Article **ECORFAN-Mexico Journal**
December 2018 Vol.9 No.21 33-51

Green economy and investment in environmental protection in the technological sector: The electronics manufacturing case

Economía verde e inversión en protección medioambiental en el sector tecnológico: El caso de la fabricación de componentes electrónicos

DARRIBA-LINDÍN, Helena[1]†, GAGO-CORTÉS, Carmen[2]* and LONGARELA-ARES, Ángeles[3]

[1] *Universidade da Coruña, University of A Coruna, Faculty of Economics and Business, Elviña, 15071 A Coruña, Spain.*

[2] *Universidade da Coruña, University of A Coruna, Economic Development and Social Sustainability Research Group (EDaSS), Department of Business, Faculty of Economics and Business, Elviña, 15071, A Coruña, Spain.*

[3] *Universidade da Coruña, University of A Coruna, Research Group on Regulation, Economy and Finance (GREFIN), Departament of Business, Faculty of Economics and Business, Elviña, 15071 A Coruña, Spain.*

ID 1° Coauthor: *Carmen, Gago-Cortés* / **ORC ID**: 0000-0002-5670-968X, **Researcher ID Thomson**: G-2514-2016

ID 2° Coauthor: *Ángeles, Longarela-Ares* / **ORC ID**: 0000-0003-0488-4950, **Researcher ID Thomson**: R-1495-2018

Received January 25, 2018; Accepted June 12, 2018

Abstract

Climate change is a reality that is becoming more and more evident. The willingness to facing this challenge, together with growing environmental awareness, favours the emergence of currents in favour of a sustainable economic model that respects the environment. Due to the main environmental impacts are generated by industries, this paper focuses on explaining the investment in environmental protection of the technological sector in its branch of electronics manufacturing. In order to achieve this objective, it is carried out a study of the different variables that may affect this type of investment and what type of influence may wield. An attempt is made to understand the relationship between organisations and the environment to reach conclusions that favour the development of policies and the reduction of environmental impacts. The methodology consisted of two types of statistical analysis: correlation analysis and regression analysis. The results obtained seem to reveal that the economic, ecological and legal variables show a high interaction with the evolution of investment in environmental protection. However, the economic and ecological factors are those that seem to explain the evolution of this type of investment.

Green economy, Investment, Environmental protection, Technological sector, Electronics manufacturing

Resumen

El cambio climático es una realidad cada vez más evidente. La disposición a afrontar este reto, unida a la creciente concienciación medioambiental, favorece la aparición de corrientes a favor de un modelo económico sostenible y respetuoso con el entorno. Debido a que los principales impactos ambientales son generados por las industrias, este trabajo se centra en explicar la inversión en protección medioambiental del sector tecnológico español, en su rama de fabricación de componentes electrónicos. Para la consecución de dicho objetivo, se lleva a cabo un estudio de los factores que pueden afectar a este tipo de inversión y qué influencia pueden ejercer. Se intenta comprender la relación existente entre las organizaciones y el medioambiente con la intención de alcanzar conclusiones que favorezcan el desarrollo de políticas y la reducción de los impactos ambientales. La metodología aplicada ha consistido en dos tipos de análisis estadísticos: correlación y regresión. Los resultados obtenidos parecen desvelar que las variables económicas, ecológicas y legales muestran una alta interacción con la evolución de la inversión en protección medioambiental. Sin embargo, los factores económicos y ecológicos son los que parecen explicar la evolución de esta inversión.

Economía verde, Inversión, Protección medioambiental, Sector tecnológico, Fabricación de componentes

Citación: DARRIBA-LINDÍN, Helena, GAGO-CORTÉS, Carmen and LONGARELA-ARES, Ángeles. Green economy and investment in environmental protection in the technologi¬cal sector: The electronics manufacturing case. ECORFAN Journal-Mexico 2018, 9-21: 33-51.

* Correspondence to Author (email: m.gago@udc.es)
† Researcher contributing first author.

1. Introduction

During the last decade, society has faced many environmental challenges such as global warming, uncontrolled emissions of gases, intensive exploitation of resources, desertification, pollution of the oceans or the extinction of animal species, among others. Consequently, the fact of knowing how to face these situations from awareness and logic has been gaining increasing relevance.

Currently, one of the answers to the environmental concern is the emergence of the green economy. This tendency has been favored by the disenchantment with the prevailing economic panorama, the financial and economic crises and the failure of the market during the first decade of the 21st century (Vargas, Trujillo and Torres, 2017).

The broad concept of green economy can be defined as the improvement of human wellbeing and social equity, while significantly reducing environmental risks. In other words, it is an economy with low emissions, which uses resources in the most efficient way and which has the support and support of society (United Nations Environment Program, 2011).

The green economy must be supported by three fundamental strategies: the reduction of carbon emissions, greater energy efficiency and the use of natural resources (Carfi & Schilirò, 2012; Vargas et al., 2017). In order to implement and develop these strategies, political support at the regulatory level is necessary, as well as support through public or private investments (Vargas et al., 2017).

In this way, we can invest in measures that help reduce the tons of carbon emissions or greenhouse gases (GHG) harmful to the environment (Galvin, 2015), measures that contribute to increasing energy efficiency, so that to carry out the same activities energy consumption is lower or more activities are carried out with the same consumption (Croucher, 2011) and measures that facilitate the development of respectful manufacturing processes with the environment making responsible use of natural resources and reducing their consumption (Rivet, 2017).

The economy and the environment achieve a high degree of interaction, due to the environmental awareness of society, since most of the productive activities are the cause of the damage to the natural environment. Therefore, they directly affect social dynamics (Vargas et al., 2017).

The beginning of environmental awareness on the part of companies is evident in the United Nations Conference on the Human Environment in 1972, also known as the Stockholm Declaration. This fact represented a turning point for companies and for the protection of the environment. Subsequently, in 1983, the World Commission on Environment and Development was created with the objective of questioning the contemporary model of production and consumption. All this would be materialized in 1992 as the Rio Declaration on Environment and Development.

Therefore, from the business point of view, the concept of environmental responsibility must be taken into account, which consists of the integration of environmental concerns into the decision-making process and into the daily operations of the companies. Given that there are multiple factors that can influence the decisions of companies when investing in environmental protection, In the present work, the influence of some of them will be observed, focusing on the situation of the technological sector or ICT sector (Information and Communication Technologies) and, more specifically, in the branch of manufacture of electronic components.

This sector has been chosen because of the crucial role it plays as a basis for the digitization of traditional sectors (Eyraud and Clements, 2012). It must be borne in mind that the international framework of current business development is marked by two fundamental issues: the globalization of the economy and the technological revolution. These aspects will suppose high rates of innovation, technological progress and productivity, intrinsic characteristics of the ICT sector.

These aspects will suppose high rates of In recent years, there has been a growing incorporation of new technologies to the production model of companiesinnovation, technological progress and productivity, intrinsic characteristics of the ICT sector.

ISSN-Print: 2007-1582- ISSN-On line: 2007-3682

This commitment to ICT goes hand in hand with greater environmental awareness because, taking into account data from the Spanish Instituto Nacional de Estadística (INE), the ICT products manufacturing branch spent € 48,732,278 on environmental protection during the year. 2015, which represents 6.7% of the total expenditure on environmental protection of the last fifteen years. In addition, it invested € 5,616,643 in equipment and facilities that prevent and control pollution, representing 1.62% of all the investment made by the manufacturing industry in Spain.

The remarkable incorporation of the new technologies to the companies, the digitalization of the economy and the continuous advances in the matter, leave record of the technological revolution that we live. That is why it is necessary to highlight the relevance of the ICT sector and its impact at the economic, social and environmental levels, resulting in a subject of great interest.

The main objective of this work is, therefore, to explain the investment in environmental protection of the companies dedicated to the manufacture of electronic components in Spain and look for those factors that can influence such investment. The period chosen for the analysis covers from 2000 to 2015, and data has been collected on the main economic, ecological, social and legislative variables that affect companies in the manufacturing sector of the ICT sector, considering them as factors that can affect the investment.

It should be specified that the manufacturing branch is included in the National Classification of Economic Activities (CNAE) 2009 in: development of electronic components, printed circuits, computers and peripheral equipment, magnetic and optical media, consumer electronics and telecommunications equipment. And, at the service level, it includes all those activities related to information technology and telecommunications, that is, it groups together all the companies dedicated to the sale of computer equipment, resource management, data processing, hosting and maintenance, among others (Ministry of Energy, Tourism and Digital Agenda, 2017).

Taking into account this objective, the scope of study, the variables and their relevance at the environmental level, two hypotheses were formulated. The first assumes that "the analyzed variables show a high relation with the investment in environmental protection". To validate it, a bivariate correlation analysis is carried out. And the second is that "the investment in environmental protection is explained by the factors studied, in the electronic components manufacturing industry". To validate this hypothesis, a multiple linear regression analysis is carried out.

The work will be structured in six sections, including the introduction in the first place. Section 2 gives a brief overview of the situation of the ICT sector and the branch of electronic components manufacturing and explains the factors that can influence investment in environmental protection. In section 3 the methodology followed to carry out the study is exposed, while in section 4 the results obtained are presented. Finally, section 5 reviews the main conclusions reached in this study and, in section 6, the bibliographic references used are collected.

2. ICT sector, manufacture of electronic components, environmental impacts and relevant factors for sustainability

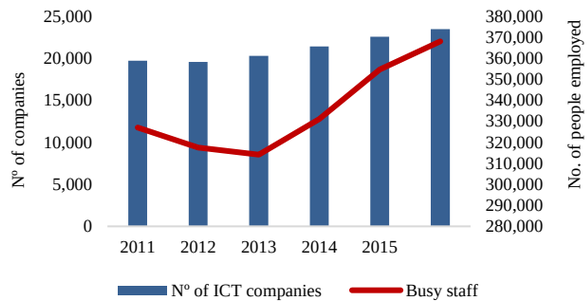
The technology sector or Information and Communication Technology (ICT) groups those companies whose activity is the manufacture of goods, provision of technological services and telecommunications. It also encompasses all those technologies that allow remote communication electronically and store and display acoustic, optical or electromagnetic information. As already mentioned, this sector is classified into several activity areas, including the telecommunications sector, due to the convergence of both at present.

At a historical level, this sector in Spain has been based on electronic communications infrastructures. Its differentiating characteristics are the rapid technological evolution and the intense competition, together with a sustained reduction in the prices of telecommunication services (Pérez and Frías, 2017). It is also worth noting its constant growth. According to the latest data from the National Commission of Markets and Competition (2017), its figures were positive until 2008, at which time the sector began to stagnate and entered a negative trend, coinciding with the beginning of the economic crisis global.

ISSN-Print: 2007-1582- ISSN-On line: 2007-3682

However, the development of new communication services through the internet facilitated the consolidation of the ICT sector. This fact, together with the high degree of innovation and the offer of better functionalities, have favored the process of replacement and growth, in a difficult economic situation for many consumers (Pérez y Frías, 2017).

Proof of this is the growth of ICT companies in Spain compared to previous years, which represents 4% (Ministry of Energy, Tourism and Digital Agenda, 2017). However, not all of its subsectors have grown at the same pace. There are branches such as computer activities or sound recording and music editing activities that grow more than usual. In contrast, the branches of telecommunications, manufacturing and publication of books and newspapers have been affected by a slight decline. The number of people employed in the ICT sector has increased, with 367,906 people in 2016 (Graph 1), together with turnover (Graph 2), which has also had a positive trend in recent years, reaching 80,000 million euros in 2016 (Ministry of Energy, Tourism and Digital Agenda, 2017).

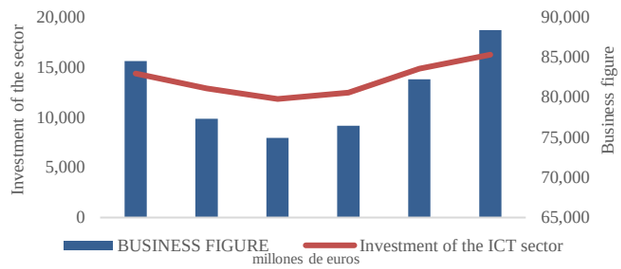


Graphic 1 Relationship of employment and companies in the sector
Source: Own elaboration based on data from the Ministry of Energy, Tourism and Digital Agenda (2017))

Relationship of employment and companies in the sector But, above all, special attention should be paid to investment, since it has been the indicator that has been most negatively affected by the economic crisis of 2008.

Source: Own elaboration based on data from the Ministry of Energy, Tourism and Digital Agenda (2017). Although in the last three years has experienced a positive trend, during 2016 investment in the ICT sector has been 16.222 million euros (Graphic 2).

The forecasts for the next few years are associated with a generalized positive trend, there is even talk of exponential growth due to the increasing linkage of the ICT sector to trade and manufacturing activities.



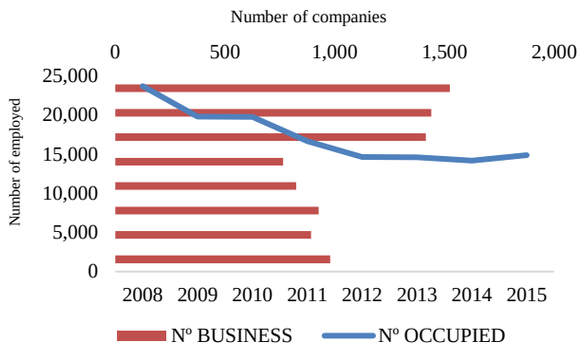
Graphic 2 Main indicators of the ICT market
Source: Own elaboration based on data from the Ministry of Energy, Tourism and Digital Agenda (2017)

Regarding the manufacturing branch, the core of this work, it constitutes 4% of the ICT sector according to the data published by the Ministry of Energy, Tourism and Digital Agenda, in the year 2017. Despite the positive trend of the ICT sector in a global term, the manufacturing sector has a negative trend in recent years, which may be due to the concentration in other branches, such as services or telecommunications.

The employment generated by these companies has suffered a stagnation in recent years (Graphic 3). As a result, the number of companies has also decreased and with it the relevance of the sector. This may be due to the growth of emerging markets such as Egypt and India, since they are the countries that have the highest growth forecasts in the sector in 2017, estimating that both countries will grow in the period between 2016 and 2020 by 7.2% and 6.7%, respectively (Ministry of Energy, Tourism and Digital Agenda, 2017) or the need to outsource production to lower costs (Myro Sánchez and Fernández-Otheo Ruiz, 2004).

In 2016, most of the employment generated by this sector comes from companies dedicated to the manufacture of electronic components (64.9%) followed by the manufacture of telecommunications equipment (21.5%). The remaining percentage is made up of subsectors dedicated to the manufacture of computers and peripheral equipment, manufacture of assembled printed circuits and manufacture of magnetic and optical media (Ministry of Energy, Tourism and Digital Agenda, 2017).

ISSN-Print: 2007-1582- ISSN-On line: 2007-3682



Graphic 3 Relationship number of companies and number of employees in the sector
Source: Own elaboration based on data from the INE and the Ministry of Energy, Tourism and Digital Agenda, for the period 2008-2015

The traditional objective of companies has always been the creation of value and benefits for their owners and shareholders. However, the transition towards a more social and green model reveals a series of goals, where the main objective is to create value for society and its environment (Ochoa, 2018). In addition to social pressure and economic aspects, companies are obliged by current legislation to comply with certain requirements and to take precautions when dealing with issues related to the environment. Environmental protection by the industry is defined by standards that define the levels of protection required according to the activity carried out and / or the polluting substances that are used or generated in the production cycle (Agudo, 2003).

In the specific case of the manufacture of products of the ICT sector, according to INE data, in 2014 a total of 1,207,756 tons of waste were generated, which represents 3.12% of the total generated by the manufacturing industry. And in 2015 it has made an energy consumption of € 186,034, representing 1.74% of total energy consumption by the industry. Therefore, the environmental management of organizations is aligned with the social responsibility of these, with the impacts on the environment and society, with the reaction of interest groups and with compliance with current legislation.

Next, we proceed to explain those factors that can influence the level of investment in environmental protection in the electronic components manufacturing industry. All of them are closely linked to the issues discussed and, therefore, will be the basis of the variables to be used in the empirical analysis of this work.

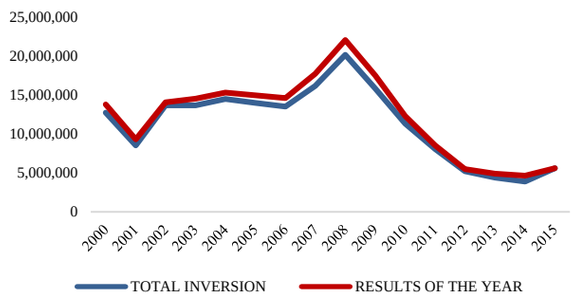
2.1. Economic factors

The care of the environment can benefit organizations, since they need natural resources for the development of their activity and, at the same time, they develop it in their own environment. Despite the classic conception that spending on measures to protect the environment implies an increase in current expenses and, consequently, a reduction in profits, this idea leads to a misconception of the social objectives of companies (Rivema, 2017).

A sustainable economic model favors the possibility of offering a quality product or service, at a lower production cost and with a lower consumption of natural resources, which leads to a greater profit margin (Rivet, 2017). In addition, the incorporation of environmental measures in organizations has repercussions in other aspects such as anticipation, adaptation to the environment and risk prevention. Companies should be prepared for legislative changes in environmental matters, increases in environmental standards or, even, adaptations in the production process. For these reasons, environmental aspects play a key role at the economic level, because they represent new opportunities and challenges (Rivet, 2017).

Environmental management is closely linked to Corporate Social Responsibility (CSR) or Corporate Social Responsibility (CSR), since economic success does not follow the unique and exclusive path of maximizing benefits, but rather the protection of the environment and the care of the social environment they are also variables to consider (Lacruz, 2005). The model developed as the basis of this work will include, as one of the explanatory factors of the investment in environmental protection, the "Economic Result" of the companies. One of the main functions of this factor is to generate benefits and create value for its owners, therefore, it will be taken into account to try to explain how the economic result affects the environmental management (Graphic 4).

ISSN-Print: 2007-1582- ISSN-On line: 2007-3682

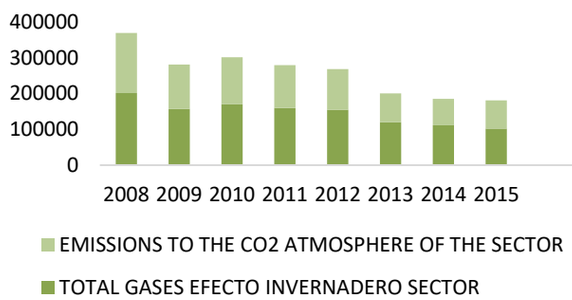


Graphic 4 Evolution of economic results together with investment in environmental protection in the electronic components manufacturing industry
Source: Own elaboration based on INE data, for the period 2000-2014

2.2. Ecological factors

The main impacts generated by the manufacturing industry of electronic components to the environment are determined by the flow of materials and waste during the production cycle. The phases related to transformation and production are those that most affect energy consumption and those that generate the most emissions harmful to the environment (Galvin, 2015). These emissions are classified into two groups: the first refers to greenhouse gas emissions (GHG), generated during the electrical or thermal production of manufacturing and, the second group, refers to the volatile organic compounds and atmospheric pollutants dangerous (European Commission, 2016).

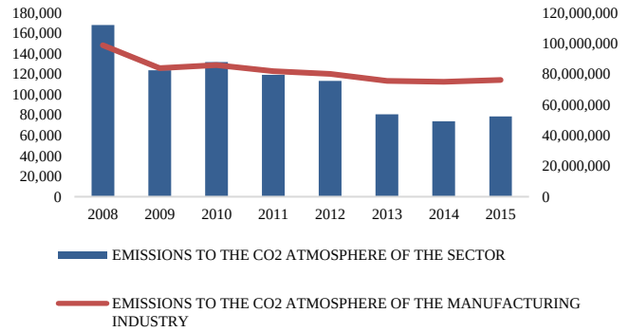
Based on this, "CO2 Emissions" have been considered as a factor to be taken into account in the model developed as the basis of this study. Graphic 5 shows a comparison of the emissions of the manufacturing branch of electronic components with the total GHG. This comparison allows to verify the weight of the emissions of this branch in a global context.



Graphic 5 GHG ratio and CO2 emissions
Source: Own elaboration based on INE data, for the years 2008-2015

In 2015, emissions from the manufacture of electronic components account for 0.10% of the total emissions of the manufacturing industry in Spain (Graphic 6). It is a small percentage, which coincides with the observations of authors such as Fuchs (2008).

Fuchs (2008) states that the industry based on information and knowledge is less aggressive with natural resources compared to traditional industry, because it favors the reduction of environmental impact through more efficient production and distribution systems. However, as we will see later, the proliferation of new technologies and the transition towards a knowledge society can have a negative environmental impact and their study is equally interesting.

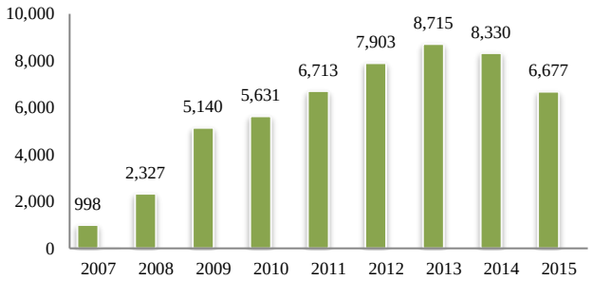


Graphic 6 Emissions from the ICT manufacturing sector in relation to the manufacturing industry
Source: Own elaboration based on INE data, for the years 2008-2015

As can be seen, the evolution of emissions follows a negative trend in the last eight years. Programs are being developed by the European Union (EU) to reduce them, such as the EU's emissions trading system (EU ETS). This organism establishes a limit for the amount of GHG that the industries emit, the objective being the reduction of emissions.

At the end of each year, companies must have enough allocations to cover all their emissions. In the event that organizations have predictions that they will exceed the limit, they can acquire emission rights between them and the rest sell them (Graphic 7). If, on the other hand, this limit is not covered, companies can reserve the surplus for future needs or sell the emission rights to organizations that need it (European Union, 2018).

ISSN-Print: 2007-1582- ISSN-On line: 2007-3682



Graphic 7 Number of emission rights marketed in the EU
Source: European Union, for the period 2007-2015

On the other hand, although in recent years technology has marked a path in the change of the traditional economic model, this transition towards a knowledge society does not mean the elimination of industrial structures, but rather the opposite. This industry requires large infrastructures for the extraction of minerals and metals and for the subsequent manufacture of components (Herrmann, Saraev and Scheidt, 2012).

The manufacturing industry generates great environmental impacts, especially in terms of resource efficiency. Precious metals and large surfaces are needed for manufacturing. For example, 60% of the environmental damage caused by laptops is attributed to their manufacture and distribution (Braga, Nedelcu and Udroiu, 2017).

Fuchs (2008) affirms that the reuse of technological products would generate improvements in the environment, but this goes in the opposite direction to the business logic. At this point, the social responsibility of companies comes into play, that is, they act in favor of ecological sustainability and, according to this logic, the tendency would be to accept less benefits in order to preserve the environment.
To reflect the effect that ecological factors may have on investment in environmental protection, the "CO2 Emissions" to the atmosphere has been chosen as an indicator.

2.3. Legislative factors

The ordinances responsible for regulating the environment with the status of law are those that ensure respect and care for the environment, whether terrestrial, aquatic or atmospheric, and the beings that live in them, flora and fauna. (Ecoembes, 2017)

Legislation marks the way for companies to act, in this case, in terms of the effects that poor environmental management or lack of awareness can have. At the Spanish level, the environmental aspects are regulated by a score of laws, however, the most relevant ones will be shown and those that really mark a trend in the investment of companies in environmental protection (De Gispert, 2000), as well as those European laws of a community nature:

- Law 26/2007 on Environmental Responsibility: follows the "polluter pays" principle with the aim of preventing, avoiding and repairing any environmental damage (Official State Gazette, 2007).

- Law 42/2007 on Natural Heritage and Biodiversity: establishes the bases for the conservation, sustainable use, improvement and restoration of the natural heritage and biodiversity. Directly related to article 45 of the Spanish Constitution (Official State Gazette, 2007).

- Law 2/2011 of Sustainable Economy: whose objective is the promotion of the development of a sustainable economic system, based on principles such as the improvement of the competitiveness, the financial stability, the promotion of the innovative capacity of the companies, the saving and the efficiency energy or the promotion of clean energies (Official State Gazette, 2011).

- Law 22/2011, of July 28, on waste and contaminated soils: its objective is to regulate the management of waste by promoting measures that prevent its generation and that mitigate the adverse impacts on human health and the environment, associated with its generation and management and improving efficiency in the use of resources (Official Gazette of the State, 2011).

- Law 21/2013 on Environmental Evaluation: its objective is to regulate the evaluation of projects or plans that may have effects on the environment, to guarantee its protection and sustainable development (Official State Gazette, 2013).

This set of regulations emphasizes the importance of social and corporate responsibility in order to maintain sustainable development over the years, and be able to enjoy the natural environment.

ISSN-Print: 2007-1582- ISSN-On line: 2007-3682

At the level of the European Community, the following regulations are found:

- Directive 2004/35 / EC of the European Parliament and of the Council, on environmental responsibility, in relation to the prevention and repair of environmental damage. It establishes the provisions to regulate situations that have caused damage to the environment and its payment through the cost of preventive or remedial measures or other administrative, legal or executive expenses incurred (European Union, 2004).

- Directive 2008/99 / EC on the protection of the environment through criminal law, in force since 2008. Its main objective is to protect the environment more effectively. For this purpose, offenses and penalties that entail "effective, proportionate and dissuasive criminal sanctions" are defined (European Union, 2008).

Table 2 shows the current legislation, both national and community level, which implies more responsibilities for the industry and sector studied. Therefore, Law 22/2011, on waste and contaminated soils, has been chosen as an indicator for empirical analysis, because it has been considered as the main regulation affecting those industries dedicated to the manufacture of electronic components..

	Validity	objective
Law 26/2007 on Environmental Responsibility	October 25, 2007	Prevent, avoid and repair possible environmental damage.
Law 22/2011, on waste and contaminated soil	July 28, 2011	Regulate the management of waste, to improve the efficiency of resources.
Directive 2004/35 / EC	April 21, 2004	Regulate situations that have caused damage to the environment and its payment through the cost of preventive or remedial measures.
Directive 2008/99 / EC	November 19, 2008	Protection of the environment through criminal law.

Table 2 Main environmental regulations
Source: Own elaboration based on OSG data

2.4. Social factors

There are multiple instruments developed by the EU for organizations to evaluate, inform and improve their performance in environmental matters. One of them is the so-called Eco-Management and Audit System of the EU (EMAS). This tool covers all sectors and is open to any type of organization that is committed to its goals (European Union, 2018). According to EU data, there are now 4,500 organizations subject to this project of which the electronic components manufacturing industry accounts for 0.47% of total EMAS in the EU.

Within this line of tools that favor the development of Environmental Management Systems, are the standards that regulate environmental management, specifically the series of ISO 14000 standards promoted by the International Organization for Standardization and developed by the Technical Committee ISO / TC 207 This tool sets the guidelines for organizations that try to be responsible with the environment. Specifically, within this series, ISO 14001, ISO 14004, ISO 14006 and ISO 14011 focus on the optimal standards for Environmental Management Systems (EMS) and the reduction of environmental impact.

The main contents of these regulations are: general requirements, environmental policy, implementation and operation planning, verification and corrective measures and management review (International Organization for Standardization, 2018).

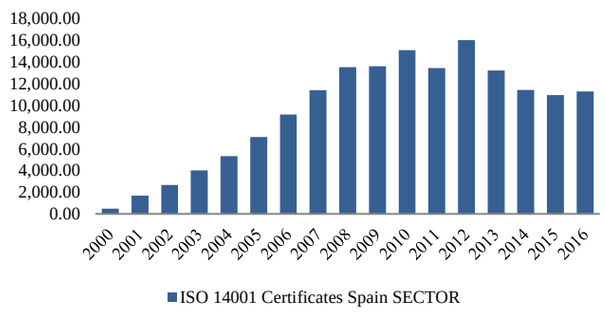
The sector under study, as can be seen in table 1, is within the top five industries with ISO 14001 certificates worldwide, with a total of 22,183 certificates, representing 8.30% of total certificates of the industry dedicated to the manufacture of electronic and optical equipment worldwide.

Order	Sector	No. certificates
1	Building	43.759
2	Metal and fabricated metal products	24.171
3	Electrical and optical equipment	22.183
4	Wholesale and retail trade, repairs of motor vehicles	17.967
5	Machinery and equipment	14.024

Table 1 The five main industrial sectors for ISO 14001 certificates
Source: International Organization for Standardization (2015)

ISSN-Print: 2007-1582- ISSN-On line: 2007-3682

At a national level, the evolution of certificates follows an increasing trend during the first ten years (Graphic 8). Both trends can be marked by the benefits that accrue from the acquisition of these certificates, such as: the improvement of the company's reputation and confidence in public tenders (International Organization for Standardization, 2018).



Graphic 8 ISO 14001 Certificates in Spain
Source: International Organization for Standardization in the years 2000-2016

Both tools are closely linked to the environmental management of organizations and to CSR. CSR must be considered as a competitive advantage, since potential consumers have priority for those products or services that respect the environment and society (Puentes, Antequera and Gámez, 2008). It involves three responsibilities: economic responsibility, aimed at maximizing the benefit of its owners; social responsibility, focused on meeting legal requirements, adapting and respecting the culture with which it interacts and environmental responsibility, which focuses on avoiding any negative impact on the environment and contributing to sustainable development (Puentes et al, 2008).

However, investment in environmental matters by organizations is also affected by external factors such as interest groups or stakeholders, a fundamental element in organizations when making decisions in this area. There are studies that confirm the positive correlation between interest groups and the existence of environmental management systems (Díez, Medrano and Díez, 2008).

According to Díez et al. (2008), interest groups can be divided into three categories: organizational, normative and social, and each of them has different effects on companies.

The organizational groups are those that are more linked to the company, and their actions directly or indirectly influence the success of this. Rosewicz (1990) in the USA, concluded in a study conducted in the USA, that the purchasing decisions of customers were oriented towards organic products and had preference for those companies that respect the environment. Within the organizational group, the shareholder is also included. The shareholders do not show a special interest in environmental aspects, however, it contrasts with their long-term responsibility in the company and their future decisions (Díez et al., 2008).

Regulatory groups encompass state and government organizations. This category is directly linked to compliance with the legislation (Díez et al., 2008). And social groups, formed by media and environmental entities, are becoming increasingly important and therefore their pressure is directly linked to the adoption of environmental policies (Delgado and Vidal, 2013).

As can be seen, the environmental concern is influencing the decisions of the different interest groups. And the organizations satisfy the needs of these interest groups, obtaining mainly benefits from this relationship (Díez et al., 2008). Through the information provided by the groups of interest to the company, or through patterns and behavior models, relevant aspects can be known for future decision-making.

The pressure exerted by stakeholders on ecological aspects causes an increase in the involvement of the management on these matters and, therefore, the company will have a greater willingness to invest in environmental protection. Therefore, a good knowledge of the stakeholders allows strategic planning and action in environmental matters, since, to greater knowledge, less risk and greater capacity for anticipation (Delgado and Vidal, 2013).

It should be noted that the regulatory groups are not the ones that have the most influence, although there is a view that these groups impose regulations and rules that may lead to changes in the company. But social groups exert a greater degree of influence, since they directly affect the level of priority (Díez et al., 2008).

ISSN-Print: 2007-1582- ISSN-On line: 2007-3682

It is also important to note that companies that promote the development of their activities within the framework of CSR are committed not only to generate benefits for their internal interest groups, but also are called to promote better living conditions in the areas of intervention of their projects and to respect the rights and to fulfill their duties, always in the constitutional foundation of the Social State of Law (Córdoba Penagos, González Santiago, & Gamboa, 2018).

Taking into account the different factors that are discussed throughout the section, the number of "ISO 14001 Certificates" has been considered as the main indicator for the analysis, because, as it is a voluntary choice of companies, it may be giving response to the needs of different interest groups. And it is noteworthy that the sector under study is within the main industries with this certificate.

3. Methodology

Taking into account what has been mentioned up to now and, above all, the remarkable incorporation of new technologies to companies, the continuous advances in this matter and the importance that the environment is increasingly charging, the main objective of this work is to look for the factors that influence that the companies dedicated to the manufacture of electronic components invest more or less in the protection of the environment.

The period chosen for the study covers from the year 2000 to the year 2015. The analysis has been structured in the behavior of an explained or dependent variable (Y) "Investment in environmental protection", based on other variables called explanatory or independent (X_i)) (Table 3).

These explanatory variables have been chosen according to their nature, distinguishing economic, ecological, social and legal factors, as already mentioned in the previous section, and as summarized below:

– The "Results of the Exercise" of companies in the sector in euros (X1): it is used as an economic variable to try to explain the investment, since investments in environmental or other matters are determined by the level of income and profits generated by the company.

– The "Emissions of CO2" to the atmosphere in tons (X2): it is used as an ecological variable, in order to show some of the impacts, in environmental terms, generated by these companies. In addition to being an indicator, whose decrease may mean an increase in environmental protection.

– The "Law 22/2011", of waste and contaminated soil (variable dummy) (X3): is used as a legislative variable since, as mentioned previously, for companies dedicated to manufacturing has been considered as the most relevant in environmental terms. Entered into force in 2011, date in which investment in environmental protection began to decrease.

– The "ISO 14001 Certificates" in number of certificates (X4): is used as a social variable, because these certificates help companies to manage and identify environmental risks; in short, they can show the environmental commitment of organizations.

Y_i	Investment environmental protection
X_1	Results of the Exercise
X_2	CO2 emissions
X_3	Law 22/2011
X_4	ISO 14001 Certificates
β_1	Coefficient of Results of the Exercise
β_2	Coefficient of CO2 Emissions
β_3	Law Coefficient 22/2011
β_4	Coefficient of ISO 14001 Certificates
e_i	Random component

Table 3 Composition of the regression equation
Source: Self Made

Taking into account these variables and their relevance at an environmental level, the objectives of the study are then formulated:

Objective 1: *Analyze the relationship of the variables studied with the investment in environmental protection in the electronic components manufacturing industry***.**

As a result of this objective, the following hypothesis is posed:

Hypothesis 1: *The analyzed variables show a high relation with the investment in environmental protection***.**

ISSN-Print: 2007-1582- ISSN-On line: 2007-3682

To validate this hypothesis, a simple correlation analysis will be carried out. This analysis allows the obtaining of significant relationships between the variables and the investment in environmental protection, through the interpretation of the Pearson coefficient.

Objective 2: *Analyze how variables relate to investment in environmental protection through regression analysis***.**

As a result of this objective, the following hypothesis is posed:

Hypothesis 2: *The investment in environmental protection in the electronic components manufacturing industry is explained by the factors studied***.**

To validate this hypothesis, a multiple linear regression analysis will be carried out.

The commented analyzes are developed with the IBM SPSS Statistics program and, once the results are obtained, it will be evaluated.

The data has been obtained from various sources. In the case of the "Investment in Environmental Protection" and the "Results of the Exercise" in the branch of manufacturing of electronic components of the Spanish technological sector, the data were obtained from the INE. The data on "CO2 emissions" were also obtained from the INE for the period 2008-2015, calculating the percentage they represent with respect to the total CO2 emissions of all Spanish industries in the period 2008-2015.

We then obtained an average of the percentages found and multiplied this by the total emissions of the years 2000-2007 to obtain an estimate of how much was issued in this period (*proxy variable*). Regarding the data of "Law 22/2011", it was considered that in the period 2000-2015 until 2011 this Law was not applied because it did not exist, putting a "0" as the value of the variable and, starting of 2011 included, a "1", because it had already entered into force (dummy variable). And the data on the "ISO 14001 Certificates" were extracted from the International Organization for Standardization between the years 2000 and 2015.

Regarding the treatment of these data, the econometric analysis carried out is discussed below.

3.1. Correlation analysis

The starting point of this analysis will be to analyze the existence of relationship or dependence between the variables that are the object of study (And with respect to X). In addition, the type of relationship and the intensity of this relationship are determined. The simple correlation analysis has been chosen because it determines how the behavior structure of one variable (Y) is explained by the behavior of another (X) (Visauta, 2002).

First of all, the aim is to analyze the correlation ratio between the values of the variable X that are given together with those of Y. The correlation will be greater the greater the power of the variable X when explaining the value that the variable Y takes, that is, a high correlation indicates that the variability of Y can be attributed to the variability of X. Otherwise, when the level of correlation is small, it indicates that the variations of Y are not attributed to the variable X, but to other causes not included in the analysis or are, but to a small extent (Montero, 2007).

To measure the degree of dependence between the variable Y and X, the coefficient of linear determination is determined, which is represented as r2. This coefficient shows the percentage of the variability of the data that is explained when associating the two variables X and Y. It takes values between zero and unity, so that:

- $r^2 = 0$ means that the ability to explain the relationship between X and Y is small.
- r2 = 1 means that the ability to explain is greater.

The square root of the coefficient of determination is known as the Pearson linear correlation coefficient, and is represented as r. This coefficient only implies the existence or not of statistical dependence among the linear variables, that is, the variables of the model can depend on another type of function (Montero, 2007). Its sign indicates the sense of the relationship between the variables, that is, if it is positive, the greater the value in one variable, the greater in the other, and if it is negative, the higher the value in one variable, the lower is in the other variable (Camacho, 2004). Take values between -1 and 1, therefore:

- r = 1 the relationship between the variables is positive, total dependence.
- r = -1 the relationship between the variables is negative.

ISSN-Print: 2007-1582- ISSN-On line: 2007-3682

– r = 0 there is no linear correlation between the variables.

To check the significance of the coefficient, a contrast is made that follows the Student's t distribution with n-2 degrees of freedom. What this contract proves is whether the population from which the sample originates has a r equal to 0 (not significant) or if r is different from 0 (it is significant) (Camacho, 2004).

3.2. Multiple linear regression

The question that arises in this analysis is what value of the variable explained corresponds to each of the values of the explanatory variables (Ramil, Rey, Lodeiro, Arranz, 2014). The expression of the model is as follows:

$$Y_i = \beta_0 + \beta_1 X_{1i} + \beta_2 X_{2i} + \beta_3 X_{3i} + \beta_4 X_{4i} + \varepsilon_i \quad (1)$$

The formulation of the model is subject to the following hypotheses (Ramil et al., 2014):

– The explanatory variables are deterministic, that is, they are not random variables.
– The disturbance is a variable with zero hope and constant and diagonal covariance matrix.
– The dependent or explained variable is random, since it depends on the random variable.
– There is absence of specification errors, that is, the X variables are relevant for the explanation of the variable Y.
– The explanatory variables are linearly independent, that is, there is no exact linear relationship between them, independence hypothesis.

The main objective is to obtain the estimates, that is, the numerical values of the coefficients β_0, β_1, β_2.

For this, the quality of the adjustment or goodness of the adjustment is taken into account, which depends on the size of the errors, that is, on how close the observed and estimated values of the return are. The quality of the adjustment can be assessed by decomposing the total variation of the return in two parts: that explained by the model and the residual. But to avoid compensation the sum of its squares is used (Ramil et al., 2014).

To analyze the quality of the adjustment these sums of squares are taken and different measures are defined that are explained below. First, the degree of dependence of Y with respect to X_1, X_2, X_3 and X4 is measured by means of the coefficient of linear determination, denoted R^2, which takes values between zero and unity. When it is close to the unit, the regression explains a high percentage of the variations of the explained variable. In general, a value close to unity should be obtained, since it is an indication of a good fit. However, a small coefficient of determination indicates that an error was probably made (Ramil et al., 2014).

Therefore, a model will be better the higher R^2 is, however, this coefficient depends on the introduction of new variables to the model. For this reason, for large samples it is replaced in R^2 for $\overline{R}^2$, which is the coefficient of determination corrected by the degrees of freedom. So $\overline{R}^2$ can be considered a good measure of the quality of the regression (Ramil et al., 2014).

To perform contrasts on the correlation coefficient R, the F statistic that follows a F (k, T-k-1) distribution of Fisher de Snedecor is used. This statistic will allow to find regions of confidence at a level of significance α for the set of bi parameters of the model (Ramil et al., 2014).

4. Results

4.1. Correlation analysis

In this part of the analysis, we have chosen the quantitative variables whose degree of relationship we want to analyze. First, the relationship between the variable Y (Investment in environmental protection) and the variable X1 (Result of the Exercise) and secondly the relationship between the variable Y (Investment in environmental protection of the sector) and the variable X2 (Emissions from CO2). Third, the relationship between variable Y and variable X3 (Law 22/2011). Finally, the relation of the variable Y with respect to the variable X4 (Certificates ISO 14001).

The matrix shown below is symmetric, where the values of the diagonal are equal to 1 because they correspond to the correlation of a variable with itself. It shows values such as the Pearson correlation coefficient, the significance of each coefficient and the number of variables involved in the calculation of the relationship (Table 4).

ISSN-Print: 2007-1582- ISSN-On line: 2007-3682

		Investment in Environmental Protection	Results of the exercise	CO2 emissions	Law 22/2011	ISO 14001 Certificates
Investment in Environmental Protection	**Correlation. Pearson**	1	,773**	,885**	-,852**	-,212
	Next (bilateral)		,001	,000	,000	,431
	N	16	15	16	16	16
Results of the exercise	**Correlation. Pearson**	,773**	1	,538*	-,587*	,133
	Next (bilateral)	.001		,039	.021	,637
	N	15	15	15	15	15
CO2 emissions	**Correlation. Pearson**	,885**	,538*	1	-,835**	-,277
	Next (bilateral)	,000	,039		,000	,299
	N	16	15	16	16	16
Law 22/2011	**Correlation. Pearson**	-,852**	-,587*	-,835**	1	,506*
	Next (bilateral)	,000	.021	,000		,038
	N	16	15	16	16	16
ISO 14001 Certificates	**Correlation. Pearson**	-,212	,133	-,277	,506*	1
	Next (bilateral)	,431	,637	,299	,038	
	N	16	15	16	16	16
** The correlation is significant at the 0.01 level (2 tails)). * The correlation is significant at the 0.05 level (2 tails)).						

Table 4 Correlation matrix
Source: self made from IBM SPSS Statistics

The Pearson correlation coefficient between the variables Y and X_1 is r = 0,773 **, that is, they show a positive relationship with a medium-high intensity. The better the result of the exercise obtained by the companies in the sector, the greater the investment they make in environmental protection. Its level of significance (p <0.01) indicates that the relationship between both variables is significant.

Between the variables Y and X_2 the correlation coefficient is r = 0.891 **, that is, positive relationship with a fairly high intensity. The greater the emissions to the atmosphere, the greater the investment made in environmental protection. Its level of significance (p <0.01) shows that the relationship is significant.

For the variables Y and X_3 the correlation coefficient is r = -0.852 **, that is, the variables show a negative relationship with a fairly high intensity. The existence of environmental laws has an impact on the reduction of investment in environmental protection. Its level of significance is relevant (p <0.01).

Finally, for variables Y and X_4 the Pearson coefficient is r = -0.212, that is, it shows a negative relationship with the number of ISO 14001 certificates, however, this relationship is not significant, therefore, the variable "ISO 14001" (X_4) will not be taken into account in the regression.

This result may be due to the fact that, as has been indicated, the sector analyzed is within the five main sectors with ISO 14001 certificates worldwide, so that, once this objective is reached, it meets the needs of the different interest groups , investment in environmental protection seems not to be significantly affected by this variable. After analyzing the results of the correlation matrix, the bivariate correlation model will be based on the variables that are shown to be significant:

- Results of the Exercise (X_1)
- CO2 emissions (X_2)
- Law 22/2011 (X_3)

When calculating the coefficient of linear determination, which is represented as r^2, we find that for Y and X_1 the $r^2 = 0.5975$, that is, the results of the exercise of these companies explain 59.75% of the investment in environmental protection. On the other hand, for the variables Y and X_2 the $r^2 = 0.7938$, that is, the emissions of CO2 emissions from the manufacturing companies account for 79.38% of the investment in environmental protection. For variables Y and X_3, $r^2 = 0.7259$, that is, Law 22/2011 explains 72.59% of the investment in environmental protection.

4.2. Multiple linear regression analysis

The multiple regression equation for investment in environmental protection is shown below, based on the result of the year, CO2 emissions and Law 22/2011, on waste and contaminated soils (Table 5). As you can see, the variable X4 has been eliminated, leaving the new expression of the model as follows:

$$Y_i = \beta_0 + \beta_1 X_{1i} + \beta_2 X_{2i} + \beta_3 X_{3i} + \varepsilon_i \quad (1)$$

		Non-standardized coefficients		Standardized coefficients	t	Next
		B	**Standard error**	**Beta**		
1	**(Constant)**	-3356480,178	3963465,824		-,847	,415
	Results of the Exercise	3,869	1,148	,381	3,369	,006
	CO2 emissions	91,020	27,130	,515	3,355	,006
	Law 22/2011	-2033087,556	1654352,627	-,196	-1,229	,245
a. Dependent variable: Investment in Environmental Protection						

Table 5 Multiple regression equation
Source: self made from IBM SPSS Statistics

Therefore, the equation that relates the variables is:

$$\hat{Y} = -3356480{,}178 + 3{,}869X_1 + 91{,}020X_2 - 2033087{,}556X_3 \quad (2)$$

The ordinate at the origin (-3356480,178): represents the constant and determines what is the estimated value of the investment if the variables "Results of the Exercise", "Emissions of CO2" and "Law 22/2011" could be annulled. As can be seen, the economic variable "Results of the Exercise" and the ecological variable "CO2 emissions" are those that are significant ($p < 0.05$) both with a positive relationship with the variable explained "Investment in environmental protection" being those that have a greater effect on this one. Regarding "Law 22/2011", it is not shown as a significant variable.

The non-standardized coefficients of "Exercise Results" and "CO2 Emissions" are treated as positive coefficients, which indicates that the estimated relationship between the dependent variable ("Investment in environmental protection") and the independent variables is directly proportional. That is, if everything else remains constant an increase (decrease) of € 100 in "Results for the Fiscal Year" will correspond to an increase (decrease) of € 386.9 in the investment and an increase (decrease) of 100 tons in " CO2 emissions "will mean an increase (decrease) of € 9,120 in investment.

The variable "Law 22/2011", in this case, does not show significant.

Table 6 shows the multiple correlation coefficients, the adjusted and unadjusted determination coefficient and the standard error for the model, which are used to determine the quality of the adjustment made.

The correlation coefficient has a value of R = 0.954, which indicates that the relationship between the explained and explanatory variables is positive. The coefficient of determination takes the value $R^2 = 0.910$, that is, 91% of the variations in investment in environmental protection are explained by the regression. The coefficient of determination adjusted to the number of independent variables of the model is $R^2 = 0.874$. In addition, since it is a high value, since $R^2 > 0.9$ it can be said that, according to these results, the model specification is correct.

Model	R	R square	R adjusted squared	Standard error of the estimate
1	,954[a]	,910	,885	1605389,362
a. Predictors: (Constant), Law 22/2011, Results of the Year, CO2 Emissions				

Table 6 Summary of model coefficients
Source: self made from IBM SPSS Statistics

Regarding the analysis of the variance with the F statistic for the test of hypotheses about whether or not there is a linear relationship between the dependent variable of the model and the set of independent variables, F = 25.233 and the significance <0.00 for which it is accepted that the hypothesis is fulfilled and there is a significant linear relationship between the investment in environmental protection and the study variables (Table 7). As it is observed, it presents a high level of significance, which indicates that the model is explanatory and that there is a significant linear relationship between the variables.

ANOVA[a] Model		Sum of squares	gl	Average quadratic	F	Next.
1	Regression	285717401000000	3	95239133660000	36,953	,000[b]
	Residue	28350025030000	11	2577275002000		
	Total	314067426000000	14			
a. Dependent variable: Investment in Environmental Protection b. Predictors: (Constant), Law 22/2011, Results of the Year, CO2 Emissions						

Table 7 Analysis of the variance
Source: self made a partir de IBM SPSS Statistics

5. Conclusions

The main objective of this work is to show what are the factors or variables that affect the investment of companies in environmental protection and, thus, to better understand the decisions taken in this matter to design policies that are more effective.

As mentioned in section 2, companies in the ICT sector, in their area of electronic component manufacturing, have always bet on the creation of value and benefits for their owners and shareholders. However, the transition towards a more social and green model reveals a series of goals, where the main objective is to create value for society and its environment, in addition to complying with current legislation on issues related to the environment.

ISSN-Print: 2007-1582- ISSN-On line: 2007-3682

At the same time, it was considered important to see how environmental protection by the industry is defined by standards that define the levels of protection required according to the activity performed and / or the polluting substances that are used or generated in the production cycle (Agudo, 2003). In order to study this problem, factors that may be influencing investment in environmental protection by companies in the sector have been identified. These factors are economic variables such as "Results of the Fiscal Year", ecological variables such as "CO2 emissions", legal variables such as "Law 22/2011" and social variables such as "ISO 14001 Certificates", all of which are related to each other.

Taking into account what has been said, in section 3 two hypotheses have been put forward and an analysis of the economic, ecological, social and legislative variables has been carried out in order to understand and verify the relationship that exists with the investment in environmental protection. These hypotheses are:

Hypothesis 1: The analyzed variables show a high relation with the investment in environmental protection**.**

Hypothesis 2: The investment in environmental protection in the electronic components manufacturing industry is explained by the factors studied**.**

Section 4 shows the results of the analyzes performed. A bivariate correlation analysis has been carried out, which allows to validate, in part, the first hypothesis. This hypothesis has been validated in part because not all the variables studied have shown a relationship with the dependent variable. This is the case of the ISO 14001 certificates, which do not have a significant relationship with the investment in environmental protection.

Regarding the economic variables "Results of the Exercise" and ecological "CO2 emissions" the linear relationship is quite high and positive, that is to say, before an increase of one or the other there is an increase in the investment in environmental protection. On the other hand, the legislative factor is significant in the correlation analysis and shows a fairly high and negative relationship with the dependent variable, that is, if there is a hardening of the laws, the investment in environmental protection will be smaller.

To fulfill the second objective of the work, a multiple linear regression analysis has been carried out. This allows to verify how the variables relate to the investment in environmental protection and obtain the regression equation to predict the value of the dependent variable. The adjustment of the estimate can be considered acceptable. The analysis allows to validate, in part, the second hypothesis.

The behavior of the investment in environmental protection depends on the values taken by the economic and ecological variables, which are the most significant. Specifically, 91% of the variations in investment in environmental protection are explained by the variables.

The results obtained in this study allow us to offer a series of recommendations:

– CO2 emissions are the main causes of climate change and, in the specific case of this work, it is observed that investment in environmental protection and this factor are closely related. Therefore, it is necessary to ask for more commitment from companies and industries in this aspect, so that they are more responsible for the damage they cause. The Paris Conference already establishes an objective to reduce GHG emissions, especially from 2020, but instead of reducing, one should try to avoid these emissions to mitigate the impacts generated. Betting on new technologies and clean ways to generate energy is the way to achieve a change in the business mentality.

– The business benefits are those that mark the way when acting in the care of the environment. In the analysis, this conception is verified, since it is observed how the economic results and the investment in environmental protection are related, that is, the organizations invest in this area in fusion of the benefits. Therefore, for the future the promotion and increase of subsidies for those companies that bet on the use of sustainable materials and tools should be a priority.

Based on the above, the main points on which future policies or regulations should affect, to promote sustainable development in the manufacturing sector of the ICT sector, would be to promote the use of sustainable materials and tools with the environment and the reduction of waste and emissions to the atmosphere (Agarwal and Nath, 2011).

ISSN-Print: 2007-1582- ISSN-On line: 2007-3682

The fact of encouraging the use of new materials would not only favor the environment, but also the companies themselves promoting the development of R + D + i.

Another point to take into account within this sector would be the promotion of the use and manufacture of reusable or renewable electronic products, which can be repaired without having to re-manufacture a new product, that is, encourage initiatives based on circular economy, in order to reduce the generation of waste of these companies. An example of this would be the manufacture of mobile phones easy to repair, with parts that can be reused or from which valuable materials can be extracted once discarded for later reuse. This is important since the generation of waste is not based solely on manufacturing, but covers the entire value chain of companies, from extraction to sale. Therefore, the promotion of the aforementioned measures could favor the reduction of large impacts in the environment, as stated by McDonough and Braungart (2002).).

At the same time, at a more general level, it would also be important to encourage the use of eco-technologies, which use new technological innovations to promote the sustainable use of natural resources, both in companies and in urban spaces (García and Balderrama, 2018). In the same line, it would also be necessary to continue promoting new initiatives for the creation of green jobs, in which the introduction of new technologies also contributes to reducing the environmental impact of companies (Network of Vocational Training Institutes, 2018). An example that unites the two lines indicated would be the installation of solar panels that can serve to provide power to charging stations of electric vehicles.

This type of projects can generate important virtuous circles, since they not only favor the reduction of the ecological footprint, but the energy savings they provide also has important economic benefits that, in certain business sectors, can favor an increase in investment in environmental protection as the results of this study show. Finally, add that the results obtained show certain limitations, such as the scarcity of data in relation to the variables used, since it was not possible to obtain data for a longer period of time. The availability of more data would allow to establish some kind of trend in the investment in environmental protection.

The confidentiality of certain data has also been a limitation, since companies are not obliged to publish certain information. Technological advances, the increasing incorporation of new technologies and the continuous development of this sector could favor future lines of research in this field.

6. References

Agarwal, S., & Nath, A. (2011). Green computing-a new horizon of energy efficiency and electronic waste minimization: A global perspective. In 2011 International Conference on Communication Systems and Network Technologies, 688-693. IEEE. doi: 10.1109/CSNT.2011.148

Agudo, J. (2003). Técnicas de control de la contaminación los estándares de protección medioambiental (Tesis Doctoral). Universidad Autónoma de Madrid, Madrid. Recuperado de: https://repositorio.uam.es/handle/10486/4975

Braga, I.C., Nedelcu, A., & Udroiu, R. (2017). Risk reduction in dimension inspection of the plastic injection-molded parts from mechatronic devices by using optical 3D measuring techniques. MATEC Web of Conferences, 94. doi: 10.1051/ matecconf/20179404001

Boletín Oficial del Estado. (2013). Ley 21/2013, de 9 de diciembre, de evaluación ambiental. Madrid, 11 de diciembre de 2013, nº 296. Recuperado de: https://www.boe.es/buscar/doc.php?id=OSG-A-2013-12913

Boletín Oficial del Estado. (2011). Ley 22/2011, de 28 de julio, de residuos y suelos contaminados. Madrid, 29 de julio de 2011, nº 181. Recuperado de: https://www.boe.es/buscar/doc.php?id=OSG-A-2011-13046

Boletín Oficial del Estado. (2007). Ley 42/2007, de 13 de diciembre, del Patrimonio Natural y de la Biodiversidad. Madrid, 14 de diciembre de 2007, n º 299. Recuperado de: https://www.boe.es/buscar/act.php?id=OSG-A-2007-21490

Boletín Oficial del Estado. (2007). Ley 26/2007, de 23 de octubre, de Responsabilidad Medioambiental. Madrid, 24 de octubre de 2007, n º 255. Recuperado de: https://www.boe.es/buscar/doc.php?id=OSG-A-2007-18475

ISSN-Print: 2007-1582- ISSN-On line: 2007-3682

Boletín Oficial del Estado. (2011). Ley 2/2011, de 4 de marzo, de Economía Sostenible. Madrid, 5 de marzo de 2011, nº 55. Recuperado de: https://www.boe.es/buscar/act.php?id=OSG-A-2011-4117

Camacho, J. (2004). Estadística con SPSS versión 12 para Windows. Madrid, España: Ra-ma, SA.

Comisión Nacional de los Mercados y la Competencia. (2017). Informe anual 2017. Recuperado de: http://data.cnmc.es/datagraph/jsp/inf_anual.jsp

Córdoba Penagos, A., González Santiago, E. A., & Gamboa, G. (2018). Percepción de las comunidades del área de influencia del campo abanico en el municipio de Espinal-Tolima de los beneficios de los programas de gestión social en el marco de la Responsabilidad Social Corporativa de Pacific Rubiales Energy [recurso electrónico] (Doctoral dissertation). Recuperado de: http://bibliotecadigital.univalle.edu.co/bitstream/10893/11361/1/CB-0574791.pdf

Croucher, M. (2011). Potential problems and limitations of energy conservation and energy efficiency. Energy Policy, 39, 5795-5799. doi: 10.1016/j.enpol.2011.07.011

De Gispert, C. (2000). Tributos ambientales sobre el agua y comportamiento del sector industrial. (Tesis doctoral). Universitat de Barcelona, Barcelona. Recuperado de: http://hdl.handle.net/2445/35365

Delgado, J., y Vidal, M. D. (2013). La influencia de los grupos de interés en el comportamiento medioambiental de los directivos: el uso de estrategias indirectas. Cuadernos económicos de ICE, 86, 153. Recuperado de: https://bit.ly/1rOvMjb

Díez, F. D. A., Medrano, M. L., y Díez, E. P. (2008). Los grupos de interés y la presión medioambiental. Cuadernos de gestión, 8(2), 81-96. Recuperado de: https://idus.us.es/xmlui/handle/11441/40035

Ecoembes (2017). 20 Leyes de medio ambiente que debes conocer. Recuperado en: https://www.ecoembes.com/es/planeta-recicla/blog/20-leyes-de-medio-ambiente-que-debes-conocer

European Commission. (2016). Best Environmental Management Practice for the Electrical and Electronic Equipment Manufacturing Sector. Recuperado de: http://susproc.jrc.ec.europa.eu/activities/emas/eeem.html

Eyraud, L., y Clements, B. (2012). Hacia una energía verde: crece en el mundo la inversión en tecnologías amigables con el medio ambiente. Finanzas y desarrollo: publicación trimestral del Fondo Monetario Internacional y del Banco Mundial, 49(2), 9-4. Recuperado de: https://bit.ly/2mNZ0RA

Fuchs, C. (2008). The implications of new information and communication technologies for sustainability. Environment, Development and Sustainability, 10(3), 291-309. doi: 10.1007/s10668-006-9065-0

Galvin, R. (2015). The ICT/electronics question: Structural change and the rebound effect. Ecological Economics, 120, 23-31. doi: 10.1016/j.ecolecon.2015.08.020

García, J. y Balderrama, A. S. (2018). Modelo AMUVAM para la valuación de espacios eco-tecnológicos. Caso de estudio: vialidad solar proyectada en la ciudad de Tijuana. Revista de Direito da Cidade, 10 (3), 1813-1841. doi: 10.12957/rdc.2018.33861.

Herrmann, C., Saraev, A., & Scheidt, L. G. (2012). Green IT: A holistic approach for identifying sustainable performance. In Electronics Goes Green 2012+(EGG), 1-6. IEEE. Recuperado de: https://bit.ly/2JIpaOx

IBM. IBM SPSS statistics.

Instituto Nacional de Estadística (2018). Principales variables por sectores de actividad: número de ocupados y resultados del ejercicio. Serie 2008-2015. Recuperado de: http://www.ine.es/jaxiT3/Table.htm?t=24917

Instituto Nacional de Estadística (2018). Cuenta de emisiones a la atmósfera. Serie 2008-2015. Recuperado de: http://www.ine.es/jaxi/Table.htm?path=/t26/p084/base_2010/serie/l0/&file=01001.px&L=0

ISSN-Print: 2007-1582- ISSN-On line: 2007-3682

Instituto Nacional de Estadística (2018). Encuesta sobre generación de residuos en el sector industrial. Serie 2012-2014. Recuperado de: http://www.ine.es/jaxi/Table.htm?path=/t26/e068/p02/serie/l0/&file=01001.px&L=0

Instituto Nacional de Estadística (2018). Encuesta del gasto de la industria en protección ambiental. Serie 2008-2016. Recuperado de: http://www.ine.es/jaxi/Table.htm?path=/t26/p070/p01/serie/l0/&file=01001.px&L=0

Instituto Nacional de Estadística (2018). Cuentas de emisiones a la atmósfera. Base 2010. Serie 2008-2015. Recuperado de: http://www.ine.es/jaxi/Table.htm?path=/t26/p084/base_2010/serie/l0/&file=01001.px&L=0

Instituto Nacional de Estadística (2018). Encuesta de consumos energéticos. Serie 2009-2015. Recuperado de: http://www.ine.es/jaxi/Table.htm?path=/t04/p02/cnae09/2015/l0/&file=04001.px&L=0

Lacruz, F. (2005). La empresa ambientalmente responsable. Una visión de futuro. Economía, (21). Recuperado de: http://iies.faces.ula.ve/revista/Articulos/Revista_21/Pdf/Rev21Lacruz.pdf

McDonough, W., & Braungart, M. (2002). Cradle to cradle: Remaking the way we make things. New York, EEUU: Farrar, Straus and Giroux.

Ministerio de Energía, Turismo y Agenda Digital. Gobierno de España. (2017). Informe Anual del Sector ICT y de los Contenidos en España 2017. Recuperado de: https://bit.ly/2xBbtjH

Montero, J. (2007). Estadística descriptiva. Madrid, España: Paraninfo, SA.

Myro Sánchez, R. y Fernández-Otheo Ruiz, C.M. (2004). La deslocalización de Empresas en España. La atracción de la Europa Central y Oriental. Información Comercial Española, ICE: Revista de economía, ISSN 0019-977X, 818, pp. 185-204. Recuperado de: https://dialnet.unirioja.es/servlet/articulo?codigo=1121852

Ochoa, J.N. (2018). Oportunidades de negocio y tendencias medioambientales. Universidad & Empresa, 20 (35), 13-50. http://dx.doi.org/10.12804/revistas.urosario.edu.co/empresa/a.5740

Organización Internacional de Normalización (2018). ISO 14000 family - Environmental management. Recuperado de: https://www.iso.org/iso-14001-environmental-management.html

Organización Internacional de Normalización. (2018). ISO 14001 - data per country and sector - 1999 to 2016. Recuperado de: https://bit.ly/2Gzune7

Pérez, J., y Frías, Z. (2017). Las infraestructuras ICT y la consolidación de la economía digital. Información Comercial Española, ICE: Revista de economía, (897), 23-38. Recuperado de: https://bit.ly/2Luhpki

Programa de las Naciones Unidas para el Medio Ambiente. (2011). Hacia una economía verde: Guía para el desarrollo sostenible y la erradicación de la pobreza. Recuperado de: http://sostenibilidadyprogreso.org/files/entradas/hacia-una-economia-verde.pdf

Puentes, R., Antequera, J. M., y Velasco, M. D. M. (2008). La responsabilidad social corporativa y su importancia en el espacio europeo de educación superior. In Estableciendo puentes en una economía global (p. 48). Escuela Superior de Gestión Comercial y Marketing, ESIC. Recuperado de: https://bit.ly/2LuAClM

Ramil, M., Rey, C., Lodeiro M., y Arranz, M. (2014). Introducción a la econometría: Teoría y práctica. A Coruña, España: Reprografía Noroeste SL.

Red de Institutos de Formación Profesional. (2018). Prospección de necesidades formativas para la generación de empleos verdes en Centroamérica y República Dominicana. Recuperado de: https://bit.ly/2x6M4L3.

Remacha, M. (2017). Medioambiente: Desafíos y oportunidades para las empresas. Navarra, España: Cátedra CaixaBank de Responsabilidad Social Corporativa. Recuperado de: https://www.iese.edu/Aplicaciones/upload/ST0431.pdf

Unión Europea. (2018). EU Emissions Trading System (EU ETS). Recuperado de: https://ec.europa.eu/clima/policies/ets_en

ISSN-Print: 2007-1582- ISSN-On line: 2007-3682

Unión Europea. (2008). Directiva 2008/98. CE del Parlamento Europeo y del Consejo, del 19 de noviembre de 2008. Recuperado de: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=OJ:L:2008:328:TOC

Unión Europea. (2004). Directiva 2004/35. CE del Parlamento Europeo y del Consejo, del 30 de abril de 2004. Recuperado de: https://eur-lex.europa.eu/legal-content/ES/TXT/?uri=celex:32004L0035

Vargas, O. I., Trujillo, J. M., y Torres, M. A. (2017). La economía verde: un cambio ambiental y social necesario en el mundo actual. RIAA, 8(2), 175-186. Recuperado de: https://bit.ly/2NxRW6J

Visauta, B. (2002). Análisis estadístico con SPSS para Windows. Madrid, España: MCGRAW-HILL, SA.

ISSN-Print: 2007-1582- ISSN-On line: 2007-3682