The Ecological Behaviour Related to Green Information and Communication Technology in Romanian Organizations

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ABSTRACT

An increased focus on environmental issues and the fulminant development of information and communication technologies led to the appearance and increased interest in the green characteristics of the available products and services. The ecological behaviour related to these technologies used by organizations, has become a widely studied and applied topic nowadays. In this context, this paper aims to analyse the perception of managers and employees of the Romanian companies in relation to the green information and communication technologies in the attempt to offer a genuine image of their attitude and see if their views are close to the international vision on environment protection. Starting from the literature regarding information and communication technologies and the available empirical studies, we have made an analysis on two categories of organizations: the ones that apply environment policies supported by the institutions and the ones that do not apply any policies, including comparisons between them. The conclusions of the study pointed out the presence of environmental concerns, not always clearly drawn or applied, but they could form the basis for the future actions and initiatives of consumers of information and communication technologies products and services in the wider context and will to fall into line with the Western level of economic and social development.

Keywords*: green ICT, environment, Romania, consumers, environment policies, recycling, virtual communication*

JEL Classification: *O13, Q53, Q56*

INTRODUCTION

The environmental issues are currently widely debated by the national and international organizations, in the developed countries as well as in the developing countries. Reducing the pollution level, the waste volume and improving the recycling process are often used to estimate the performance

achieved in different countries or/and regions. The motivations which form the foundation of these interests were generated by the massive deterioration of the ecosystem as a consequence of the industrialization from the previous century which continues nowadays in different forms. The degradation of the environment and the drastic decrease of natural resources are often perceived as the price to be paid for the economic and social evolution. Thus we mention the global warming is considered to be mostly (90%) the consequence of the human activities according to a report made by the Intergovernmental Panel on Climatic Change, coordinated by UN and published in 2001. The same document mentions that *the carbon emissions that have been present so far as well as the future ones will contribute to the global warming and the increase of sea level during the following 1000 years, due to their great persistence in the atmosphere* (IPCC, 2001) The main cause of this problem comes from the use of fossil fuel in the production of energy and, secondly, cutting the rainforest which leads to the emission of carbon blocked in the biomass. The observations of the above mentioned report as well as other studies regarding the environment should contribute to the increase in number of initiatives taken to stop the activities which are not favourable to the environment regardless of their source, namely the state, entrepreneurs or the population. Unfortunately, the changes in this field are slow; the immediate interests continue to be a priority and the concern for the future generations can be seen more on a declarative level and less in practice. Technology evolution has its advantages and disadvantages in this regard. On one side, it contributes to the creation of certain methodologies and production methods that are less invasive in regards to the environment, as international organizations are busy promoting its issues, but, regardless of the performance level, it contributes to the increase in pollution, energy consumption and the increase in waste volume, impossible to manage efficiently. At the same time, it is known that the technological progress has brought the human kind to a level which, not a very long time ago, existed only in our imagination.

The technological innovations from different fields had important influences on the environment ensuring the necessary frame and resources for their accomplishment. On one hand, they made possible an easier identification of the environment issues and stating potential or/and real solutions but on the other hand, they encouraged the development of new technologies able to allow measurements and complex estimations regarding the changes in the ecosystem. At the same time, the international organizations have elaborated regulations to put a limit to the exaggerated trend towards technology use and take into account the impact on the natural ecosystem. ICTs follow this direction as one of the current trends with important influence on all fields of

activity and social life. They are characterized by a spectacular and extremely quick evolution, having both favourable and unfavourable effects on the environment. Still, improving the ICT-environment relationship depends on the attitude of the population, degree of education, awareness on the problems and effects on the ecosystem shown by individual consumers and organizations. In Palmer and Neal's opinion (1994), education will increase the degree of awareness related to the impact of the human activities on the environment and it will bring a model to harmoniously develop the economy and keep the same quality of life for individuals.

In Romania the awareness related to the environment can be noticed too scarcely in the individual and organizational activities and concerns. Joining the European Union imposed certain conditions regarding pollution and waste which have not yet been fulfilled. This paper aims to identify the manner in which the organizations in Romania, as consumers, are involved in promoting and implementing green ICT specific practices. Thus, we have created and tested four work hypotheses, analysed mainly within the companies which apply environmental policies supported by the institution but in comparison between them, there are also the ones which do not have such policies.

- **H1**: The organizations which have environmental policies supported by the institution do not use systems of rationalization for the energy consumption and the internal regulations adopted for this purpose are often disregarded.
- **H2**: The rules on recycling the consumables from the ICT field, mainly paper, are present and applied, mostly, by the companies who have environmental internal policies and this aspect is helped by the limited resources needed for the accomplishment of such an approach.
- **H3**: The rules regarding the disposed equipment are applied according to the environmental policies.
- **H4**: The organizations prefer to communicate in the virtual environment rather than travel, which influences the ecosystem in a positive way, even if the main reasons are financial.

We consider that having knowledge, but mostly understanding these facts could support the organizations as consumers, in order to display a favourable attitude towards environment, by measures of smaller or greater impact and by an active involvement in pro-environment activities.

THEORETICAL FUNDAMENTALS OF RESEARCH

It is widely acknowledged that ICT has revolutionized society. It has led to important change in the business and the social life, it caused the implementation and popularization of certain concepts such as digital economy, virtual enterprise, virtual organization, information and knowledge society, intelligent enterprise, so on, as well as an updated list of e-s (e-business, e-commerce, e-tax, e-governance, e-accounting, e-learning etc.) in which every human activity can be represented in the virtual environment. Obviously, critics have not taken long to appear against this technological explosion, among which environmental issues can be found. The encouragement of consumption, seen as a general solution for development and settlement of unbalances, crises and recessions, given the significant growth of the population and the planned-limited reliability of products, based on the permissive access to resources by the large producers and the facilities brought by the development of transportations, resulted in significant unbalances of the environment with an impact on the entire population, apart from improving the living standards of a part of the world population. (Petcu, Miron and David-Sobolevschi, 2012) Nevertheless, their evolution did not stop, not even slow down. According to Hargroves and Smith' approach (2005), ICT defines the ultimate two values of innovation. From the point of view of our paper, these authors' opinion is very interesting, as they state: *if the last wave of innovation, ICT, was driven by market needs such as reducing transaction costs, we believe that there is significant evidence that the next waves of innovation will be driven by the twin needs simultaneously to improve productivity whilst lightening our environmental load on the planet.* (Hargroves and Smith, 2005)

The studies on the ICT effects on the environment have appeared very quickly highlighting their bidirectional character. They have been made by national and international organizations, by analysts from public or private companies and have been the object of study of wide research projects in order to find the best methods to become more efficient or for marketing purposes. More precisely, the studies highlight, on one side, the favourable influences by use of equipment and appliances to estimate the environmental situation and develop certain methods to fight the negative influences coming from different fields of activity and, on the other hand, the consumption of non-renewable resources, pollution and a bigger volume of electronic waste as a result of their production and use. Under the above mentioned conditions, it was demanded to make some detailed analyses which could ponder the positive and negative effects on the ecosystem and this led to the appearance of concepts such as *green ICT*, *green computing* or *ICT sustainability*. According

to the literature in the field, green ICT represents *the study and practice of designing, manufacturing, using, and disposing of computers, servers, and associated subsystems- such as monitors, printers, storage devices, and networking and communications systems- effectively with minimal or no impact on the environment. Green IT also strives to achieve economic viability and improved system performance and use, while abiding by our social and ethical responsibilities... Thus Green IT includes the dimensions of environmental sustainability, the economics of energy efficiency, and the total cost of ownership, which includes the cost of disposal and recycling… It is the study and practice of using computing resources efficiently*. (Murugesan, 2008) The concerns for green ICT have become more and more justified since the studies highlighted that these technologies are responsible for at least 2% of global greenhouse gas emissions (Webb, 2008), with data centres accounting for about 1.3%. (Koomey, 2011) Even under these conditions, the market is invaded by products which are harmful to the environment, the consumption continues to increase excessively and irrationally and the migration speed to the green concept is done rather slowly. The international organizations, in cooperation with the governments try to stimulate the development of an industry based on green principles, either by granting fiscal advantages or by allotting funds, or even by imposing restrictions related to the environment. In the case of companies, a great number of managers consider that the way in which they respond to the current requirements of getting involved in environment protection will significantly influence the competitiveness and even ability to survive, a reason why long-lasting development is considered one of the mega-trends of the present day economy. (Lubin, Esty, 2010)

The undertaken studies have shown that green ICT can significantly contribute to the decrease of the negative effects on the environment by their production and use of their own equipment and appliances, and this applies to all the fields in which they are used. Unfortunately nowadays they still generate negative effects on the environment, identified as the following:

- Consumption of energy: it varies a lot depending on the generation and type of equipment. For example, an average desktop computer uses 70W when active and 9W in low power mode; laptops use significantly less energy – about 19W when active and 3W in low power mode – but can draw 12-24W when charging. (Bray, 2006)
- CO_2 emissions: according to Gartner Inc. ICT industry accounts for approximately 2% of global carbon dioxide (CO2) emissions, a figure equivalent to aviation. (Gartner, 2007)
- Great volume of electronic waste: 20-25 million tons of electronic waste (e-waste) is generated worldwide each year. (Robinson, 2009)

- Consumption of paper: Global paper use has doubled since the mid-1970s. (Worldwatch Institute, 2004) Consumption of papermaking fibre is projected to increase from 370 million tons in 2005 to 504 million tons by 2020 (Worldwatch Institute, 2004)
- Consumption of non-renewable resources: at least 240 kilos of fossil fuel, 22 kilos of chemical products and 1.500 kilos of water are necessary to produce a computer. (Bridgwater, 2012)
- The uses of dangerous metals such as lead, mercury, cadmium which reside in e-waste continue to be dangerous not only during the life time, but also after the equipment disposal. (MacLean, Akoh and Egede-Nissen, 2010)

The mentioned problems might be solved by a series of more or less complex measures, accessible to both, producers and users, highly promoted by the environmental organizations. For consumers, they mainly refer to virtualization, energy and consumables saving, purchasing environment-friendly products, recycling electronic waste so on. For producers they are promoted as eco-innovations, a wider concept which considers *the production, assimilation, exploitation of a product, production process, services, management or business method which is new for the organization (developed or adopted) and whose results, within the life cycle, lead to the reduction of environment risks, pollution or any other negative effects of resource use (including energy) in comparison to the relevant alternatives*. (Kemp, 2009)

In Romania, the green concept is not well-represented in the consciousness of the population and in the practices of the public and private economic organizations. The current norms are often ignored by the persons responsible for their implementation as well as by those who should check them. Such an example is the way the law of selective waste collecting is applied or better said not applied, a law which has been in force since the 6th of August 2010. (MO, 2010) According to the information offered by the Institute of Public Policies (IPP, 2011), only 33% of the public institutions under study owned different waste bins for each office and 32% had special depositories. Also, only 47% of the institutions had a measure plan on selective disposal. In the situation in which not even the state institutions do not apply this law, the chance that the private companies or individual consumers should abide by such a norm is very low and this makes it impossible to reach the European Union objective to recycle at least 50% of total quantity of waste by 2020. According to the same source, which repeats a statement of the Ministry of Environment and Forests from April 2011, only 1% of the total quantity of waste is reused, Romania succeeded in reaching the established recycling target (40%) only in the case of plastic. In an optimistic view, we consider that these results are only the beginning and we are

trying to identify, in what follows, the way in which the economic organizations, as consumers, practically apply the concept of green ICT.

METHODS AND DATA

The ICT industry has known a spectacular evolution in Romania in relation to the international accomplishments and supported by the free access to information and technology. Unfortunately, the attitude towards environment is not as deeply rooted as in the western spirit. The reasons are various. We take into consideration the lack of education and documentation, regarding the consequences of over-using technology on the environment, the level and educational style, not popularizing the importance of the environment in the media, the precarious economy, the unclear illegal frame, the lack of practical means accessible to the consumers to apply the environment protection methods so on. Apart from the above mentioned aspects, the evolution of the ICT sector has brought significant benefits, in 2011 contributed with almost 3% at the GIP (Vuinici, 2012), proving to be one of the most profitable fields of activity in Romania. The part with the best results was the software development.

In order to establish the degree of involvement of the organizations from Romania in green ICT we have elaborated a survey spread on 400 companies visible in the virtual environment and we have received 116 answers. The response average rate was 29%, considered acceptable for this type of study, considering the low level of involvement in the pro-environment activities in Romania. The next table presents a few of the main characteristics of the respondents, respectively the type of organization, field of activity and presence of the environment protection policies supported by the institutions (Table 1). Some organizations are active in several fields and, for this reason; the value of an indicator is higher than the percentage of 100%.

General characteristics of the sample

Table 1

<table>
<tr><th>Organization type</th><th>Frequency</th><th>Percent</th><th>Field of activity</th><th>Frequency</th><th>Percent</th><th>Environment policies supported by the institutions</th><th>Frequency</th><th>Percent</th></tr>
<tr><td rowspan="3">Small and medium enterprises</td><td rowspan="3">66</td><td rowspan="3">57%</td><td>Software</td><td>56</td><td>48%</td><td>Yes</td><td>40</td><td>34%</td></tr>
<tr><td>Hardware</td><td>4</td><td>3%</td><td rowspan="3">No</td><td rowspan="3">76</td><td rowspan="3">66%</td></tr>
<tr><td>ICT services</td><td>60</td><td>52%</td></tr>
<tr><td>Corporations</td><td>24</td><td>21%</td><td rowspan="2">Other field</td><td rowspan="2">32</td><td rowspan="2">28%</td></tr>
<tr><td>Public institutions</td><td>26</td><td>22%</td></tr>
</table>

The study we made showed us that the big private companies are the most interested ones in applying certain policies on institutional level, followed by the public ones. The small enterprises are less involved in the environmental issues. The next table summarizes these aspects and it presents the main reasons of the companies which apply environmental policies supported by the institution (Table 2) according to information obtained from these.

The existence of environment regulations and the motivations of the companies included in the sample related to the degree of involvement in the green ICT support

Table 2

Organization Type	Environmental policies supported by the institution	Frequency	Percent	The main reason for creating a green institutional policy in the ICT field	Frequency	Percent
Small and medium enterprises	Yes	10	15%	Improve environment certification	2	20%
				Improve efficiency	4	40%
				Reduce costs	4	40%
	No	56	85%			
Corporations	Yes	16	67%	Reduce costs	4	25%
				Improve environment certification	6	37.5%
				Improve efficiency	4	25%
				Social reputation	2	12.5%
	No	8	33%			
Public institutions	Yes	14	58%	Political pressure	2	14%
				Laws	4	29%
				Reduce costs	4	29%
				Improve efficiency	2	14%
				Improve environment certification	2	14%
	No	12	42%			

In the next section we shall analyse separately the four hypotheses of the study, presented in the first section of this paper.

RESULTS AND DISCUSSIONS

The results obtained from the analysis of hypotheses are the following:

H1: The organizations which have environmental policies supported by the institution do not use systems of rationalization for the energy consumption and the internal norms adopted for this purpose are often disregarded.

The study highlights that even the organizations who have environmental policies supported by the institution might present dysfunctions in applying them by disregarding some simple rules to use the equipment but also determined by the lack of interest displayed by the organization to monitor and limit the consumption of energy (Table 3).

Green ICT and the consumption of energy at the organizations which have environmental policies supported by the institution

Table 3

	Indicators on the rational use of energy					
	How often do you turn off your computer when you leave the office?		Is there a system to rationalize the consumption of energy in your company?		Has your company got policies to efficiently consume energy by setting the computers on power save mode?	
Public institutions	Daily	57%	Yes	14%	Yes, they are applied	43%
			I don't know	72%	There are, but they are not really applied	43%
	Very rarely	43%				
			No	14%	There aren't	14%
Corporations	Daily	75%	Yes	75%	Yes, they are applied	62,5%
	Very rarely	12,5%			There are, but they are not really applied	25%
	2-3 times a week	12,5%	No	25%	There aren't	12,5%
Small and medium enterprises	Daily	100%	Yes	60%	Yes, they are applied	20%
					There are, but they are not really applied	20%
			No	40%	There aren't	60%

The situation varies depending on the indicator which is used: for some rules there is recorded a higher percentage of appliance in the private companies, for others, in the public institutions. An important method to rationalize the consumption of energy is the use of an automated monitoring system. Unfortunately, not all the companies have the updated equipment for the environment issues according to the data presented.

For the organizations which do not have environmental policies supported by the institution, 66% of the cases do not use a system to rationalize the consumption of energy. Also, as regards the methods to have a more efficient consumption, meaning setting the computers on power save mode, 87% of the respondents mention that there are no such rules and where there are, they are hardly applied.

H2: The rules on recycling the consumables from the ICT field, mainly paper, are present and applied, mostly, by the companies who have environmental internal policies and this aspect is helped by the limited resources needed for the accomplishment of such an approach.

Recycling is an important topic for the consumers in our country (and not only), but it is a less used practice, as we have mentioned in the previous parts. The small number of initiatives, such as selective waste disposal or the collecting centres for the electric and electronic waste are either not sufficiently popularized, or the population is far too little interested in their existence and do not use them. Unfortunately, in Romania the level of education of the population and of the organizations related to these issues is considerably below the level from the developed countries. As regards the results of the study, it seems that the rules on consumable recycling exist and are mostly applied. In the case of the public institutions and the small and medium enterprises, there are noticed initiatives and the conditions for recycling are met in a percentage of 100%. In the case of the big companies, 87,5% gave a positive answer to this part. Even so, 14% of the public institutions recycle only an insignificant part of paper. Mention must be made that he has analysed only the organizations which declared to have environmental policies supported by the institution.

In order to bring more arguments for the previous observation related to the low level of recycling in Romania, we mention that an analysis of all the answers shows that 59% of the organizations have initiatives, but they come in a small number. As regards paper, 57% do not recycle it, or they recycle an insignificant quantity. We consider that a study on the individual consumers would reveal an even worse situation, which is really easy to notice in the way the selective waste disposal bins are (not) used, an issue which has been widely discussed and debated lately.

H3: The rules on the disposed equipment are applied in agreement with the environmental policies.

An important aspect, similar to the one presented in the previous hypothesis but with much more significant and wide influences on the environment is that of the disposed equipment. The studies highlight an increase in the access to computers and Internet during the years 2007-2012, but also in the consumption of other products and services specific to ICT. Even if the level is below the expectance and especially considerably below the level of other European Union countries, in this case, it is the real situation of the disposed equipment. As a whole, among the organizations which have environmental policies supported by the institution, 75% declare that they take it to the recycling centres, 15% donate it and only 10% disposes of it without any responsibility towards the environment. Table 5 presents the situation for each category of organizations.

Influence on the environment by equipment disposed

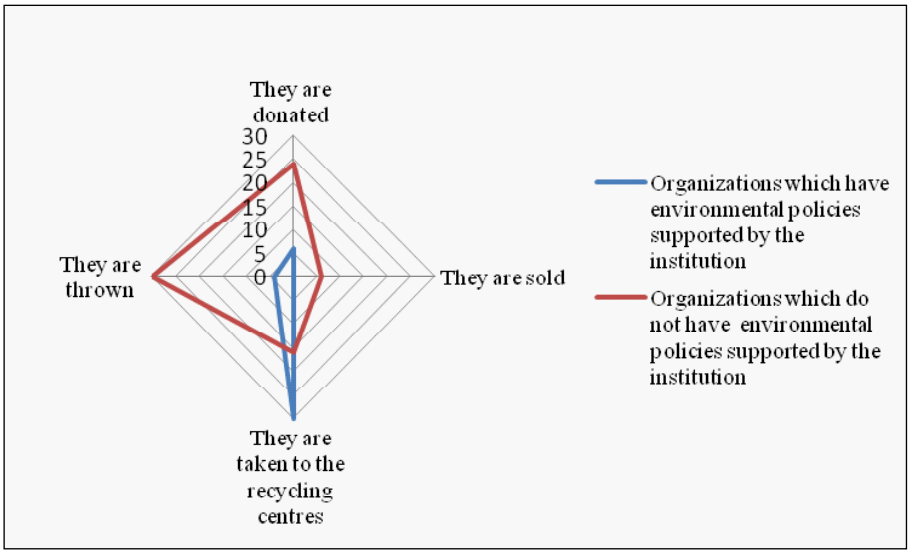
Table 4

	Public institution		**Corporation**			**Small and medium enterprises**	
What happens to the disposed equipment from your organization?	They are taken to the recycling centres	They are donated	They are taken to the recycling centres	They are donated	They are thrown	They are taken to the recycling centres	They are donated
	86%	14%	62,5%	12,5%	25%	80%	20%

For the organizations which do not have policies to protect the environment, supported by the institution, the analysis of the data highlights that most of them leave the equipment by the bins, respectively 40%, and only 20% take it to the recycling centres. The rest donate or sell it. A comparison between the two categories of organizations, namely the ones which have environmental policies and those which do not, shows significant differences in this regard (Figure 1).

Situation of the disposed equipment for the two categories of organizations

Figure 1



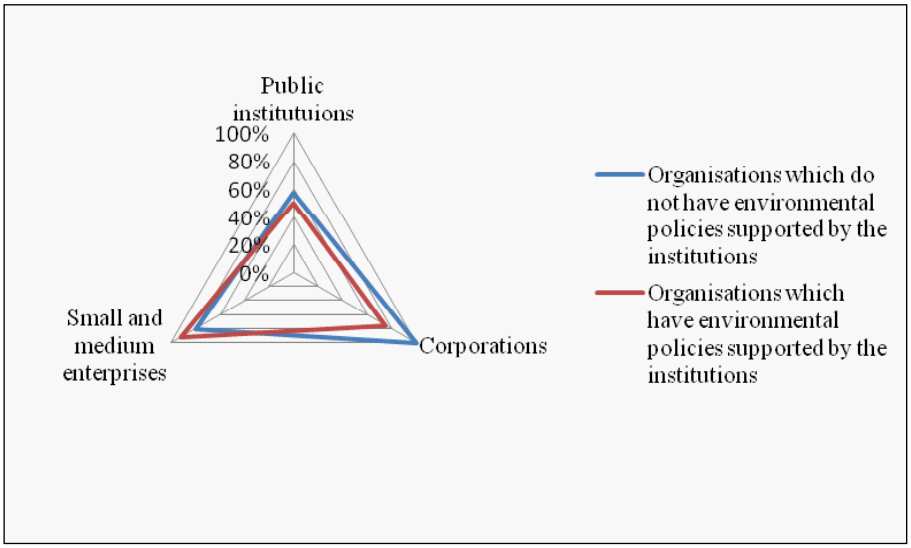
H4: The organizations prefer communication in the virtual environment in favour of travelling and this influences the ecosystem in a positive way, even if the main reasons are financial.

The use of the virtual environment in the process of communication between the organizations brings not only financial benefits, but it is also favourable to the environment. The advantages for the environment are influenced by various factors, such as the equipment in use, the sources of energy which make them work, their efficient use, and the way in which they compensate for the travelling so on. The ICT evolution has influenced the increase in use and utility of the virtual environment for communication, but also its excessive and unjustified use. As for the environment, the benefits are obvious and immediate, seen mainly in the decrease of pollution and consumption of non-renewable resources (fuel). According to the results of the study, a big part of the respondent organizations which have policies of environmental protection supported by the institution use the virtual environment in order to communicate in the interest of the company, namely 57% of the public institutions, 100% of the big companies and 80% in case of the small and medium ones. A significant difference between them can be seen

if we look at the frequency of their use. In this case, we have noticed that it is only in the big companies that most part of the contacts in the virtual environment are made, more precisely 62,5%, an aspect helped by the existence of the necessary infrastructure and the great number of contacts made. We mention that this last hypothesis is also confirmed by the analysis of all the answers, according to which 77.5% of all the participants use the virtual environment to communicate in the organization and with the business partners. Even if it is important and interesting, the way in which the organizations and their members use communication in the virtual environment strictly for business is difficult to establish. As we can notice from the comparative representation of the use of the virtual environment for the communication inside and between organizations (Figure 2), the small and medium companies which do not implement environment policies supported by the institution use this kind of communication more than those who have these policies.

The use of the virtual environment to communicate for different categories of organizations

Figure 2



This last result proves that the premise for the use of this communication method does not relate to the environment as it is based on more pragmatic advantages, such as the decrease of expenses and the speed of sending and receiving the messages.

CONCLUSIONS AND LIMITS

The main goal of this study was to delineate the level of interest and involvement of the organizations from Romania, as consumers, in the protection of the environment by means of certain green ICT practices. We have also tried to identify the existence of the differences between companies which have implemented environmental rules supported by the institution and those which do not have such regulations. We consider this study is important as it identifies the behaviour of the Romanian companies related to the environment and it establishes a few general lines of action which might stimulate a similar attitude to the one of the developed countries. Even if there can be found numerous defects on national level related to the attitude of the consumers towards the ecosystem, its importance represents a coordinate and a major concern for a part of the Romanian society. The opening towards occident has made it possible for the individuals to have contact which civilizations where the respect for the environment is present and there is displayed a great responsibility towards it. Also, the international companies which open up their subsidiaries in Romania bring rules and favourable practices for the protection of the ecosystem and even if their implementation does not reach the desired level, the progress can be seen. These aspects, related to the joining to the European Union which imposed certain standards and goals, impossible to achieve without the active and solidary participation of the population and the companies, in time might lead to important changes in the attitude towards the environment.

However, the practices analysed by us within the study have not followed at least two initiatives with a major impact on the environment, reasons that we have considered objective. First, we take into consideration the degree of involvement in developing equipment which would be favourable to the environment, to monitor its evolution or include less favourable characteristics in comparison to the present day offers to similar products. The reason for the absence of this indicator from the study was the scarce presence of the activities mentioned in Romania and the number of respondents involved in the *creation of hardware equipment,* more precisely one single company. Also, *the software development which would clearly attend to the environment issues* is to be found in too little extent among the projects in which the respondents were involved, only two of them gave positive answers. This is why we have considered the analysis would not be valuable for this particular indicator. From our point of view the two aspects are the main limitations of the study, acceptable if we consider the green ICT analysis from the perspective of the consumers. The subsequent research will focus on these issues in order to pin-

point the green ICT concept from the perspective of hardware and software producers. Another aspect which might also be considered a limitation of this paper is the choice of the sample and data gathering from the on-line environment which, in spite of certain drawbacks is more and more used due to the facilities available to both the respondents and the conceivers of the study, mainly because it gives the possibility to monitor the research progress in real time.

Beyond the limitations we have mentioned, the image of the green ICT concept created by this paper on the relationship between the ICT and the environment for the Romanian organizations, as consumers, is an objective one and it might bring useful information to the institutions empowered to prescribe regulations but also to companies and individual users on condition that education on environment should take the place it deserves, similar to the one held in the developed countries. We also consider that the research topic is a current one, as it is proven by the serious involvement of the international environment organizations as well as of the private companies in major investments in all that could be *green* and/or *eco*.

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