The effects of Entrepreneurship and Sectoral Outputs on three Dimensions of Sustainable Development: A Literature Review and an Empirical Assessment for Developed Countries

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Abstract

Sustainable development is the normative objective to follow a development trajectory viable in the long-term by balancing economic, environmental and social needs. There is a shared consensus that entrepreneurship and sectorial outputs are considered as a principal canal to create sustainable products and services and implement new projects that address many environmental and social concerns. Therefore, this paper examines what entrepreneurship and sectoral outputs contribute with regard to sustainability. More precisely, the specific focus of this paper is to examine the influence of entrepreneurship and sectoral outputs on different dimensions of sustainable development. As for the empirical data, they were gathered from a panel of 21 development countries covering the 2001-2016 period. In fact, using the FMOLS technique, the empirical evidence indicates that entrepreneurship and sectoral outputs have a significant positive impact on the economic, ecological and social sustainable development dimensions.

Keywords Sustainable development dimensions; entrepreneurship; sectorial outputs and development countries.

1. Introduction

"We are determined to protect the planet from degradation including through sustainable consumption and production, sustainably managing its natural resources and taking urgent action on the climate change so that it can support the needs of the present and future generations"[1].

[1] General Assembly, 2015 "The 2030 Agenda: For people, planet and prosperity"

Both Entrepreneurship and sectoral outputs have been given a key role to increase the dynamism of economies and help employment creation and improvement. In fact, for many years, entrepreneurship has been proposed as a motor to economic development in many countries (OECD, 1998, 2003; UN, 2004). Therefore, to achieve sustainable development goals, it is necessary that food is nutritious and accessible for everyone where natural resources are used in a manner that keeps ecosystem functions to meet present and future human needs. In line with this reasoning, the sectoral outputs (agriculture, industry and service) actively contribute to sustainable development. These sectors have decent employment situations and work in a right price environment. In this case, communities can live in food security, and have control over their livelihoods and equitable access to resources which they use in an adequate way.

In fact, the link between entrepreneurship and economic growth, and sectoral outputs and economic growth is important in supporting the future global development, policy and research. In this context, the European Union's 'Gothenburg adopted in 2001 a strategy based on the economic, social, and environmental dimensions of sustainable development while recognizing the association of these factors (CEC, 2005).

Therefore, given this background, it has become important to evaluate the contribution of entrepreneurship and sectoral outputs in achieving the objectives of sustainable development for some developed countries. In fact, this study attempts to determine how entrepreneurship and sectoral outputs can at the same time lead to economic growth and accomplish social and environmental goals. Although a considerable number of time series studies, such as those of Thai & Turkina (2013), Dau & Cazurra (2014), Omri (2017) and Omri & Dhahri, 2018, have been carried to determine the relationship between entrepreneurship and sustainability goals, there have been few empirical investigations on the contribution of sectoral outputs to sustainable development. Compared to other studies, ours aims at clarifying the contribution of entrepreneurship and sectoral outputs to each pillar of sustainable development separately. More precisely, the main objective of this paper is to investigate the relationship between entrepreneurship, sectoral outputs and sustainable development for a panel of 21 developed countries over the 2001-2016 period. We used the Fully Modified Ordinary Least Square (FMOLS) approach. Then, the economic model incorporates the Cobb–Douglas production function to produce new evidence on the links between entrepreneurship, sectoral outputs and economic dimension, environmental dimension and social dimension of sustainable development. Moreover, the introduction of this function helped us to explore the causal relationships between the fallowing variables; entrepreneurship, sectoral outputs, economic growth, environmental quality and human development. Indeed, this method seems useful to clearly determine the role of these factors in achieving sustainable development objectives and easily detecting whether or not entrepreneurial failure and sectoral products in this framework have occurred.

Therefore, the structure of the paper is organized as follows: we started with the introduction which is provided in section 1. It identified the research gap and the aim of the paper. Then, section 2 offers a literature review that covers the relationship between entrepreneurship and sustainable development and sectoral output and sustainability. In section 3, the study methodology is presented, including empirical setting, the sample and data collection, and measures. On the other hand, the descriptive statistical analysis and the results of the regression analysis are discussed and presented in section 4. After that, section 5 presents and discusses the results of the study compares them with those of the prior literature. Finally, section 6 concludes by discussing the contributions and recommendations of the study.

2. **Overview of Related Literature**

2.1. Entrepreneurship and sustainable development dimensions

2.1.1. Economic effect of entrepreneurship: entrepreneurship and economic growth

A long time ago, several authors, such as Schumpeter (1934, 1942), Romer (1986) and Lucas (1988), emphasized that capital and labor are not the only factors of economic growth. They pointed out the necessity of knowledge as an important factor for production. On the other hand, the theoretical and empirical support of the research in this field was originally very rich. Theoretically, Schumpeter (1911) and Holcombe (1998) showd that entrepreneurship can stimulate long-term economic growth. Moreover, a large volume of empirical research from the last two decades has found that entrepreneurship and economic grouth may be jointly determined (e.g Acs et al, 2009 and Prieger et al, 2016). Most of the empirical results indicated that entrepreneurship positively influences economic growth (see, inter alia, Audretsch and Keilbach, 2004; Van Stel and Storey ,2004 and Urbano and Aparicio, 2015). These authors also indicated that occasional entrepreneurship rates reflect the creation of knowledge, which can indeed cause the increase of economic growth. Moreover, entrepreneurs, as agents of change and innovation, should contribute to the reduction of unemployment (e.g. Wong et al, 2013 ; Silvester, 2015; Prieger et al, 2016). These authors found that entrepreneurship stimulates economic growth through a process of competitive firms. However, many studies, such as those of (Rahman, 1999 ; Armendáriz and Morduch, 2000 and Kiiru, 2007), showed that entrepreneurship institutions are more likely to be oriented towards the opportunity of a driven entrepreneurship to outreach social development objective. In a similar study, Quatraro and Vivarelli (2014) indicated that surviving entrepreneurs can cause turbulences and negatively affect economic growth. In addition, increasing surviving entrepreneurship may be counterproductive from both the environmental and economic points of view (Vivarelli, 2013).

2.1.2. Ecological effect of entrepreneurship: entrepreneurship and environmental quality

Nowadays, the climate change and the environmental degradation are regarded as the greatest challenges to humanity. In this area, a mature body of the literature has shown that many countries had put in

entrepreneurial policies to restore then sustain the environmental quality. In this case, The World Council for Sustainable Development (WBCSD) prepared for business leaders to be committed to sustainability objectives which comprise advocacy, policy development, promotion, and contribution to the sustainable future of developing nations in transition (World Council for Sustainable Development, 2009). Dean & McMullen (2007) rightly observed that in a global and political framework, entrepreneurship is intended to save the environment or the social responsibility. For their part, Cohen and Winn (2007) agreed with Dean and McMullen who stated that harnessing innovative entrepreneurship conserves the environment which endorses the view of sustainable entrepreneurship.

Thus, the environment becomes a key factor of their argument with little regard to social systems. Their purpose is to explore the entrepreneurial enterprise in relation to the society and the environment, but not only from an economic point of view. Similarly, Katsikis, and Kyrgidou (2007) revealed that entrepreneurship, as a teleological process, tends to achieve sustainable development by discovering, evaluating and exploiting opportunities and creating value that produces economic prosperity, social cohesion and environmental protection. Additionally, Schaper (2002) reported that entrepreneurs could play an important role in solving environmental problems. He added that these entrepreneurs could contribute to solving environmental problems by creating new, more environmentally sustainable products and services. According to Haal et al's (2010) panacea hypothesis, entrepreneurship could overcome many of our social and environmental problems and be the action needed to put us on the path to a more sustainable and healthy future (Brown, 2006; Brugmann & Prahalad, 2007).

Such a sustainable entrepreneurship is a sub-set of entrepreneurship, Crals, and Vereeck (2004) indicated that sustainable entrepreneurship can be defined as the continuing commitment by businesses to behave ethically and contribute to economic development while improving the quality of life of the workforce, their families, the local and global community as well as future generations. On similar grounds, Crals and Vereeck (2004), Hockerts and Wüstenhagen (n.d) pointed out that sustainable entrepreneurship is the discovery and exploitation of economic opportunities through the generation of the market disequilibria that initiate the transformation of a sector towards an environmentally and socially more sustainable State."

2.1.3. Social effect of entrepreneurship: entrepreneurship and human development

It is widely thought that entrepreneurship is important for the development of nations. However, the role of the entrepreneur has been neglected in economics. In fact, economists have focused on the role of entrepreneurship in the economic outputs, such as growth, productivity and employment and not so much on the human development. Hence, the purpose of this part is to focus on the literature review that links entrepreneurship and human development. According to Dean and MC Mullen (2007) and Shepherd and Patzel (2011), entrepreneurial action is defined as a necessary factor in the future development of the

society as a whole. As for Wheeler et al (2005) and Senge et al (2007), they revealed that entrepreneurship could be a solution to various social problems. For their part, Almeida et al. (2013) and Lozano et al. (2013) emphasized that the society needs more initiatives and investments from enterprises, educational institutions, and governments to adopt innovative solutions so to achieve sustainability goals. Hence, they believe that entrepreneurship can be a solution to social inequality.

On the other hand, on taking into account the seminal contribution by Baumol (1990), it has become known that the Shumpeterian innovative entrepreneurs coexist with With defensive entrepreneurs, needy entrepreneurs are those who start a new business not because of market opportunities and innovative ideas, but simply because they need an income to survive. For various reasons, this kind of 'survival-driven' self-employment is particularly diffused in African countries (Yamada, 1996; Desai, 2009 and Naudé, 2010), where poverty and unemployed often push a large number of people into entrepreneurial activities ranging from street vending to traditional and personal services (see, e.g Maloney, 2004; Sonobe, et al, 2011).

The study of Amorò s and Cristi (2011) focused on the relationship between entrepreneurship and human development indicators in some African countries. In fact, they approved and provided empirical evidence to the hypothesis that, while this kind of entrepreneurship is hardly able to trigger the economic performance of African countries, it contributes nonetheless to the reduction of inequalities by affecting the wealth distribution in the society. Similarly, Naudè (2010) analyzed the effects of entrepreneurship in some African countries using broader and more non-material and subjective measures of human well-being. Their study showd that entrepreneurship in African countries may matter for individual and societal development, beyond the mere increase of GDP.

With this strand of literature, it has become clear that entrepreneurship is a key factor in addressing sustainable development challenges. Due to its growing recognition as a driver of sustainable development, entrepreneurship is subject to research across many scientific disciplines. Therefore, we can suppose that entrepreneurship is positively related to the three dimensions of sustainable development in the developed countries.

2.2. Sectoral outputs and sustainable development dimensions

2.2.1. How do sectoral outputs influence economic growth?

Isiksal and Chimezie (2016) documented the effect of industrialization in Nigeria from 1997-2012 using Johansen's co-integration testing approach. They found that no country, particularly the developing ones, has attained a level of economic growth without sub-sector linkage. Their results revealed that agriculture, industry and services positively influence GDP.

In fact, in the 18th century, Adam Smith perceived a significant relationship between the improvement of agricultural productivity and the wealth of nations. In this context, several studies, such as those of Sen, (1986,1989); Yamaguchi and Sanker, (2006) and Enoma, (2010) focused on different

countries, time periods, modeling techniques and different proxy variables which have been used to determine the links between economic growth and agricultural outputs.

In addition, the study of Mylene and John (1994) tried to investigate the relationship between agricultural output growth, agricultural imports and development assistance in a sample of 56 developing economies. Their result highlighted a long-run relationship between aid and agricultural imports where aid had a positive impact on agricultural growth. In the same context, Henneberry and Curry (2010) empirically investigated the import demand of 12 out of the 15 largest agricultural import markets over the 1974-1990 period. In fact, they observed that domestic production is positively related to agricultural import volume in the high growth countries. They also concluded that agricultural exports lead to economic growth of countries. Yamaguchi and Sanker (2006) examined the impact of a structural adjustment program on food imports and agricultural exports in the case of Sri Lanka. They found that agricultural exports are positively related to the agriculture sector. In addition, they showed that the devaluation of currency reduces real food imports and increases agricultural exports.

Recently, Ovindo and Rekwot (2014) have studied the relationship between economic growth, agricultural productivity and inflation in Nigeria during the period 1970 and 2011. They found that there is a one-way relationship between economic growth and the agricultural sector. In the same vein, Furtado (2018) pointed out that the agricultural sector is seen as an engine for economic growth.

On the other hand, the impact of industrialization on economic growth has been widely studied. Since World War II, in the industrialization era, the main Asian economies, including Japan, the Republic of Korea, and the People's Republic of China (PRC) have undergone remarkable economic changes (fast economic growth and major employment shifts from the agriculture sector to the manufacturing one). Over this period, the manufacturing sector has been an important engine of growth. This rapid industrialization has been sustained by high savings, investment rates, and export oriented policies.

A large volume of empirical research from the last two decades has found that economic growth and manufacturing acts may be jointly determined (e.g. Hausman and Taylor, 1981; Verspagen, 1991 and Szirmai 2012) and revealed that the provided manufacturing acts, as an engine of growth for low and for some middle-income countries, have a sufficient level of human capital. They added that the growth engine features are not found for the service output. For his part, Kaldor (1967) emphasized that the industrial output plays a key role in economic growth as the potential productivity growth is the highest in this sector. Consequently, the industrial output can improve the economy with the right policies, which will transform the sluggish economic recovery into an economic resurgence. In fact, a study conducted by Rodrik (2009) showed that transition into modern industrial activities acts as an engine for economic growth. Besides, he noted that the structural transformation is the sole explanation of accelerated growth in the developing world. On the other hand, Katuria and Raj (2009) examined the engine of growth at the regional level in India. Their results showed that there are industrialized regions that grow more rapidly than other regions.

Moreover, the economic literature has introduced a number of theories that tried to explain the change in the service output share and its effects in economic growth. In this context, Chenery et al (1986) agreed whith Clark (1941) who noted that there is a positive relationship between the share of services in GDP (or total employment) and GDP per capita. In his fundamental article, Baumol (1967) showed that higher productivity growth in the "progressive" (manufacturing) sector than in the "stagnant" (service) sector leads to shifts of labor from manufacturing to service industries. He added that aggregate output growth slows down over time as the sector with a lower productivity growth expands.

Another study conducted about India, Thomas (2009), pointed out that services have been the prime mover of growth resurgence since the 1990s. Moreover, a number of recent papers conducted by Ngai and Pissarides (2007) and Acemoglu and Guerrieri (2008) have focused on the same subject in analyzing the multi-sector growth models developed by Baumol, which emphasized that the total factor productivity causes employment shifts to the "stagnant" (service) sector over the (non)-balanced growth path. In this context, several scholars (e.g Laitner, 2000; Kogsamut, et al, 2001 and Foellmi and Zweimuller, 2008) relied on a demand side explanation for structural change. More recently, Barry and Poonam (2012) have noticed that GDP increases when the share of services in production and employment is important. They added that this increase is more significant when adding modern services, including post and communications, financial intermediation, computer, and business services.

2.2.2. How do sectoral outputs influence the environment quality ?

Undoubtedly, agriculture, manufacturing and services have an environmental impact on the earth planet. In fact, the major challenges of a nation is how it can develop and adopt agriculture farming practices that can produce the food needed to feed an increasing population and simultaneously sustain our environment on a long-term basis. In the same line, several studies have focused on the effect of agricultural practices on the environment pollution (see, inter alia, Ongley, 1996 ; Obioha, 2009 ; Litterman et al, 2003). In fact, Hawken et al. (1999) reported that a moderate, severe, or an extreme soil degradation has globally affected 1.2 billion hectares of agricultural land 80% of which have taken place in the developing countries. As for Ongley (1996), he pointed out that the main cause of pollution in Europe is agriculture. In same line, Wassman et al.(2000) highlighted that much of the planet's methane (CH4) emissions come from the production of livestock and continuously flooded rice paddies. By referring to an estimate of Wang et al (2000) , the total methane emissions from rice were estimated at between 10 and 15 per cent of the total global methane emissions.

Admittedly, increasing the concentration of carbon dioxide leads to a partial closure of plant stomata (the small openings in plant leaves that control the flow of air). This phenomenon decreases in evaporative cooling and can cause leaf temperature to exceed air temperature (Shafer, 2002).

As for Tilman et al (2002), they revealed that the delay and reduction of fertilizer application could reduce the overall costs and pollution without harming the yields. Moreover, studies conducted by Halicioglu (2009) and Mensah (2014) revealed that there is an inverted U-shaped relationship between growth of agricultural outputs and environmental pollution however, agricultural activity is not the only cause of environmental pollution. In fact, industrial activities cause a lot of damage to the three main constituents of the environment, which are land, air, and water; and living things. Moreover, industrial activities produce waste that contains harmful chemicals, particulates, and toxic heavy metals, which, when released into the air, they can, cause respiratory problems. Thus, toxic chemicals and heavy metals can accumulate in animal tissues and harm many living things along the food chain. Consequently, environmental pollution is the contamination of the principal components of the environment, which includes air, water, and soil, as well as the discharge of solid and hazardous waste. These different effects of industries have a direct impact on humans and their environment (Ademoroti 1996).

Pandey (2005) reported that in the United States, the main source of pollution is the industry as it represents more than half of the volume of all water pollution and for the most deadly pollutants. The same situation is in the developing countries, where there is usually weak monitoring and enforcement. The author added that humans consider industrialization as the best and quickest manner for development but, at the same time, industrialization has a negative impact. In fact, the developing countries are increasingly concerned with the growing pollution levels in cities. In this context, governmental and environmental organizations globally are concerned with environmental issues and put pressure on industries to reduce their pollutant emissions.

Dasgupta et al (2000) suggested that the sectoral composition of industry is a principal determinant of the environmental quality. Besides, some industrial processes are much dirtier or more emission intensive than others. Hettige et al (1998) emphasized that Industrial processes differ significantly in their production of waste residuals which, in turn, have a varying potential in creating environmental damage.

Recently researchers such as (Costanitini et al 2013 and Wang et al, 2013), revealed that the there is no relationship between sectoral outputs and environmental degradation. More recently, Omri (2018), he examined the relationship between sectoral outputs (service, industrial, agricultural) and environmental degradation for 69 countries over a period from 2001 to 2011 and found that the impact of sectoral outputs on the environmental degradation is positive.

Besides, the service sector contributes to the environment pollution. In this vein, Al-Amin et al (2007) showed that a quantitative assessment of selected air emissions of the service sector in the Malaysian economy increased during the 1991 / 2000 period. Their finding highlighted that the contribution of transport & communication, trade, financial related service, public service and entertainment sectors in economic growth is almost steady; yet, the CO, CO2, SO2 and NOx emissions from the selected sectors are quite important. In the same line, Rosenblum and Hendrickson (2000) noted

that, with such a large share of the Gross Domestic Product in the U.S, the effets of services have become an important component of overall emissions, waste, and energy consumption. They also emphasized that the service industries have significant indirect environmental effects on an economy-wide basis even when their direct emissions are negligible. Furthermore, industrial pollution is greatly responsible for the environmental degradation, one of the prime concerns of societies today.

2.2.3. How do sectoral outputs influence the human development*?*

Sectoral outputs is essential to achieve human development since it creates dynamic and competitive economic forces that stimulate employment and income, encourages international trade and ensures an efficient use of resources. As such, it is a major driver of poverty alleviation and shared prosperity. However, this sector is considered only as an economic opportunity.

Undoubtedly, agriculture is the principal activity that produces most of the world's food, fiber and materials for shelter, and in some systems, medicinal plants. As such, it is a fundamental for good health and for the continuity of people's lives. However, agriculture is connected with many of the world's major health problems, for example under-nutrition, malaria, HIV/AIDS, food borne diseases, diet-related chronic diseases, and a range of occupational health hazards (Hawkes and Rule, 2020). These authors pointed out that being an agricultural producer is a determinant of health through intermediary processes related to income and labor. In fact, agriculture has an effect on the income earned by people who make their living from the land. The amount, type, stability, and control of producers' income influence their ability to purchase and access food, water, land, and health-related services.

Focusing on the role of agriculture in poverty reduction, Delgado et al., (1998) revealed that the agricultural sector has shifted its focus from fostering economic growth to maximizing poverty reduction or achieving 'shared' growth. Therefore, growth with maximum benefits leads to poverty reduction. In a similar study, Mellor (1976) and Timmer (2005) stressed the role of the agricultural productivity in development. They agree that agricultural productivity growth is central for a sustainable economic development . On the other hand, the fourth industrial revolution shows that we are facing a revolution that profoundly changes our way of life. In fact, the several benefits of the industrial revolution are characterized by a fusion of technologies across physical, digital and biological domains. Moreover, they can bring a fundamental change in an unprecedented non-linear way. These scientific and technological advances improve health service. Recently, Compagnucci et al (2020) emphasized that medical and technological breakthroughs and advances will make health and healthcare much more connected, precise and democratized, with significantly improved human outcomes. In line with this reasoning, this author added that the industrial innovations inevitably carry risks and raise important questions. The rising healthcare spending and the unaffordability of treatments are already a global challenge besides,

there are concerns that expensive new treatments and technologies will only exacerbate these trends and technology may deepen healthcare global inequalities.

According to Ling and Issac (1996)), industrial effluents from industrial firms' operations have adverse effects on human health, the natural environment, and socio-economic aspects.

In this context, Bianchi et al (1997) and Schmitz & Nadvi (1999) pointed out that there is a global need for industrial transformations, especially in the developing countries where poverty, unemployment and inequality still remain significant. However, Agu and Evoh (2011)) agreed that manufacturing output is expensive and causes a lot of air and sound pollution for both companies and individuals, which threatens people's health.

Current studies show the role of the service output in improving the people's living conditions. For example, Shepherd and Pasadilla (2011) stated that many services, such as basic human services, produce outputs that are important for human development. Moreover, some other services are important inputs in the production and distribution of goods that are necessary for human development purposes. Moreover, a service sector is considered profitable when these goods and services can be made available for the poor in a more cost-effective and broader manner. Furthermore, these authors recommended that less restrictive service trade policies have recorded better human development outcomes across a range of sectors. Therefore, appropriate service trade liberalization can stimulate human development not only directly, through improved outcomes, but also indirectly, through the income channel. In another study (e.g Findlay and Warren, 2000; Eschenbach and Hoekman, 2006 and Arvis et al., 2010) showed that a more restrictive service environment is associated with a less efficient and lower-quality service provision, an inefficient resource allocation, and a slower economic development.

Bjørnskov et al (2008) pointed out that a less limited policy environment in the distribution sector can lead to a more efficient and less costly service provision as well as to a wider availability of important human development products, such as vaccines.

Moreover, it has long been recognized that education services have an obvious link with human development. In this context, Benhabib and Spiegel, (1994) revealed that the liberal policies towards education can improve the availability of education services and increase students' access to them. Therefore, this environment favorable for the educational service stimulates adult literacy and enrolment rates. In fact, greater access to education services can also indirectly improve life expectancy, not only as a result of a better knowledge of hygiene but also, possibly, because of the greater life and empowerment that derives from the ability to better use individual talents and abilities.

3. Econometric modeling and data

3.1. Econometric modeling

In this paper, we examine the contribution of entrepreneurship and sectoral outputs on three dimensions of sustainable development for 21 developed countries, namely Austria, Australia, Belgium, Finland,

France, Hungary, Ireland, Italy, Japan, Korea Republic, Luxembourg, Netherlands, New Zealand, Norway, Poland, Portugal, Singapore, Spain, Sweden, Switzerland, and the United Kingdom. The data were obtained from the World Development Indicators, the Global Entrepreneurship Monitor (GEM), the United Nations Education Science and the Culture Organization (UNESCO). This implies that entrepreneurship and sectoral outputs are in fact endogenous variables. As mentioned earlier, most of the existing literature recommended that these endogenous variables be likely to lead to changes in sustainable development dimensions. Therefore, the interrelationships between these two variables and sustainable development dimensions are worth investigating by considering them separately in a modeling framework.

On the other hand, the aggregate production function is used to examine the interrelationship between these variables. For this purpose, we employ the Cobb–Douglas production function counting capital and labor as additional factors of production. There are very serious concerns about the entrepreneurship and sustainability (Cohen and Winn, 2007; York and Venkataraman, 2010 and Ben Youssef et al 2017) but there isn't a shared consensus for this relationship. However, no much attention is paid to the relationship between sectoral production and sustainable development. Therefore, our study aims at filling this gap.

As a consequence, our proposed model, which is consistent with the broader literature on the effects of entrepreneurship and sectoral production in sustainable development cited above, takes the following form:

$$\gamma = e^{\varepsilon} AK^{\alpha} E^{\lambda} L^{\beta} \quad (1)$$

In our model, we allow technology to be endogenously resolute by entrepreneurship and sectoral production within an augmented Cobb–Douglas production function, Dritsaki and Stamatiou, (2018). By referring to literature below, entrepreneurship and sectoral production have different impacts on sustainable development pillars. Therefore, we have:

$$A(t) = \theta\ (EP)^{\alpha}\ (SO)^{\beta} \quad (2)$$

where θ is a time-invariant constant, EP and SO denote entrepreneurship and sectoral production, respectively. SO is determined by the agriculture (YA), industrial (YI) and service (YS) sectors. Then, we substitute Eq. (1) into Eq. (2) as follows

$$Y = \theta\ EP(t)^{\lambda_1}\ SO(t)^{\lambda_2} EC(t)^{\lambda_3}\ K(t)^{\alpha} L(t)^{1-\alpha}\ e^{\varepsilon} \quad (3)$$

In Eq. (1), we divide both sides of the equation by population to obtain all series in per capita terms. By taking log, the linearized production function can be written as follows:

It should be noted here that SO is represented by the three sectors (agriculture "YA", Industrial "YI" and service "YS" As we have previously surveyed.

$$\log Y_t = \alpha_0 + \alpha_1 logEP_t + \alpha_2 logYA_t + \alpha_3 logYI_t + \alpha_4 logYS_t + \alpha_5 logEC_t + \alpha_6 logK_t + \varepsilon_t \quad (4)$$

Then, we write Eq. (4) in a growth form with a time series specification as follows:

$$g(Y)_{it} = \alpha_0 + \alpha_{1i}\, g(EP)_{it} + \alpha_{2i}\, g(YA)_{it} + \alpha_{3i}\, g(YI)_{it} + \alpha_{4i}\, g(YS)_{it} + \alpha_{5i}\, g(EC)_{it} + \alpha_{6i}\, g(K)_{it} + \varepsilon_{it} \quad (5)$$

where subscript = 1, … , N denotes the country (=21 in our study) and t= 1, … , T denotes the time period, and g(Y) represents the growth rate of per capita GDP, g(K) the source of the growth rate of capital stock, g(EP) represents the entrepreneurial activity, g(YA) represents the real added value of agriculture, g(YI) denotes the real added value of industry, g(YS) symbolizes the real added value of services and g(EC) the source of the growth rate of per capita energy consumption. Moreover, the returns to scale are involved in the entrepreneurial activity while the real added values of agriculture, of industry, of services, of energy consumption and of capital stock are shown by α_1 α_2 α_3 α_4 α_5 and α_6, respectively.

Then, we use the production function in Eq. (5) to derive the empirical models to separately study the contribution of entrepreneurship and sectoral production to economic growth g(GDP), to environmental quality g(E) and to human development g(HDI). These models are also inspired by the previous theoretical and empirical literature and as they help analyze the linkages between our variables of interest. Therefore, the three functions that determine the role of entrepreneurship and sectoral production in the three pillars of sustainable development are the following:

$$g(GDP)_{it} = \alpha_0 + \alpha_{1i}\, g(EP)_{it} + \alpha_{2i}\, g(YA)_{it} + \alpha_{3i}\, g(YI)_{it} + \alpha_{4i}\, g(YS)_{it} + \alpha_{5i}\, g(EC)_{it} + \alpha_{6i}\, g(K)_{it} + \varepsilon_{it} \quad (6)$$

$$g(E)_{it} = \beta_0 + \beta_{1i}\, g(EP)_{it} + \beta_{2i}\, g(YA)_{it} + \beta_{3i}\, g(YI)_{it} + \beta_{4i}\, g(YS)_{it} + \beta_{5i}\, g(EC)_{it} + \beta_{6i}\, g(K)_{it} + \varepsilon_{it} \quad (7)$$

$$g(IDH)_{it} = \lambda_0 + \lambda_{1i}\, g(EP)_{it} + \lambda_{2i}\, g(YA)_{it} + \lambda_{3i}\, g(YI)_{it} + \lambda_{4i}\, g(YS)_{it} + \lambda_{5i}\, g(EC)_{it} + \lambda_{6i}\, g(K)_{it} + \varepsilon_{it} \quad (8)$$

In the above equations, Eq (6), α1, α2, α3, α4, α5 and α6, suggests that the entrepreneurial activity, real added value of agriculture, of the industry, of services, of energy consumption and of capital stock are the key factors of economic growth (e.g Henneberry and Curry, 2010; Szirmai, 2012; Abdouli and

Hammami, 2017; Ben Youssef et al, 2017). In Eq (7), β1, β2, β3, β4, β5 and β6, postulates the effect of entrepreneurial activity, the real added values of agriculture, of the industry, of services, of energy consumption and of capital stock on CO2 emission (e.g; Ongley, 1996; Mensah, 2014; Saidi and Hammami, 2015; Ben Youssef et al, 2017). Eq (8) λ1 λ2, λ3 λ4 λ5 and λ6 states that entrepreneurial activity, of the industry, of services, of energy consumption and of capital stock can influence human development (e.g, Patzel and Shepherd, 2011; Almeida et al., 2013; Lozano et al., 2013; Goy, 2019; Hawkes and Rule, 2020

3.2. Data source and descriptive statistic

The present study uses annual data about the 2001 /2016 period for 21 developed countries, namely Austria, Australia, Belgium, Finland, France, Hungary, Ireland, Italy, Japan, Korean Republic, Luxembourg, Netherlands, New Zealand, Norway, Poland, Portugal, Singapore, Spain, Sweden, Switzerland and the United Kingdom. The data are obtained from the World Development Indicators, the World Bank Indicators, the Global Entrepreneurship Monitor (GEM), the United Nations Education Science and Culture Organization (UNESCO). The variables used in our study are presented in the appendix.

The descriptive statistics mean that the standard deviation (Std. Dev.), the minimum, maximum values and the coefficient of the variation (CV) of these variables are recorded below in table 1.
Besides, the minimum and maximum values indicate the existence of possible outliers that help calculate the coefficients of variation for each variable (standard deviation / average) to check for the heterogeneity / homogeneity of the sample according to the variable being studied.

As an example, the coefficient of variation of the GDP variable is 0.046 <0.15, which indicates the homogeneity of the sample compared to the GDP. In the same line, Ln HDI (0.04<0.15) LnYA (0.07 <0.15), LnYI (0.04 <0.15) and LnYS (0.04 <0.15) and LnK (0.09 <0.15) showed that the samples are homogeneous compared to the variables HDI, YA, YI, YS and K, respectively. Inversely, LnRE (0.98> 0.15), LnEP (0.20> 0.15) lnE (0.18>0.15) indicateed the heterogeneity of the sample compared to capital stock, energy consumption, and entrepreneurship, respectively.

Table1
Descriptive statistics

Variables	Mean	Std-Dev	Min	Max	Coef-Var
LnGDP	10,47109	0.5886562	8.513426	11.68877	0.046
LnE	2,109805	0.3949803	1.324963	3.211837	0.18
LnHDI	25,69065	1.188188	22.564424	28.34217	0.04
LnEP	6.131805	1.23463	3.330604	9.246095	0.20
LnYA	22.61102	1.618132	17.90283	24.98352	0.07
LnYI	25.48095	1.223659	21.97067	28.13738	0.04
LnYS	26.44257	1.200947	23.46352	29.12181	0.04
LnEC	15.74429	15.4306	0.4692615	59.6064	0.98
LnK	4.603231	0.4277356	-2.556819	5.272293	0.09

Notes: Std dev. and CV indicate standard deviation and coefficients of variation (standard deviation-to-mean ratio), respectively.

Table 2 reports the results of Pearson's correlation between all the panel series of the explanatory variables. Moreover, the correlation between entrepreneurship and energy consumption is negative. On the other hand, entrepreneurship is negatively correlated with the energy consumption, agricultural, industrial and service outputs whereas, energy consumption is positively related to capital but negatively related to agricultural outputs, industrial outputs and service outputs. In fact, this indicates that there is a negative correlation between capital and the three output sectors while industrial outputs are positively correlated with agricultural and service outputs. However, the relationship between agricultural and service outputs is negative.

Table2
Correlation matrix

	LnEP	lnEC	LnK	LnYS	LnYA	LnYI
LnEP	1000					
lnEC	-0.128	1000				
LnK	0.337	0,140	1000			
LnYS	-0.080	-0,262	-0,045	1000		
LnYA	-0.177	-0,024	-0,140	-0,232	1000	
LnYI	-0.297	-0,146	-0,305	0,440	0,084	1000

4. Main results and discussions

4.1. Panel Unit Root Tests

We start our investigation with the implementation of the panel unit root tests. In a panel data analysis, several tests, such as those of the Levin et al. (2002) and Im and Pesaran (2003) are used to determine the stationary variables. According to these tests, the null hypothesis implies that there is a unit root (i.e. the variables are non-stationary) whereas the alternative hypothesis states that no unit root exists in the series (i.e. the variables are stationary). However, Pesaran (2007) was the first to propose a unit root test on panel data, which relaxes the constraint imposed by Levin and lin (1992,1993) of homogeneity of the autoregressive root. Thus, in our study, we use Pesaran(2007) test, which is based on the famous augmented Dickey-Fuller regression.

Table 3 shows that all the series are not stationary in level. Hence, all variables are integrated in order I(1).

Table3
Results of the panel unit root test (Pesaran, 2007)

Variables	In level	1st difference
LnGDP	-2.37	-3.39**
LnE	-2.46	-3.43**
LnHDI	-2.41	-2.62***
LnEC	-1.60	-3.08**
LnK	-2.46	-3.40**
LnEP	-2.42	-3.74**
LnYA	-1.31	-2.75 **

LnYS	-1.45	-3.93**
LnYI	-1.33	-3.66**

Note: critical value -2.67 (5%); * , ** and *** indicate a correlation significance at 1%, 5% and 10% levels, respectively.

4.2. Panel cointegration test: Pedroni (1999, 2004)

The co-integration between the variables of our study are presented in table 4. ADF-statistics and PP-statistic statistical tests are significant and integrated. According to the results of within-dimension and between-dimension statistics, the variables are co-integrated in our panels. Therefore, we reject the null hypothesis of absence of cointegration. This shows the existence of a long-term cointegration relationship between the variables.

Table4
Pedroni's panel cointegration test

		within-dimension		Weighted		Between	
		Statistic	prop	Statistic	prop	Statistic	prop
Economic dimension	Panel v-Statistic	14.99549	0.0000	-0.320606	0.6257		
	Panel rho-Statistic	5.728762	1.0000	6.925700	1.0000		
	Panel PP-Statistic	-2.771202	0.0028	-3.749167	0.0001		
	Panel ADF-Statistic	-2.053955	0.0200	-2.610014	0.0045		
	Group rho-Statistic					7.989948	1.0000
	Group PP-Statistic					-13.67676	0.0000
	Group ADF-Statistic					-2.319728	0.0102
Environmental dimension	Panel v-Statistic	-2.637417	0.9958	-3.523909	0.9998		
	Panel rho-Statistic	6.455872	1.0000	4.285745	1.0000		
	Panel PP-Statistic	-5.776348	0.0000	-9.424765	0.0000		
	Panel ADF-Statistice	-6.514145	0.0000	2.425477	0.0076		
	Group rho-Statistic					6.487570	1.0000
	Group PP-Statistic					-16.23969	0.0000
	Group ADF-Statistic					-1.406859	0.0797
Social dimension	Panel v-Statistic	-2.012865	0.9779	-4.051322	1.0000		
	Panel rho-Statistic	6.298123	1.0000	6.029716	1.0000		
	Panel PP-Statistic	-6.514313	0.0000	-11.54444	0.0000		
	Panel ADF-Statistic	-5.139869	0.0000	-5.076482	0.0000		
	Group rho-Statistic					7.280466	1.0000
	Group PP-Statistic					-19.77057	0.0000
	Group ADF-Statistic					-7.167293	0.0000

4.3. The FMOLS estimation

After checking the stationary and long-run co-integration of the used variables, we now estimate the three long-run relationship between (a) entrepreneurship, sectoral outputs and economic growth; (b) between entrepreneurship, sectoral outputs and CO2 emissions and (c) between entrepreneurship , sectoral outputs and Human Development Index of the developed countries' panel using the panel method FMOLS while

the other variables were used as instrumental. The empirical results of Eq. (6), (7) and (8) obtained from this method are depicted in table 5.

The empirical results about Eq. (6), which analyzes the economic effect of entrepreneurship and sectoral outputs on economic growth, showed that entrepreneurship has a positive and significant impact on the per capita GDP for the country of our study. This implies that economic growth is elastic with entrepreneurship as a 5% increase of entrepreneurship raise economic growth within a range of 0.029%. This result is consistent with the findings of Habbershon et al. (2010), for European contexts and Ben Youssef et al (2017), for 17 African countries. From the same table, we can see that industrial outputs have the highest contribution to economic growth followed by the service and agricultural output. The magnitudes of 0.298, 0.142 and 0.117 , which implies that a 5% rise of the industrial, the service and agricultural outputs increase economic growth in the developed countries by 0.3%, 0.14% and 0.12%, respectively. These results mean that the sectoral outputs in the developed countries positively contribute to economic growth, which confirms, for example, the results showed by Isiksal and Chimezie (2016).

Moreover, capital stock and consumption of energy showed a positive and statistically significant effect on economic growth at the level of 1% and 5%, respectively. The coefficient magnitude of 0.090 and 0.541 implies that a 1% and 5% increase of the capital stock and consumption of energy use, respectively, lead to an increase of the per capita GDP by 0.9% and 0.54%, respectively, indicating that an increase of capital and energy leads to the increase of economic growth. These results are also in line with the observations of Abdouli and Hammami (2017) for the MENA countries.

Table 5 also shows the factors affecting the environmental quality (environment dimension) of 21 developing countries by using the panel FMOLS estimation. It also illustrates some interesting results. It appears that the environmental degradation is a positive function of entrepreneurship, three sectoral outputs and consumption energy. In fact, the effect of entrepreneurial activity on the environmental degradation is positive and statistically significant for all the countries considered. This suggests that environmental quality is elastic with respect to entrepreneurship, and a 1% increase of entrepreneurship increases CO2 emissions within a range of 0.083%. These results are consistent with the findings of Omri (2018) but contradict those of Cohen and Winn (2007), Haal et al (2010) and York and Venkataraman (2010). Besides, Haal et al (2010) recommended that entrepreneurship can be the solution to various social and environmental problems.

On the other hand, the magnitudes of 0.189 and 0.472 suggest that a 1% rise of the agricultural and service output increases the environmental degradation by 0.19 % and 0.47 %, respectively; then, a 10% increase of the industrial output increases CO2 emission by around 0.084%. These results confirm the ones showed by (Omri, 2013; Apergis and Payne, 2014). In addition, energy consumption has a positive and significant impact on CO2 emissions. This implies that a 1% increase of energy consumption increases CO2 emissions by around 0.35%. This result is consistent with the findings of Apergis and Payne (2014), for a panel of seven Central American countries and Ben Jebli and Ben Youssef (2015),

for a group of North Africa countries. As for the capital stock, it has an insignificant negative impact on CO2 emissions.

According to the results from Eq. (8) presented in table 5, it is clear that all the dependent variables, except energy consumption, have a positive and statistically significant impact on the human development index besides, the reported coefficients of entrepreneurship, the sectoral outputs (YA, YS and YI) and the capital stock are statistically significant at 1%, 5% and 10% levels. This implies that all these variables promote human development.

The coefficient of the entrepreneurial activity is 0.372, implying that a 5% increase of entrepreneurship increases human development by 0.372% for our sample countries. These results reveal the key role played by entrepreneurial activity in achieving the objective of third dimension of sustainable development. This result is similar to the findings of Silvestre (2015) who highlighted the important role played by the entrepreneurial activity in the use of more sustainable products and services.

Moreover, the coefficient of the agricultural output indicates that the agricultural sector has a significant and positive effect on human development at 1% level. In fact, a 1% increase of the agricultural output stimulates human development by 0.605%. This finding supports the view of Delgado et al., (1998), Hawkes, and Rule (2020). Delgado et al., (1998), who showed the fundamental role of agriculture in maximizing poverty reduction or achieving 'shared' growth. In turn, Hawkes and Rule, 2020 recommended that agriculture is essential for good health through the production of the world's food, fiber and materials for shelter, and in some systems, medicinal plants. As for Delgado et al., (1998), they showed the fundamental role of agriculture in maximizing poverty reduction or achieving 'shared' growth.

For the panel estimation, the variable of the service output has a significant and positive effect on human development at 5% level. This suggests that a 5% increase of the services output raises human development by around 0.08%. This result is in line with those of a previous study conducted by Arvis et al. (2010), for the case of the high-income countries, and Eschenbach and Hoekman (2006), for transition economies.

The FMOLS estimator results showed also that, at level of 10%, the output industry positively and significant affect human development. The magnitude of 0.348 indicates that a 10% increase in industrie production favors human development by around 0.35%. This result means that the output industry played an essential role in the improvement of social welfare and confirms the results showed by Bianchi et al (1997) and Schmitz and Nadvi (1999) for the context of the developing countries. Moreover, we find that a 1% increase of the capital stock increases human development by around 0.34%. In fact, the capital stock constitutes an important channel for the stimulation of the living conditions and achieving the social objective of sustainable development (Lau et al, 1991 and Knight, 1996). Finally, the variable of energy consumption has an insignificant impact on human development.

Table5
Results of Panel FMOLS Estimation for Eq. (6), Eq. (7) and Eq. (8)

Fully Modified Ordinary Least Squares (FMOLS)			
	Indep vbls	Coefficient	Probability
Economic dimension	Dependent variable: Economic growth (GDP)		
	LnEP	0.029**	(0.025)
	LnYA	0.117**	(0.010)
	LnYS	0.148**	(0.032)
	LnYI	0.298**	(0.01 3)
	LnK	0.090*	(0.003)
	LnRE	0. 541**	(0.013)
Environmental dimension	Dependent variable: CO2 emission (E)		
	LnEP	0.083*	(0.003)
	LnYA	0.189*	(0.000)
	LnYS	0.472*	(0.007)
	LnYI	0.0838***	(0.052)
	LnK	-0.013	(0.642)
	LnRE	0.348*	(0.024)
Social dimension	Dependent variable: Human development (HDI)		
	LnEP	0.372**	(0.049)
	LnYA	0. 605*	(0.000)
	LnYS	0.079**	(0.014)
	LnYI	0. 348***	(0.067)
	LnK	0.337*	(0.000)
	lnRE	0.001	(0.870)

P-values are reported in parentheses. *,**, *** indicates significant level at 1%, 5% and 10%, respectively.

5. Conclusions, policy and research recommendations

Although the literature on sustainable development has increased over the last few years, there has been a little amount of research on the contribution of entrepreneurship and the sectoral outputs. Besides, these studies have not linked these factors with the three pillars of sustainability. Similarly, the literature on this subject neglected the importance of entrepreneurial activity and sectoral outputs for human development and environmental quality. Additionally, the majority of previous studies have tried to determine the relationship between these factors and economic growth. Moreover, our study makes the difference compared to others by studying the effect of entrepreneurship and sectoral outputs not only on economic growth, as the first dimension of sustainable development, but also on the two other dimensions, such as environmental and social sustainability.

Therefore, our main findings are as follows. First, for economic sustainability, we found that entrepreneurship and sectoral outputs positively contribute to economic growth. Second, for the environmental sustainability, our study revealed that entrepreneurship and the real value added of agriculture of industry and of the services increase CO2 emission for the panel of our analysis. Moreover, for the third sustainable development pillar rated by social sustainability, our work showed a positive

relationship between entrepreneurship and the determinants of sectoral outputs for the case of the developed countries. Finally, we can deduce that entrepreneurship and sectoral outputs are important as they can help improve the standards of living and create wealth besides, they have been recognized as solutions to overcome future problems, such as climate change not only for the entrepreneurs but also for the related businesses as they help drive the change with innovation, where new and improved products can lead to the development of new markets.

Given this perspective, the purpose of our research is to analysze the contribution of and sectoral outputs in achieving sustainability goals. More precisely, our study attempts to clarify the fundamental role of entrepreneurship and sectoral outputs to move towards a healthier, more reassuring and more durable future in some developed countries. Using the FMOLS estimator, we attempted to examine the influence of entrepreneurship and sectoral outputs in the three pillars of sustainable development, such as *economic efficiency* "reflection of sound and sustainable management, working for economic growth", *environmental quality* "preservation of natural resources in the long term" and *social equity* to meet the basic needs of people" , on an equal basis, for 21 developed countries over the 2001-2016 period.

Furthermore, our empirical results might offer important conclusions with regard to the sustainability approach, which have important policy implications. We found that entrepreneurship in the developing countries contribute to economic growth and the improvement of social objectives.

However, they increase the environmental pollution. Besides, they have various explanations. In fact, the positive effect of entrepreneurship on economic growth means that the entrepreneurship activity can support economic growth in the countries of our study, which implies that our results seem to confirm the ideas of the neoclassical theory, mainly those of Marshall, which assume that entrepreneurship is always linked with profit. Therefore, entrepreneurship plays a special role in shaping the landscape of a country's economy besides, economists and policy makers recognize this fact. In fact, entrepreneurial activity has never been an imitator but it is only an innovator of how to stimulate the monopolist. Since economic progress comes from innovations, a monopoly innovator should be protected and entrepreneurship should be encouraged so that productivity and the diversification of products and services will be protected. Globally, the concerned countries can resist competition.

On the other hand, the positive link between human development and entrepreneurship implies that an increase of entrepreneurship promotes life quality in terms of poverty, education and health. Although education is a direct or indirect driving force in every country's economy, entrepreneurship can play a significant role in the improvement of the advanced skills and innovative thinking to work through the modern challenges in the workplace. In fact, entrepreneurship not only develops the idea of starting companies but also it thinks creatively and ambitiously. In this case, the developed countries of our sample must take advantage of the positive effect of entrepreneurship because it creates opportunities, ensures social justice, instills confidence and stimulates the economy. In addition, they should encourage

young kids to develop their initiatives and help them to be more inventive and self-confident in whatever they undertake and to act in a socially responsible way.

In the health sector, entrepreneurship, as a process that can help produce new ventures from new or existing concepts, ideas and visions, can improve the sanitary conditions in the countries of our sample. In fact, a strong healthcare sector of the country is very necessary to certify that the citizens of the country are healthy and can gradually contribute to the economic growth of the country.

Moreover, entrepreneurship ensures an effective delivery of services and a fruitful treatment of operations, which leads to the patients' satisfaction. Therefore, this can substantially reduce the costs by introducing new ideas that help reduce the costs in hospitals.

In order to keep their patients, health care providers must pay attention to what is best and healthiest for the patient's health. They must be convinced by practices that seek only to resolve their health problems and always think about the health of patients in their decision-making. On the other hand, unethical practices by the healthcare providers are very distressing and displeasing, which often results in comprising the safety and wellbeing of the patient. In this context, entrepreneurship can create an environment that promotes the application of all these practices.

While our results indicate that entrepreneurship is important in achieving the economic and social pillars of sustainability, they alarm that entrepreneurship is harming the environmental quality. These latest results contradict those of Shepherd and Pratzelt (2011) who supported that entrepreneurship can protect the ecosystem, improve the environmental quality, reduce deforestation and increase freshwater supply in some developed countries. Therefore, it is necessary for these countries to be careful in this context. In fact, they must orient the spirit of enterprise and innovation towards services that help protect the environment. Besides, they must encourage young entrepreneurs in their research to find solutions to these problems. Such efforts might resistor and decrease environmental pollution.

Furthermore, our study revealed a positive link, on the one hand, between the sectoral outputs and economic growth and, on the other hand, between the environment quality and human development. Therefore, what can be learned from these results is that the sectoral outputs stimulate economic growth and social welfare but it can cause the environmental degradation in these countries. This recommends that policy makers of these countries should reflect more prudent policies. These policies should, on the one hand, favor more working conditions in the agricultural, service and industrial sectors to ensure economic growth and human development. Nevertheless, they should be careful about the environment quality by following production methods that do not threaten environment safety. Indeed, sustainability objectves cannot be achieved without the role of economic sectors because they are the main components of the economy. Moreover, sustainability development is ensured by the economic sector's performance, which could lead to structural change resulting in an efficient reallocation of labor across the economic sectors.

Given this context, our results made us recommend serious policy implications in order to improve the worldwide environment situation. First, despite their advanced world position, these countries made some efforts in the environmental conservation, but they are insufficient. To maintain their great economic prosperity, these countries have to use more resources and logistics to diminish CO_2 emissions resulting from energy use, as of which come from fossil fuels. Consequently, it is advisable for these countries to resort to cleaner fossil fuel resources, like natural gas, higher-grade coal and use more energy sources, such as hydro, solar, geothermal, and wind. In fact, it is necessary for them to think about more advanced technologies in order to guarantee both their wealth and welfare.

While sustainable development is determined by competing and evolving visualizations of how to adequately balance three policy pillars, it certainly needs systemic modifications in socio-economic relationships and their influence on the environment. Moreover, balancing the need for environmental protection, economic well-being and social equity across an appropriate and integrated approach through diverse institutions at different levels is a fundamental challenge for the achievement of sustainability. In fact, sustainable development requires the promotion of values that stimulate the consumption standards within the ecological limits to which all can fairly aspire. More specifically, sustainable development focusing on social, economic and environmental concerns further increases the difficulty of the interaction between these different goals. This suggests the existence of a cooperation between the various actors to pursue these remarkably evolving goals.

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Appendix: Definitions of the variables

variables	**Definitions**
Gross Domestic Product (GDP)	Since the 1930s, the GDP has been the most widely used measure of national growth worldwide (Lippman, 2009). In fact, the real GDP is essential in accurately measuring productivity, which is essentially an output (real GDP) divided by inputs (Dynan and Sheiner, 2018). Moreover, it is the most closely watched aggregate economic indicator and the so often used as a measure of a country's production. The data collected from the World Bank Indicators are in constant U.S. dollars.
CO2 emissions	CO2 emissions are the release of carbon dioxide into the atmosphere. This indicator is used as a measure of environmental quality. Then, the data, which are collected from World Bank Indicators, are in metric tons.
Human Development Index (HDI)	HDI is an indicator designed to track the development of countries in respect of three dimensions of development: health, education and income. Thus, the HDI is calculated using a simple average of the three indices: education, life expectancy (a proxy for Health), and GDP (a proxy for the national income) (Salas - Bourgoin, 2014). In fact, the World Development Indicators and UNESCO's datasets are the sources of our data for these indices. Then, the average of each of the three indices is calculated as follows follows (Human Development Report, 1990): $$Dimension\ index\ = \frac{Actual\ value - Minimum\ value}{Maximum\ value - Minimum\ value}$$
GDP index	*GDP index is calculated using* the *GDP per capita (constant US$)*
Life expectancy index	*it measures the relative success of a country of a newly born infant who would live an average number of years. We use 85 years, as a maximum value and 20, as a minimum value (Human Development Report, 2010). We use the World Bank Indicators.*
Education index	*it is composed by two thirds of the average duration of schooling for adults and a third of the expected duration of schooling for school-aged children [2/3 adult literacy rate + 1/3 school enrollment (primary, secondary and tertiary)] (Human Development Report, 2010). We use the World Bank Indicators.*

For each country of our sample, the HDI will be calculated as the simple arithmetic average of the three indexes previously analyzed (Sagar & Najam, 1998).

Thus, HDI = 1/3 (GDP index + life expectancy index + education index).	
Entrepreneurial activity (EP)	Is measured by means of formal entrepreneurship. According to Kappler et al. (2007), formal entrepreneurship is defined as "any economic unit of the formal sector incorporated as a legal entity and registered in a public registry...". It is measured using the total number of new registered businesses as a percentage of the working-age population (Groşanu et al, 2015) (World Bank,). This indicator is widely used in academic literature when studying the effects of the factors various determinant of entrepreneurship (see for instance, Dau and Cuervo-Cazurra, 2014). The ratio of entrepreneurship is presented as follows: $$\text{Entrepreneurship} = \frac{\text{Number of newly registered \& unregistered business}}{\text{working population}'\text{sage}}$$
Agricultural outputs (YA)	They are measured by per capita agricultural value added (Omri, 2018). Data are collected from the Word Development Indicators. Industriel outputs (YI): they are measured by means of the per capita industry value added (Omri, 2018), which is calculated using data from the World Bank
Service outputs (YS)	They are measured by means of the per capita service value added (Omri, 2018).. We refer to the Word Development Indicators as our data source.
Energy Consumption (EC)	It is measured using the consumption of primary energy, which is represented by energy forms before its transformation to other end-use fuels. Moreover, energy consumption in the residential sector represents an important part of the total demand (Rahman et al, 2017). Then, the data are measured in metric tons of oil equivalent. The World Development Indicators are our data source for this variable.
Capital stock (K)	It is measured by the gross fixed capital formation (constant 2005 US$). Traditional growth theories focus much on capital as a major factor of production (Stern and Cleveland, 2004). In fact, Bartleet and Gounder (2010) showed that capital stock plays a fundamental role in economic growth.