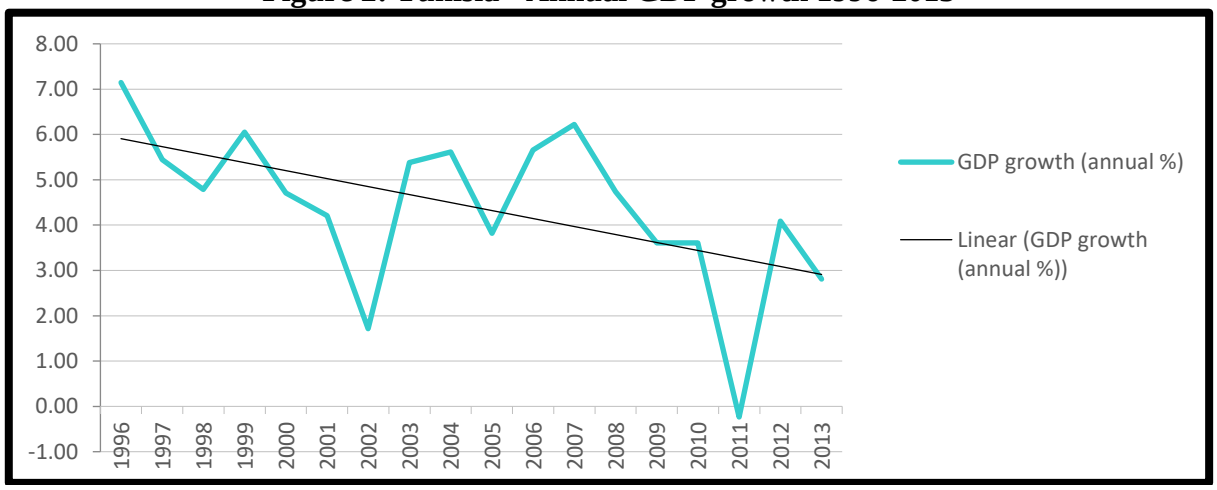
- Promotion of energy efficiency and renewable energy, which has contributed to an energy intensity of 0.08 ktoe per US $1000 of GDP. However, this is well below the MENA average of 0.18 and even below the world average of 0.13, which implies that a further 10% gain in energy efficiency would raise GDP by 0.4%, suggesting that many investments would be cost effective (World Bank 2010).
- Urban water is supplied 24 hours a day and coverage is universal, while water saving technology in the agriculture sector has increased water use efficiency to the second highest in the region. Nevertheless, renewable water resources/capital use is less than half the MENA average (Ministry of Higher Education and Scientific Research [MHESR] 2016).
- Population density is relatively high, especially in some parts of the coast, yet the cost of air pollution was the lowest of eight MENA countries covered in a World Bank study (Sarraf *et al.* 2004).

However, some resource constraints, mainly in water and land, remain. Consequently, a strong policy framework is needed that reflects the economic value of resources and more integration of sustainable development issues. This aspect is lacking in standard neoclassical economic models supported by the international institutions like the World Bank, as explained in the previous section.

The *third* feature is related to the "Jasmine" revolution, which has identified the unemployment problem, especially that for higher educated graduates (20%). This unemployment shows the fragility of economic growth in Tunisia and is evident in Figure 2, which shows that since 1996 Tunisia has had unstable and long-term downward linear GDP

growth rate, thus limited jobs growth. Consequently, solving the employment problem and improving the long-run economic growth depends on Tunisia's success in moving to a different growth model, driven by innovation (Koubaa *et al.* 2010). An innovation-driven growth model should include more investment in innovation in new sectors that include the environment issues and sustainable development.

Figure 2: Tunisia - Annual GDP growth 1996-2013



Source: World Bank (2015)

2. Public strategy of investment in sustainable development in the key sectors

A National Commission for Sustainable Development (CNDD) was created in October 1993, two years after the creation of the Ministry of the Environment. The CNDD is the core body to establish the overall approach to sustainable development, to trace the strategic orientation of the country in this area and to ensure the implementation of all the programs. The CNDD is chaired by the Prime Minister and includes all parties, governmental and non-governmental, involved in the implementation of sustainable development. The Minister of the Environment is the vice president. The secretariat of the CNDD is assured by the National Agency for Environmental Protection (ANPE) through the Tunisian Observatory for Environment and Sustainable Development (OTEDD).[1]

The CNDD is assisted by a technical committee chaired by the Minister of the Environment and composed by those responsible for environmental matters in the ministries and public institutions involved. Since the creation of the CNDD, several public institutions operating in the environmental field have been implemented, such as the Protection Agency and Coastal Management (APAL) created in 1995, the International Centre for Environmental Technologies of Tunis (CITET) created in 1996, the National Waste Management Agency (ANGED), established in 2005 and finally the National Genes' Bank (BNG), established in 2003. Similarly, a set of legislation has been put in place, creating a quite modern framework related to environmental protection including air quality, the maritime public domain, the

[1] The Tunisian Observatory for Environment and Sustainable Development (OTEDD), under the authority of the Ministry of the Environment and Sustainable Development, has as its main mission to collect, produce, analyze, manage and disseminate data on the state of the environment and sustainable development, in order to help policy makers to take into account the imperatives of environmental protection and those of economic development.

conservation of water and soil, establishing a national plan of urgent action to fight against marine pollution incidents, and also setting up waste control management and disposal with implementing regulations. All these legislative efforts were largely influenced by international conventions ratified by Tunisia.

It should be noted that in the last three or four years, non-governmental organizations and community groups (including social organizations, citizens' movements, and single citizens) have pursued informal regulation. Although these regulatory pressures vary from region to region, the pattern everywhere is similar: factories negotiate directly with local actors in response to threats of social, political or physical sanctions in order to compensate the community or to reduce emissions (the recent events in the islands of Djerba and Kerkennah are indicative of this new situation).

The sustainable development policies introduced in Tunisia are set out in the following sections, based around three major policy tools: (a) national agency for the protection of environment, (b) national development plan and (c) education and research in the area of sustainable development.

a. National Agency for the Protection of Environment

The ANPE was created in August 1988. Its main objectives are: 1) to participate in the development of the general policy of the government and global actions in the context the National Development Plan; 2) to provide government with advice to ensure the implementation of policies and measures to ensure preservation of the environment and to provide preventive measures and risk of natural or industrial disasters; 3) to control and monitor pollutants and waste treatment facilities; 4) to monitor, in collaboration with other departments, of the evolution of scientific technical or economic research, and promote training, education, study and research in the fight against pollution and environmental protection. In addition to its central structures, the ANPE is represented at the regional level, by seven delegates.

Regarding the transfer of environmentally friendly technologies to small-to-medium size firms, the ANPE conducts periodically specific sectoral studies (such as in leather, textile, surface treatment, jeans stonewashing, agribusiness and dairy industries). These sectoral studies aim to identify different technologies for the prevention of pollution or industrial pollution control.

b. 11th Development Plan (2007-2016) and Environmental Issues

Based on the analysis of key aspects of the 11th Development Plan for Tunisia in all sectors and socio-economic development, the main challenges of sustainability can be seen in terms of major objectives that must be overcome in the future so that they do not impede the promotion of sustainability at the national level and not handicap its implementation, despite the need for economic growth. These challenges are the following:

i. Establish a sustainable consumption and production (i.e. green economy)
ii. Enhance social equity and national solidarity
iii. Manage natural resources sustainably
iv. Promote quality of life of citizens
v. Developing sustainable cities

vi. Manage harmoniously and sustainably the coast
vii. Promoting sustainable transport
viii. Rationalize energy consumption and promote new and renewable energy
ix. Strengthen the capacity to adapt to climate change,
x. Promote knowledge society
xi. Adapting governance for better promotion of sustainable development.[2]

Based on the three columns set up in the Conceptual Framework (Figure 1), Table 1 identifies the critical eco-sustainability criteria that can be discerned for the 11th Development Plan and then relates these objective criteria to the investment planning criteria set up by the national Tunisian Government and supporting implementation strategies. In the Development Plan there is the goal to devote 1.25% of GDP for investment related to environmental protection and sustainable development. The plan aims to orient the traditional economic sectors (agriculture, industry, extractive activities, tourism and transport) towards management modes that preserve nature and production ecosystems, as well as promote production systems that are ecologically rational and economically viable.

Table 1: Tunisian Planning Structure

Eco-sustainable criteria in Tunisia	**Investment planning criteria in Tunisia**	**Supporting implementation strategies in Tunisia**
11th Development Plan (2007-16) • Devote 1.25% of GDP for investment related to environmental protection and sustainable development • Reduce energy intensity by 2-3% annually and increasing the use of renewables by 4% through greater emphasis on investments in energy efficiency and renewable • Encourage companies to get ISO 14001 certification • Initiatives and programs in the area of education and research	• National Agency for Improving Energy (ANME) • National Commission for Sustainable Development (CNDD) was created in 1993 • Tunisian Observatory for Environment and Sustainable Development (OTEDD) • National Waste Management Agency (ANGED) in 2005World Bank (2010) • Federative Research Programs (FRP) since 2002 (renewable energy, water, biotechnology, environment)	• Regional environment programs • Integrate with economic development • Maintenance ecosystem integrity • Voluntary regulation • Decentralized programs

[2] National Strategy for Sustainable Development. Republic of Tunisia. Accessed December 12, 2011 from http://www.environnement.gov.tn/fileadmin/medias/pdfs/projet_etude/3.pdf

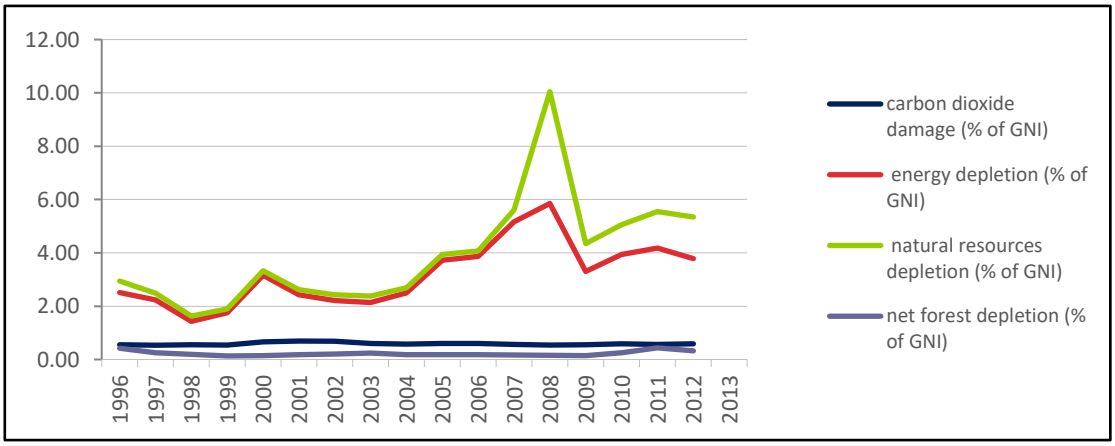
At the industrial level, the policy consists of using the lever of the industrial modernization program to encourage companies to get ISO 14001 certification.[3] This has led to a significant increase in the number of companies with this certification, reaching, in 2013, nearly 4% of the total number of industrial firms, of more than 10 employees per firm, in the country.

In this national plan, the objective is to reduce energy intensity by 2-3% annually and increasing the use of renewable by 4% through greater emphasis on investments in energy efficiency and renewable. As a consequence, a 4-year energy management program (2008-11) was initiated, including sustainable development concerns into economic growth. The aim is to sustain economic growth through the substantial application of appropriate development models that take into account the country's natural resources conservation. Figure 3 shows only a limited rate in the increasing trend of depletion of natural resources. (Note particularly the relatively low carbon dioxide damage, see Figure 11 later for more details). This shows that some sustainability efforts have been successful, but also reinforces the necessity to further integrate (in more detailed efforts) the environmental issues with economic strategy. This integration on economy and ecology is the centerpiece of 'economia'; the managing of both aspects of the 'household' (Davies 2004).

The Economic Commission for Africa (ECA 2011) has conducted a program in order to evaluate the position of the African countries (16 selected countries) with regards to sustainable development issues. According to this program, Tunisia is one of only two countries that have implemented the National Environment and Sustainable Development Program (NSSD) since 2002 (Algeria is the only other one). The NSSD was identified as the priority action for implementation within the framework of the 9th National Plan, which consisted of:

- Development of regional programs on environment for sustainable development, based on regional indicators for promoting sustainable companies (industrial, tourism, agriculture);
- Integration of environmental concerns into economic development activities; and
- Maintenance of ecosystem integrity.

Figure 3: Trends on Tunisian Energy and Natural Resource Depletion 1996-2012



Source: National Institute of Statistics, Tunisia

[3] ISO Environmental Management Systems Certification. See website http://www.iso.org/iso/iso14000

c. Investment in education and research in the area of sustainable development

Along with the support of the creation of national institutions charged of the launch of initiatives and programs in the area of sustainable development, in the area of education and research, Tunisia has initiated the Federative Research Programs (FRP) since 2002 in order to address development issues by putting together all concerned innovation-based stakeholders (research teams, universities, industries and public institutions) into collaboration. These programs are financed through multi-annual agreements, which define projects' structures, objectives and expected results, human and material resources to be mobilized as well as follow-up and evaluation procedures. The main programs are described in Table 2.

Table 2: Main Research Programs with regards to Sustainable Development 2002-2008

Programs	Components
Renewable Energy 2003-2006	5 projects: - Solar water heating, - Development of innovative processes for solar cooling, - Individual air conditioning using natural gas, - Analysis of recent technologies of Aeolian energy for local production, - Development of an Aeolian energy production model. **Human resources:** 22 research groups from public and private institutions. **Funds:** 650,000 euros
Renewable energies 2005-2008	**Projects**: 2 projects were in progress: - Hydrogen energy, - Development of a new generation of batteries. **Human resources:** 8 research teams from public and private institutions. **Funds:** 700,000 euros
Water 2004-2007	**Projects:** 4 projects were in progress between 2004-2007: - enhancing water treatment systems, - implementation of small scale water treatment stations using innovative methods, - criteria of selection and results measurement for rural purification stations, - use of solar energy for water desalination. **Human resources:** 31 research groups from public and private institutions. **Funds:** 900,000 euros
Remote sensing for forests assessment 2004-2007	**Projects:** A specific program aimed to establish a forest inventory in 21 governorates between 2004-2007. **Human resources:** This program was realized by a group of specialized researchers from the National Remote Sensing Centre with the participation of specialized technical services from the Ministry of Agriculture and Hydraulic Resources. **Funds:** 600,000 euros
Biotechnology 2005-2008	**Projects:** A specific project aimed to find solutions to the phenomenon of broken leaves of palm trees. **Human resources:** 4 research teams with the participation of enterprises and specialized public institutions. **Funds:** 500,000 euros

Source: Ministry of Higher Education and Scientific Research (MHESR), Tunisia

These research programs should be supported by a significant investment in education, in order to establish a long-term strategy for sustainable development. This supposes the development of the scientific field of sustainable development. In this perspective, we explored national data (from research directorate in the Ministry of Higher Education and Scientific Research [MHESR] 2016) showing the existence of institutional research structures specialized in this field. The main constraint is to identify clearly the field of sustainable development. Indeed, sustainable development is a concept that is transversal (or cross-discipline) in the concerned scientific domains and in application sectors. Therefore, in order to reduce the bias resulting from this transversal concept, we have just selected the domains that clearly mention environmental science, energy, or life science.

The exploration of the public research institutions in Tunisia show the existence of 12 research institutions specialized in the area of sustainable development, which represents 36.6% of the total national public institutions. With regards to the historical national framework, we find that 41.6% of these research institutions were created in the period of 2005-2006 and are under the supervision of three exclusive ministers: High education and scientific research, agriculture, environment and sustainable development.

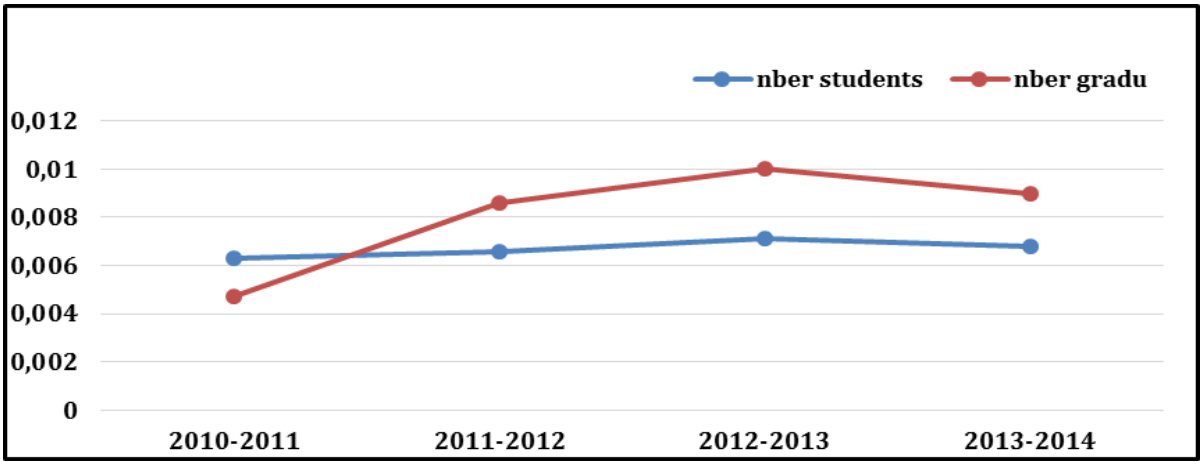
Moreover, in terms of research structure, there are in Tunisia 146 research laboratories and 638 research units. The distribution of these research laboratories with regards to the area of sustainable development shows that 50% of the research laboratories are specialized in the field of Life and Biotechnological science, which include issues directly related to sustainable development. Further, nearly 50% of the research units are engaged in "life science and biotechnology"[4] through MHESR.

Given that a long-term national strategy in sustainable development should be based on a significant investment in education, we infer that the added value is measured through the evolution of the number of graduated students in the field of environmental science and the evolution of publications in this field. An extended analysis of the evaluation of the trends in on the number of students and number of graduated students in the environmental sciences on the period 2010-2014 was conducted thanks to the data provided by the MHESR, see Figure 4.

The data in Figure 4 are of concern given the policies conducted since 2006 in a perspective of supporting the expansion of the sustainable development field at the national level. We note the stagnancy of the number of students in this field, which could be explained by the political and economic instability since the Arab spring. Further, the decrease of graduated students is not dramatic, but it is a worrisome trend. Therefore, there is a need for a more concentrated effort in monitoring and supporting the specialization of the research skills in the sustainable development area. Moreover, we underline the difficulty to integrate other scientific fields that do not specify sustainable development in their research domain but nevertheless conduct research projects related to this area (especially biotechnology, agriculture, and engineering). This research definition issue affects the evaluation regarding the development of specific skills in the sustainable development area.

[4] Life Sciences and Biotechnology: Medicine, Agriculture, Biology (plant and animal), Environment.

Figure 4: Evolution of the Number of Students and Graduated Students in Environmental Science 2010-2014



Source: Ministry of Higher Education and Scientific Research (MHESR), Tunisia

d. The involvement of the private sector in sustainable development

Finally, we explore the involvement of the private sector in national policy supporting the development of the sustainable development activities. The latest survey of R&D activities in Tunisian firms (National Observatory of Science and Technology in the MHESR 2009) consists of a sample of 803 firms operating in both the manufacturing and service sectors. When we explore this sample, we find 15 companies operating in sectors related to sustainable development. Within this subsample of 15 companies, 8 companies declare investing in R&D activity during the previous three years (the average of the total sample is 26%); 5 companies spend an annual budget for such activity (the average for the total sample is 10.1%); and 4 companies have a special department dedicated to R&D (the average for the total sample is 10.3%). Specific R&D department in this set of firms consist of between 13 and 6 staff (the average of the total sample by R&D structure is 7). We note the lack of updating and monitoring data since 2009, which restrict us in deepening the analysis on entrepreneurship and the creation of new activities in the area of sustainable development.

IV. Evaluation of Public and Policies Investment in Sustainable Development

Two steps are conducted in this analysis; first univariate and then bivariate analysis. The aim is to evaluate the effectiveness of Tunisia's sustainable development policies as set out above.

The *first* step is to examine sustainable development policies by using descriptive time series data for the period 1996-2012. The data used include more than 1,000 economic, social, environmental indicators for Tunisia. There are limitations to the data collected from the World Competitiveness Forum (2013):

- Some key indicators are not available for long periods, such as private investment in energy, investment in infrastructure, investment in renewable energy.
- Key indicators related to innovation effort in sustainable development are not available (e.g. investments to sustainable sectors, sectors efforts, investment in energy, R&D)

- Values are missing for some years mainly for the private investment in R&D for sustainable development. We note that currently, there is a sectorial national program to evaluate evolution of sustainable development in the private sector. The first descriptive results were shown in the previous Section 4.2d.

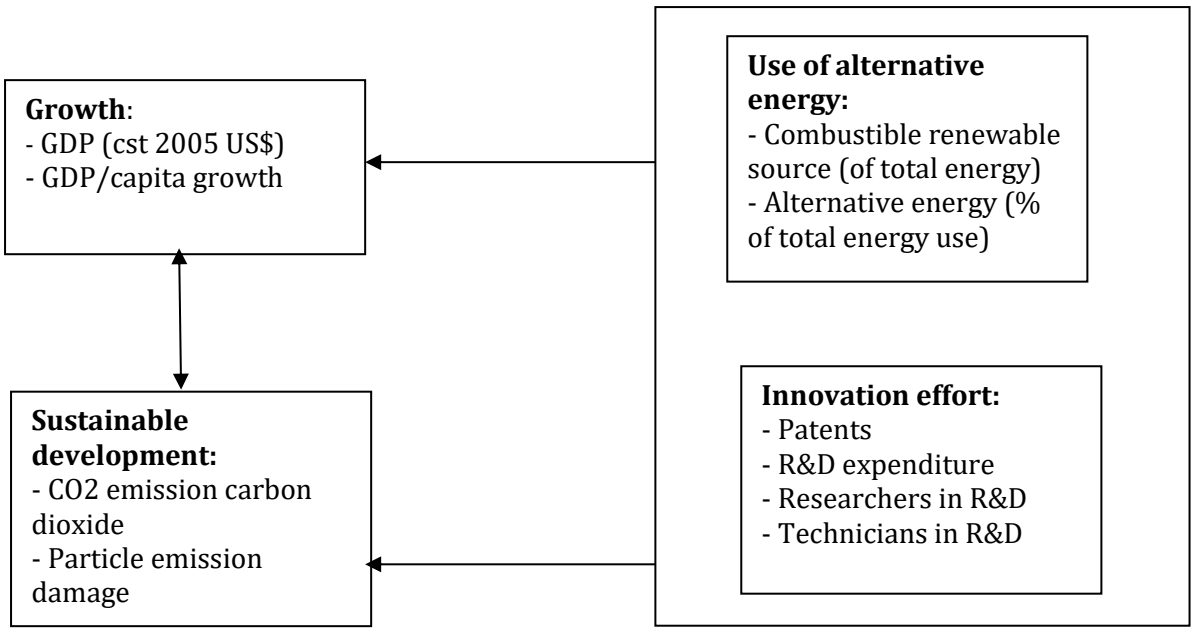
Ten indicators are obtained from the World Competitiveness Forum (2013) report that are most significant. These indicators are tested for correlation between innovation effort and alternative energy use from one side and the realization of sustainable effects from the other, which can be summarized by framework schema in Figure 5.

1. The results of the descriptive analysis

Based on the conceptual framework (Figure 1) aiming to evaluate the national strategies conducted from the perspective of sustainable development, we retained from the available variables those related to national efforts for sustainability (in terms of use of alternative and renewable energy and the innovation investment) and the output indicators for sustainability in terms of (growth and environmental damage). For all the variables used here, we proceed to their standardization prior to representing their evolution in figures that follow.

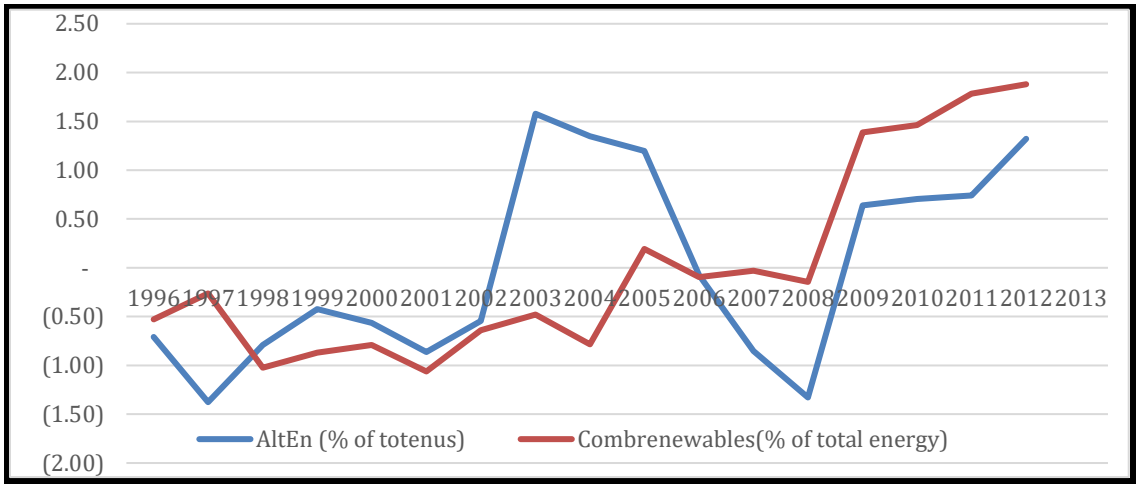
Given the fact that for these indicators two or more variables were available, we made a univariate analysis to evaluate the significance of the variables and to retain those to be used in the context of our evaluation framework. The second step consisted of testing the existence of the relationship between the efforts indicators (input indicators) and their effects (output indicators) on two pillars of sustainable development: Economic aspect (growth) and the environment (CO2 carbon emission, Particle emission damage [ParEmDam]).

Figure 5: Framework of Evaluation Analysis of Trends in Tunisian Sustainable Development Strategy



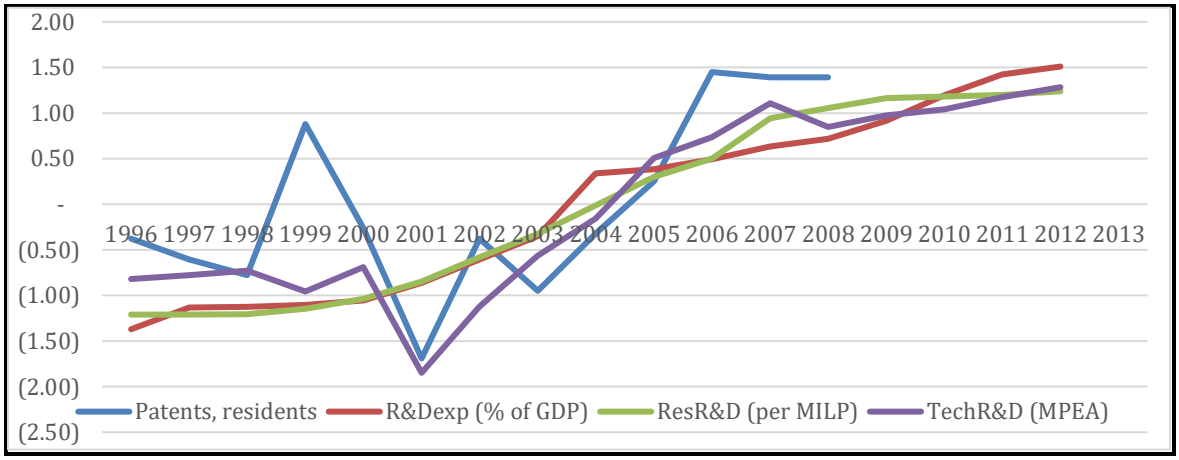
Firstly, a univariate analysis is conducted on the first sustainable development input: Use of alternative and renewable energy. A test for significance of the indicators shows significance with the use of alternative energy (AltEn% total energy use) and combustible renewable (Comrenewables% of total energy). The results are shown in Figure 6, and indicate rising energy effort in both through this period, with collapse in AltEn 2005-2008, and flattening in Comrenewables 2005-2008.

Figure 6: Energy Effort Variables 1996-2012



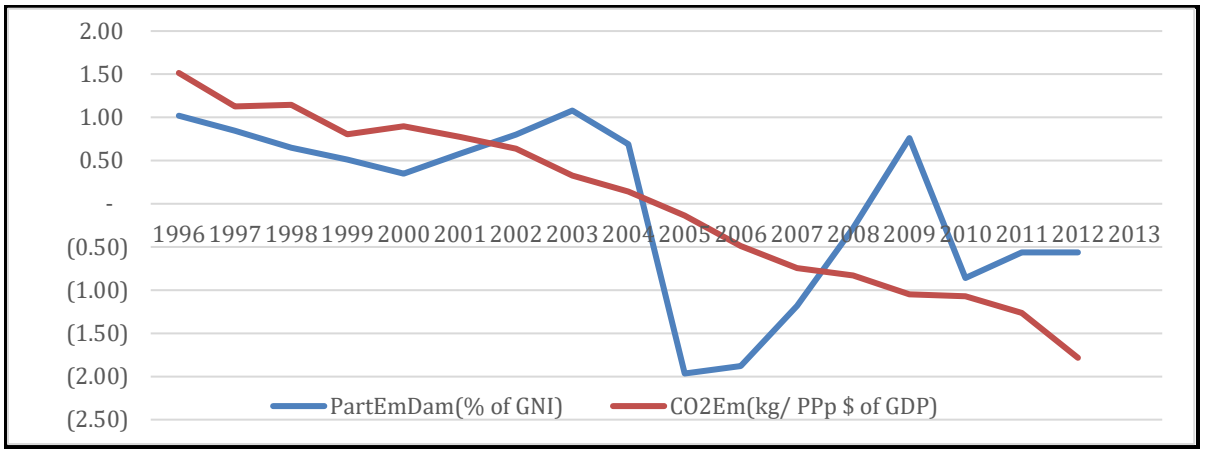
The analysis of innovation investment effort is now carried out. The univariate analysis results show the significance of the R&D expenditure (% GDP) and the R&D researchers (per million people) as shown in Figure 7. All four indicators show strong growth since 2001.

Figure 7: Innovation Effort by Various R&D Measures 1996-2012



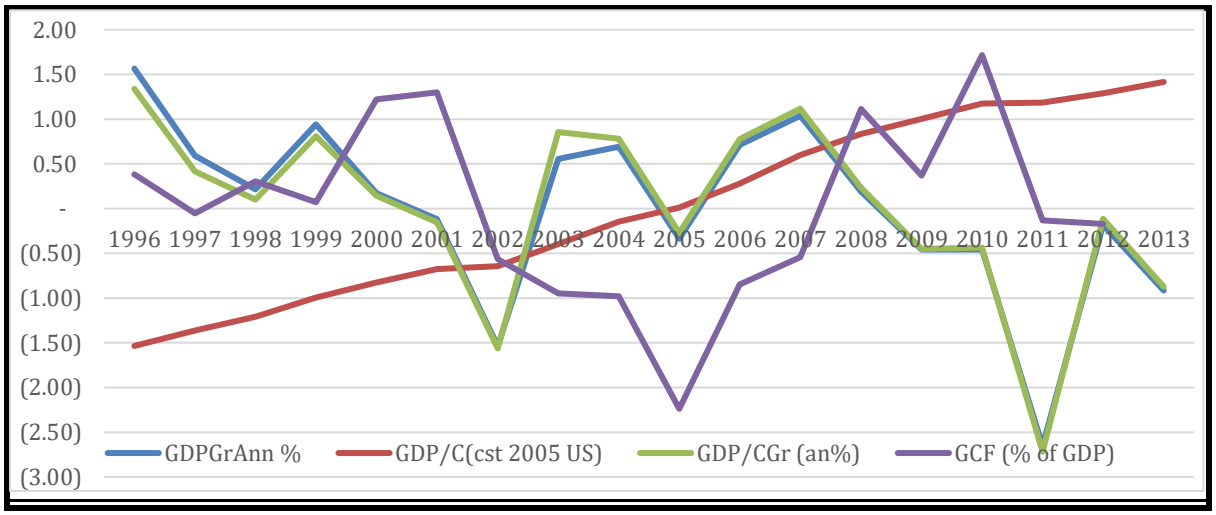
From the output sustainable development side, a univariate analysis of two output indicators, environment and growth is conducted. For the first indicator, we used two variables: (i) Particle emission damage (PartEmDam) – as a percentage of Gross National Income (GNI), and (ii) CO2 emissions (CO2Em) – as kilogram per US$ (purchase price parity, PPP) of Gross Domestic Product (GDP). The results in Figure 8 show that the there is significant fluctuation in the indicator "PartEmDam" with some recent flattening at a lower level of damage; whereas "AltEn" shows strong downward trend throughout. Consequently, the "CO2EM" indicator is retained as an output indicator for sustainable development.

Figure 8: Univariate Analysis of Particle Emission Damage and CO2 Emissions 1996-2012



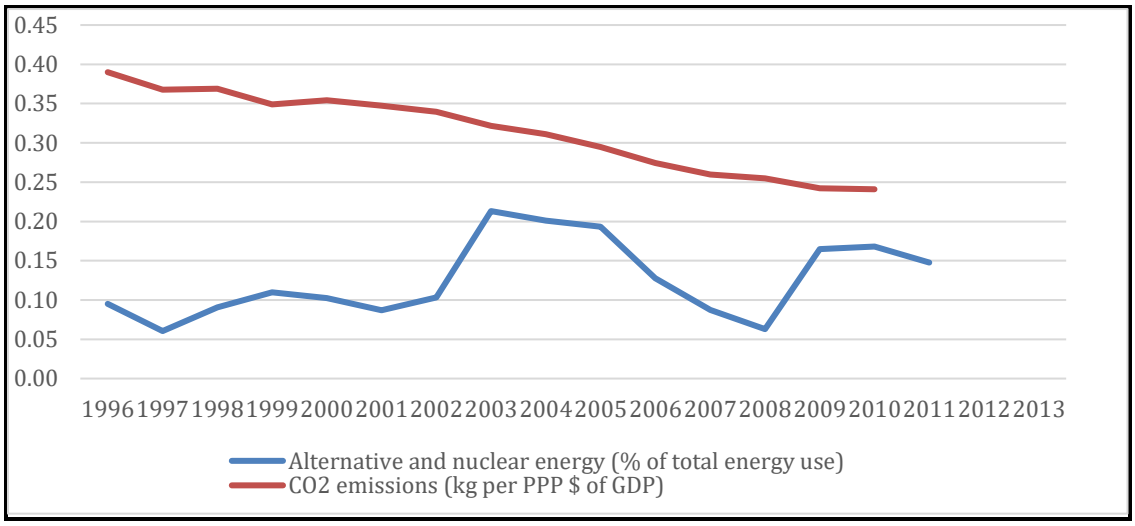
The same analysis is carried out for the growth variable and the results show the significance of the indicator GDP/per capita (GDP/C at constant 2005 US) as shown in Figure 9.

Figure 9: Growth Variables 1996-2012



The second step consisted of testing the existence of relationships between the efforts investment in alternative energy (input indicators) and their effects (output indicators) on one pillar of sustainable development; i.e. the environmental indicator (CO2emission). The results of the analysis conducted to test the existence of correlation between using renewable energy (input indicator) and the decrease of the CO2 emissions (output indicator) in the period 1996-2011 is shown in Figure 10.

Figure 10: Alternative/nuclear Energy Use and Effects on CO2 Emissions 1996-2011



The results are significant and show a positive correlation between the input indicator and the environmental output of sustainable development. This result is consistent with the theoretical analysis.

2. Results for multivariate analysis

In order to evaluate the global input efforts and the output results, the final analysis consisted of conducting an analysis which takes into account the retained indicators to evaluate the whole framework: Output indicators – CO2 emission (kg/PPP of GDP) and GDP per capital (cst 2005 US), with input indicators – combustible renewable (% of total energy) and R&D expenditure (% of GDP). The aim here is to evaluate the most significant realization of sustainable development with regards to the national policies and efforts. Table 3 summarizes the main results.

Table 3: Correlation Matrix[a]

		CO2Em (kg/ PPp $ of GDP)	Combrenewables (% of total energy)	GDP/C (cst 2005 US)	R&Dexp (% of GDP)
Correlation	CO2Em(kg/ PPp $ of GDP)		-,845	-,990	-,981
	Combrenewables(% of total energy)	-,845		,832	,842
	GDP/C(cst 2005 US)	-,990	,832		,980
	R&Dexp (% of GDP)	-,981	,842	,980	
Sig. (1-tailed)	CO2Em(kg/ PPp $ of GDP)		,000	,000	,000
	Combrenewables(% of total energy)	,000		,000	,000
	GDP/C(cst 2005 US)	,000	,000		,000
	R&Dexp (% of GDP)	,000	,000	,000	

a. Determinant = ,000 sig

The multivariate analysis using Principal Component Analysis (PCA) shows that the first component (#1) explains more than 90% of the inertia as shown in the table of variance, Table 4:

Table 4: Total Variance Explained

Compon-ent	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	3,740	93,490	93,490	3,740	93,490	93,490	2,509	62,730	62,730
2	,228	5,709	99,199	,228	5,709	99,199	1,459	36,469	99,199
3	,022	,562	99,762						
4	,010	,238	100,000						

Extraction Method: Principal Component Analysis

The first component addresses the variable CO2 particle emission to the variables, R&D expenditure and GDP growth. This means that the greater increase of R&D expenditure and growth improvement, the less the environment is damaged by the CO2 particle emission. The second component shows the importance the use of renewable energy in the economy (see Table 5).

Table 5: Rotated Component Matrix[a]

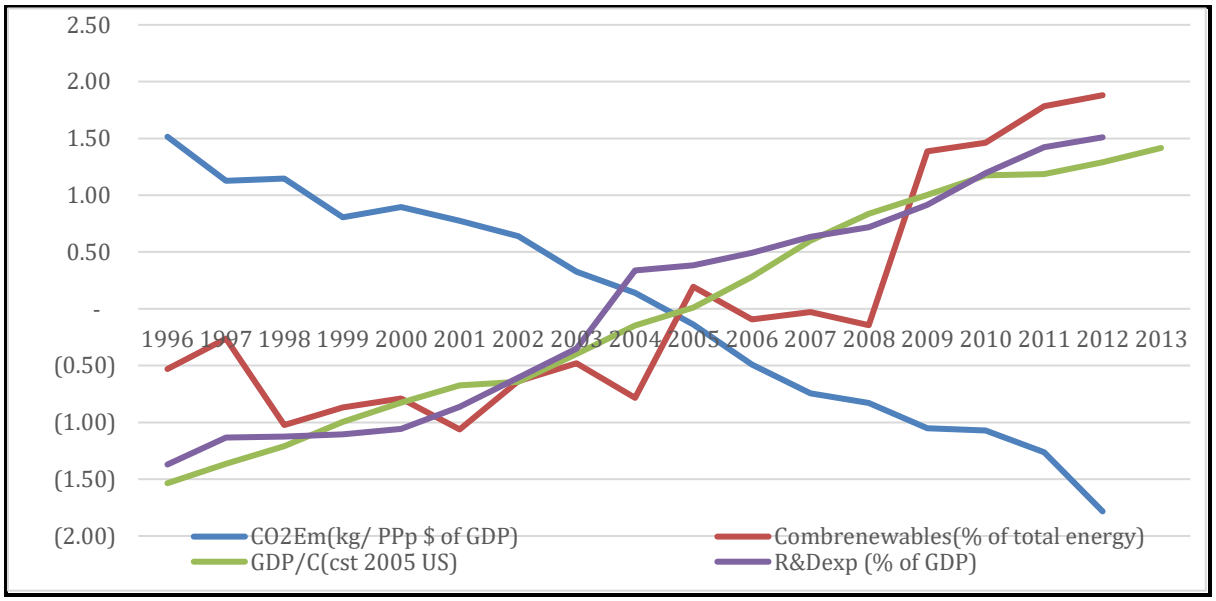
	Component	
	1	2
GDP/C(cst 2005 US)	,880	,465
CO2Em(kg/ PPp $ of GDP)	-,868	-,488
R&Dexp (% of GDP)	,865	,486
Combrenewables(% of total energy)	,481	,877

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.
a. Rotation converged in 3 iterations.

The results show that all the variables had the same trend over the period 1996 to 2011, except the CO2 emission variable which can be interpreted that despite heavy use of traditional fossil fuels for energy (as is the case in all developing economies), sustainability efforts on energy via renewables has been made. This is evident from negative relationship between CO2 emissions and GDP, showing a positive relationship of sustainability efforts in reducing carbon damage on environment despite growth in GDP. This confirms that sustainable development should be reinforced through R&D expenditure, integrating the energy efficiency in the economic strategy.

Looking at all four indicator variables (two input and two output) from the Figure 5 framework over the period 1996 to 2013, Figure 11 shows that only CO2 emissions have a negative relation to economic growth. The other three indicators have a positive relationship, with GDP rising steadily on a per capita basis, and with this rise there is an increase over this period in the two input indicators, combustible renewable (as % of total energy) and R&D expenditure (as % of GDP).

Figure 11: Multivariate Analysis – Four Indicators selected from Figure 5 Framework



V. Discussion

The analysis in the previous section shows the positive relationship between the national efforts to integrate the sustainable development issue with economic growth. However, the results should be improved in the long-run, and the evaluation suggests the use of more specific indicators as conducted in this study. At the same time, the analysis shows the positive relationship of sustainability efforts in the reduction of CO2 damage to the environment. Also, renewable energy has begun to play a key role in Tunisia's economic and environmental development, but more efficiency in the energy policy has been observed and needs to be applied to the economic sectors so that ecology and economy are combined as one 'economia'.

Significantly, the national strategy already in operation should sustain the development of new ecological sectors that need investment and knowledge, and which could also reduce the level of unemployment. However, the analysis also shows that criteria for distributing R&D spending should be focused on strategic sectoral strategies in the area of water, energy, health and the environment. The creation of public funds open to private sector participation could be envisaged for activities considered high risk to stimulate the development of new business with high value added in the issue of sustainable development.

As demonstrated, the Tunisian system of environmental protection and sustainable development is relatively complete and could be compared to that of some developed countries. However, we must not forget that this system is relatively inefficient and would find difficulties to achieve the goals it has set itself. Before the revolution, the system was plagued by corruption and lawlessness. After the revolution, the environmental issue emerged as *last* among the programs implemented by the various short-term governments that alternated in running the country, and consequently long-term strategy implied by the conceptual framework in Figure 1 was sacrificed for short-term political gain. The next economic and social development plan currently under discussion is no exception to this "short-term" rule in which little space is accounted for sustainable development. This demonstrates that there is no real political will to change things, despite sustainable development already having taken root over the previous two decades.

Tunisia has the pre-conditions for paradigm shift to sustainable development, as shown in the previous section, but its political instability lends itself to only "short term" rule. This is where the strength of Kalecki's theoretical perspective can assist in moving Tunisia to a more sustainable future. What is required is a coherent chain of short period situations that coalesce into a long period path to sustainable development. Thus, there is a need to shift from "short-term rule" to "short period development." Figure 1 provides the three elements (or pillars) that need to be set within a planning framework. The first, ecological rules, are already in place in some sectors of the Tunisian economy, and this needs to be extended into strategic sectors as identified above. The third, cumulative effective demand, is latent in the economy and requires investment in co-evolution strategies that can deliver ecologically sustainable full employment. It was the co-evolution of automobile innovation (private sector) with transport infrastructure (public sector) that led to the dominance of the car in the second half of the 20th Century (Courvisanos, 2012). The second element, perspective planning, is the most problematic due to the lack of political stability, but the political emphasis in short-termism can be turned to sustainability in the short period as a path to Tunisia's paradigm shift.

VI. Conclusion

The aim of this study is to identify the conditions that are necessary for a paradigm shift in economic and ecological development in both public and private efforts to support and enhance the development of new potential niche of sustainable and innovative sectors. This is important since the crisis and the political instability have shown the fragility of the development model of most of developing countries. In parallel, this study is one of the rare efforts in evaluating national policies in the area of sustainable development mainly in the case of developing countries. This could contribute to the emergence of deeper analysis for further research towards ecologically sustainable full employment.

This contribution has some limits related to the availability of more targeted variables. Moreover, this contribution should be deepened with a sectorial analysis and a qualitative analysis to test the perception and the efforts made by the industrial sector in a perspective of sustainable development.

Finally, exploring the new modes of coordination and cooperation between the actors, could contribute to building an ecological sustainability model of innovation that would emerge from which political economy policies can be combined with niche investments that are developing in new sectors related to sustainability, which can be applied to the Tunisian case in the transition from autocratic to democratic power.

References

Aitken, Brian J. and Ann E. Harrison. "Do Domestic Firms Benefit from Direct Foreign Investment? Evidence from Venezuela," *The American Economic Review,* 89 (June 1999): 605-18.

Barker, Joel A. *Paradigms: The Business of Discovering the Future*, New York: HarperCollins, 1993.

Ben Slimane, Sonia, and Messaoud Zouikri. "Investissements directs étrangers et capacité d'absorption nationale: les leviers de croissance des économies du Maghreb," *Marché et organisations*, N°26, Ed L'Harmattan (Mai 2016).

Bertschek, Irene. "Product and Process Innovation as a Response to Increasing Imports and Foreign Direct Investment," *Journal of Industrial Economics* 4 (Dec. 1995): 341-57.

Blomström, Magnus and Edward Wolff. "Multinational Corporations and Productivity Convergence in Mexico," in W. Baumol, R. Nelson, and E. Wolff (eds), *Convergence of Productivity: Cross-National Studies and Historical Evidence*, New York: Oxford University Press (1994): 263-84.

Blomström, Magnus, Robert E Lipsey, and Mario Zejan. *Explains the Growth of Developing Countries?* in W. Baumol, R. Nelson, and E. Wolff (eds), *Convergence of Productivity: Cross-National Studies and Historical Evidence*, New York: Oxford University Press (1994): 243-59.

Blomström, Magnus, Steven Globerman, and Ari. "The Determinants of Host Country Spillovers from Foreign Direct Investment: A Review and Synthesis of the Literature," in N. Pain (ed.), Inward Investment, Technological Change and Growth: The Impact of Multinational Corporations on the UK Economy, Basingstoke: Palgrave (2001): 34-65.

Courvisanos, Jerry. "A post-Keynesian Innovation Policy for Sustainable Development," *International Journal of Environment, Workplace and Employment* 1 (January 2005): 187-202.

_____. *Cycles, Crises and Innovation: Path to Sustainable Development – A Kaleckian-Schumpeterian Synthesis*, Cheltenham, UK and Northampton, US: Edward Elgar, 2012.

Courvisanos, Jerry and Bart Verspagen. "Innovation and Investment in Capitalist Economies 1870-2000: Kaleckian Dynamics and Evolutionary Life Cycles," *Investigación Económica*, 62 (octubre - diciembre II(242) (2002): 33-80.

Davies, Geoff. *Economia*, Sydney: ABC Books, 2004.

Drine, Imed. "Institutions, governance and technology catch-up in North Africa," *Economic Modelling* 29 (November 2012): 2155-2162.

Economic Commission for Africa [ECA]. *National Strategies for Sustainable Development in Africa: A Sixteen-Country Assessment*, March, Addis Ababa, Ethiopia: United Nations Economic Commission for Africa, 2011.

Farkas, Beatrice. *Absorptive Capacities and the Impact of FDI on Economic Growth*, Discussion Paper No. 1202, German Institute for Economic Research, DIW Berlin, 2012.

Freeman, Christopher and Carlota Perez. "Structural Crises of Adjustment, Business Cycles and Investment Behaviour," in G. Dosi, C. Freeman, R. Nelson, G. Silverberg and L. Soete (eds), *Technical Change and Economic Theory*, London: Pinter (1988): 38-66.

Haddad, Mona and Anna E. Harrison. "Are There Positive Spillovers from Direct Foreign Investment? Evidence from Panel Data for Morocco," *Journal of Development Economics* 42 (October 1993): 51-74.

Harcourt, Geoffrey C. *The Structure of Post-Keynesian Economics*, Cambridge: Cambridge University Press, 2006.

Jessop, Bob. "Towards a Schumpeterian Workfare State? Preliminary Remarks on Post-Fordist Political Economy," *Studies in Political Economy* 40 (Spring 1993): 7-39.

Kalaora, Bernard. *Du développement au développement durable: Un défi pour les sciences sociales*, Historiens et Géographes Paper No. 387, 2005.

Kalecki, Michał. *Theory of Economic Dynamics*, in J. Osiatyński (ed.), *Collected Works of Michał Kalecki, Volume II Capitalism: Economic Dynamics*, Oxford: Clarendon Press, pp. 205-348 [original book published 1954, London: George Allen and Unwin], ([1954] 1991).

_____. "Trend and Business Cycle," in J. Osiatyński (ed.), *Collected Works of Michał Kalecki, Volume II Capitalism: Economic Dynamics*, Oxford: Clarendon Press, 435-50 [original published 1968 as "Trend and Business Cycle Reconsidered" in *Economic Journal*, 782 ([1954] 1991): 263-76.

Kemp, René, Johan Schot, and Remco Hoogma."Regime shifts to sustainability through processes of niche formation: The approach of strategic niche management," *Technology Analysis & Strategic Management* 10 (June 1998): 175-95.

Koubaa Karim, Hatem Mhenni, and Foued Gabsi. "Determinants of innovation in emerging country: an empirical study at the Tunisian firm level," *International Journal of Technological Learning, Innovation and Development* 3 (Fall 2010): 205-225.

Lee, Keun. *Schumpeterian Analysis of Economic Catch-up: Knowledge, Path-creation and the Middle-income Trap*, Cambridge: Cambridge University Press, 2013.

Li, Xiaoying and Xiaming Liu. "Foreign Direct Investment and Economic Growth: An Increasingly Endogenous Relationship" *World Development* 33 (March 2005): 393-407.

Lowe, Adolph. *The Path of Economic Growth*, Cambridge: Cambridge University Press, 1976.

Medearis, John. "Schumpeter, the New Deal and Democracy," *American Political Science Review* 91 (December 1997): 819-32.

M'henni, Hatem and Rigas Arvanitis. "La résilience des systèmes d'innovation en période de transition : La Tunisie après le 14 Janvier 2011," *Revue Tiers Monde*. (Octobre-Décembre 2012): 57- 81.

Ministry of Higher Education and Scientific Research [MHESR]. website database, Tunis, Tunisia. Accessed 30 March 2016 from http://www.mes.tn, 2016.

National Institute of Statistics. website database, Tunis, Tunisia. Accessed 30 March 2016 from http://www.ins.tn, 2016.

OECD. *Investing in Youth: Tunisia – Strengthening the Employability of Youth during the Transition to a Green Economy*, OECD Publishing, Paris, 2015.

Ozturk, Ilhan. "Foreign Direct Investment – Growth Nexus: A Review of the Recent Literature," *International Journal of Applied Econometrics and Quantitative Studies* 4 (July - December 2007): 79-98.

Perez, Carlota. *Technological Revolutions and Finance Capital: The Dynamics of Bubbles and Golden Ages*, Cheltenham, UK and Northampton, US: Edward Elgar, 2002.

Peri, Giovanni and Dieter Urban. *Catching-up to Foreign Technology? Evidence on the "Veblen-Gerschenkron" Effect on Foreign Investments*, NBER Working Paper No. 10893, Cambridge Mass, 2004.

Rothbarth, Erwin. "Review of *Business Cycles* by J.A. Schumpeter," *The Economic Journal* 52 (June - September 1942): 223-29.

Sadik, Ali T. and Bolbol, Ali A. "Capital Flows, FDI, and Technology Spillovers: Evidence from Arab Countries," *World Development*, 29 (December 2001): 2111-25.

Sahal, Devendra. *Patterns of Technological Innovation*, Massachusetts: Addison-Wesley, 1981.

Sarraf, Maria, Bjorn Larsen, and Marwan Owaygen. *Cost of Environmental Degradation – The Case of Lebanon and Tunisia*, Environmental Economics Series, Paper No. 92, June, Washington D.C.: World Bank, 2004.

Schumpeter, Joseph. *Business Cycles: A Theoretical, Historical and Statistical Analysis of the Capitalist Process*, 2 Volumes, New York: McGraw-Hill, 1939.

_____. *Capitalism, Socialism and Democracy*, New York: Harper & Row,1942.

Smith, Keith. "Innovation as a Systemic Phenomenon: Rethinking the Role of Policy," in K. Bryant and A. Wells (eds), *A New Economic Paradigm? Innovation-based Evolutionary Systems*, Discussions in Science and Innovation 4, Department of Industry, Science and Resources, Canberra: Commonwealth of Australia (1998): 17-53.

Toivanen, Otto, Paul Stoneman, and Paul Diederen. "Uncertainty, Macroeconomic Volatility and Investment in New Technology," in C. Driver and P. Temple (eds), *Investment, Growth and Employment: Perspectives for Policy*, London and New York: Routledge (1999): 81-94.

UNCTAD [United Nations Conference on Trade and Development]. *World Investment Report 2013 – The Shift Towards Services*, New York and Geneva: United Nations, 2014.

_____. *World Investment Report 2013 – Global Value Chains: Investment and Trade for Development*, New York and Geneva: United Nations, 2013.

Verspagen, Bart. *Uneven Growth Between Interdependent Economies*, Cheltenham, UK and Brookfield, US: Edward Elgar, 1993.

Wallace, David. *Environmental Policy and Industrial Innovation: Strategies in Europe, the USA and Japan*, London: The Royal Institute of International Affairs and Earthscan, 1995.

WCED [World Commission on Environment and Development]. *Our Common Future*, Oxford: Oxford University Press, 1987.

Wells, Peter E. *The Automotive Industry in an Era of Eco-Austerity: Creating an Industry as if the Planet Mattered*, Cheltenham, UK and Northampton, MA, USA: Edward Elgar, 2010.

Witt, Ulrich. *The Evolving Economy: Essays on the Evolutionary approach to Economics*, Cheltenham, UK and Northampton, US: Edward Elgar, 2006.

World Economic Forum. *The Global Competitiveness Report 2013-2014*, Full data edition, 2013.

World Bank. *Republic of Tunisia, Development Policy Review: Towards Innovation –Driven Growth*, Social and Economic Development Group, January, 2010.

World Bank *Data: Tunisia*. Accessed 30 March 2016 from: http://data.worldbank.org/country/tunisia, 2015.

Zawislak, Paulo Antônio and Luciana Manhães Marins. "Strengthening Innovation in Developing Countries," *Journal of Technology Management & Innovation* 2 (2007): 44-54.