

Green ICT Awareness in Organization - An Empirical Study in Romanian Companies

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ABSTRACT

Business strategy involves adopting the equilibrium between competitiveness and performance, on one hand, and the responsibility towards environmental goals, on the other hand. The transition to green economy becomes synonym with two structural transformations: firstly, the IT industry restructuring through the development of green information and communication technologies (green ICT), and secondly, the using of IT solutions, according to environment protection and sustainable development. The purpose of this paper is to assess the organizational behavior on adopting green information tools into the policies and processes of an enterprise. To conduct this research, a methodology based on an empirical study was used. Proceeding from an investigation that shows the concerns of some Romanian companies in green ICT concept and practices, the findings suggest a low awareness level about these subjects. Practical implications of the study refer to the fact that the results of research may be useful for managers who are looking to implement green ICT practices in their business strategy and the organizational processes.

KEYWORDS: *green ICT, sustainable development, energy efficiency, server virtualization, environmental goals.*

JEL CLASSIFICATION *O33, M14, M15*

INTRODUCTION

In the knowledge based economy, the economic development resources are founded on innovation capacity and the potential of technology to transform organizations, communities and entire societies. The information and communication technologies (ICT) are both an instrument for economic, social and environmental performance, and an engine for sustainable development. The organization is forced to consider the impact of ICT use on the environment and to adopt solutions to minimize any negative effects. From this perspective, the organization is confronted with a paradigm change that advances in at least two directions: first, toward promoting green information and communication technologies (green ICT) to improve the global sustainability of the whole business through IT, and second, toward developing ICT departments that consider and integrate sustainability in their actions. During the year 2006, the term green ICT makes its appearance after global warming and climate change have become one of the most pressing environmental concerns. The importance and consecration of this subject in our actual World's problematic has made with Gartner report, entitled *Gartner's Top 10 Strategic technologies for 2008* (Gartner, 2007). Green ICT is acknowledged as a strategic technology that will play a fundamental role in reengineering of business and production processes to reduce the environmental footprint of organizations (Watson et al., 2010). The IT industry was

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inevitably affected by a new development paradigm that will change the vision on environment protection. From the concept of *paperless office* to *Cloud Computing* technology, energy efficiency practices, low-cost strategies, or reduction of CO₂ emissions level are adopted by companies. Moreover, the non-ICT sector organizations are forced to introduce green ICT practices, due to the main tendencies which affect global economy, such as:

- ❖ Increasing the energy cost, following the conventional sources exploitation, which become more rarely and expensive.
- ❖ The carbon footprint described as the total GHG emissions caused directly and indirectly by a person, organization, event or product. These can include direct emissions that result from activities that the organization controls and its energy usage, and indirect emissions from products and services that the organization does not directly control.

Both great companies and the small and medium enterprises (SMEs) are aware of increasing energy cost, the natural resources diminishing, or regulations constraints and ecological fiscalty. For big size corporations, green ICT is a responsibility in terms of reducing the ecological footprint, and also an opportunity to achieve economic, social and environment performance, through the using of eco-friendly technologies.

This study aims to assess the behavior of organizations related to the need of adoption the green ICT solutions in their business processes. We will examine attitudes and perceptions towards the awareness of organizations in sustainable development and implementation of green ICT.

1. BACKGROUND AND LITERATURE REVIEW

As it is a recent term, green ICT doesn't have a common definition. Generally, green ICT refers to a set of initiatives and strategies that reduce the environmental footprint of technology. This arises from reductions in energy use and consumables, including hardware, electricity, fuel and paper – among others. Because of these reductions, green ICT initiatives also produce cost savings in energy use, purchases, management and support, in addition to environmental benefits. Murugesan (2008) define green ICT as the study and practice of designing, manufacturing, using, and disposing of computers, servers, and associated subsystems efficiently and effectively with minimal or no impact on the environment. Green ICT is related with Corporate Social Responsibility. In this context, green ICT strives to achieve economic viability and improved system performance and use, while abiding by the social and ethical responsibilities (Murugesan, 2008). Environmental problems and sustainable development are beyond from usual marketing actions. They are part of competitiveness and the dynamic of an organization. The green technologies implementation could be an engine of competitiveness and also, a tool for improving processes, according to sustainable development principles. Lamb (2009) considers green ICT as an ideal way to reduce energy consumption of data centers, the carbon footprint and gas emissions, and also, to manage the electronic waste. Following the growing accumulation of greenhouse gases, the term green ICT has emerged to symbolise the efforts of reducing carbon footprint in IT services (Velte et al., 2008). Green ICT focuses on two major issues: first, it allows reducing the environmental impact of each element of the ICT lifecycle; second, green ICT can support the whole business in its mission to adopt more environment-friendly ways (Molla et al., 2009). Harmon et al. (2010) refer to green ICT as

the practice of maximising the efficient use of computing resources to minimise environmental impact. The Info-Tech Research Group (2009) considers green ICT as initiatives and strategies that reduce the environmental footprint of technology by increasing efficiency and reducing the demand for resources. Another approach belongs to Dutta and Mia (2010), who state that green ICT is supposed to significantly decrease the environmental footprint of the IT industry and to foster environmental innovations in other industry sectors. Anyway, is widely recognized that green technologies address some major problems of the contemporary economy, such as rising energy cost, limited non-renewable resources, pollution, waste proliferation, and gas emissions leading to the greenhouse effect. There are several practices which synthetically describe the steps that an organization must take into consideration (Murugesan & Gangadharan, 2012):

1. **Reducing energy consumption by PCs.** For example, it can be made some changes in the behavior of ICT users, like the ways to use computers that can significantly decrease energy consumption.
2. **Turning off systems when not in use.** This way is the most basic energy conservation for most systems.
3. **Greening data centers.** It is focused on hardware infrastructure from the data centers, which should be conformed to European Directive on RoHS. (Directive 2002/95/EC).
4. **Virtualization.** It is a key strategy to reduce data center power consumption. For example, server virtualization allows businesses to reduce the capital cost of future server purchases, and the operational costs of energy and maintenance by hosting multiple virtual servers on a smaller number of more powerful servers.

Although Green ICT is becoming more common in theoretical approaches, European SMEs do not broadly embrace green initiatives through ICT. According to Kuo (2010), there are both motivational and organizational factors, but also technological constraints. Green ICT does necessarily need a paradigm change, related to the perception of users about eco-responsible practices that are required to apply them in the information domain. Then, the organization is forced to consider the impact of ICT use on the environment and to adopt solutions to minimize any negative effects. This is quite difficult for many managers and requires changes in the organizational structure, organizational culture, leadership, and so on. Not least, the green ICT implementation rises up technological constraints. This means some practices should be used, such as: hardware reconfigurations, Data Center infrastructure efficiency, virtualization or hardware mobility (the replacement of traditional PCs with portable computers). The ICT notoriety becomes obviously, but they are source of ascension of the climatic issues, in the meantime. According to Climate Group report (2008), ICT is responsible for 2% of global emissions of CO₂. Through an intelligent use they might be the way to reduce the environmental footprint, to increase energy efficiency and to use better the natural resources. Understanding ICT through a green perspective, two major trends for green ICT adoption by organizations are revealed (Bansal & Roth, 2000). Firstly, green ICT generate economic opportunities (e.g. cost savings, prevent resource restrictions, risk reduction, innovation), that are related to a sustainable development vision. In this context, Olson (2008) states that a green strategy has the potential to significantly impact both top line revenue growth and bottom line cost savings. Secondly, green ICT increase the eco-investments practices, which are appreciated by internal or external stakeholders (Bieker, 2003). These practices are evaluated through a positive return on investment (ROI), which is crucial for green ICT initiatives.

Nowadays, many companies have discovered the advantages of green ICT solutions. Among these, the most popular initiatives adopted today are server virtualization, PC power management, printer consolidation, remote conferencing and telecommuting projects, IT energy measurement. All of these lead to an immediate cost reduction benefits along with a reduced environmental footprint. However, green ICT implementation is more than software and hardware reconfiguration. The decision about implementing or not implementing green ICT strategies and tools is a management and leadership issue. Managing IT infrastructure concerning green ICT requires a strong commitment from the top management (Sarkar & Young, 2009). For this reason, we conducted an empirical study in 19 Romanian companies, in order to assess the green ICT awareness as well as the organizations' outlook, attitudes, and reasons for adoption these practices.

2. RESEARCH METHODOLOGY

Starting from the purpose of this research, the empirical study conducted in the surveyed companies allows us to get an in-depth view on green ICT implementation practices. The companies are small and medium sized, from services sector (7 companies from car rental services, 6 companies from logistic services, and 6 companies from online sales). For data collection, we used a questionnaire that reflects the guideline of organization in using green ICT (Table 1). A number of fifty seven top- and mid-level managers were chosen as respondents, in the period of September to November 2013. The questions have focused on the following items:

- i. The green ICT concept notoriety.
- ii. Sustainability and environmental strategies.
- iii. The implication of top- and mid-level managers in sustainable development and Corporate Social Responsibility (CSR) programs.
- iv. Projects development for energy efficiency optimization in Data centers.
- v. ICT users' behavior.
- vi. The reasons of not implemented green ICT practices.
- vii. The perception about economies achieved by using green ICT.

Table 1. The guideline in using green ICT

Items	Yes	No
1. Knowing the concept of green ICT		
2. Sustainability is an integral part of corporate strategy		
2. Green ICT strategy is aligned with sustainability goals		
4. Stakeholders pressure to use green ICT practices		
5. Turning off inactive computer/monitors		
6. Use of printing restriction policies		
Environmental awareness for managers	Percentage (%)	
7. The level of implication of top- and mid-level managers in sustainable development		
8. Knowledge of international and European regulations on sustainable development and CSR (Directive 2002/95/EC; Directive 2002/96/EC; ISO 14001; ISO 26000).		
9. The percentage of projects developed for energy efficiency optimization through green ICT solutions		

The green ICT initiatives adopted by organization	
10. Virtualization and consolidation (server virtualization and consolidation, storage consolidation and desktop virtualization).	
11. ICT equipment recycling	
12. Reducing the energy consumption of data centers	
13. Changing ICT users' behavior (powering out system not in use, going paperless, using recycled paper, telecommuting and teleworking).	
14. Reconsidering business process through distance working, geo-localization, and video conference.	
15. Reducing electronic waste from obsolete computing equipment.	
16. Using software that centrally manages energy settings of PCs and monitors.	
17. Procuring energy-efficient equipment, such as Energy Star certified devices.	
The reasons of not implemented green ICT practices	
18. No official legislation enforcing green ICT practices	
19. No pressure from management/customers	
20. Employees lack the appropriate knowledge/training	
The perception about economies achieved by using green ICT	
21. The consumption of energy was reduced after 3 month	
22. The consumption of energy remained at the same level	
23. The consumption of energy increased	
24. The consumption of consumables decreased	
25. Increased storage / computing capacity.	
26. Decreased waste using responsible recycling vendors	

Source: Author

This questionnaire gives us an overview of state of the arts in green ICT field, for the surveyed companies. Since the sample of respondents is not being considered statistically representative, the results of this research reflect only the sample and are to be considered qualitative.

3. RESULTS

The empirical study of the green ICT practices, related to sustainability and environmental issues, reveal the following results.

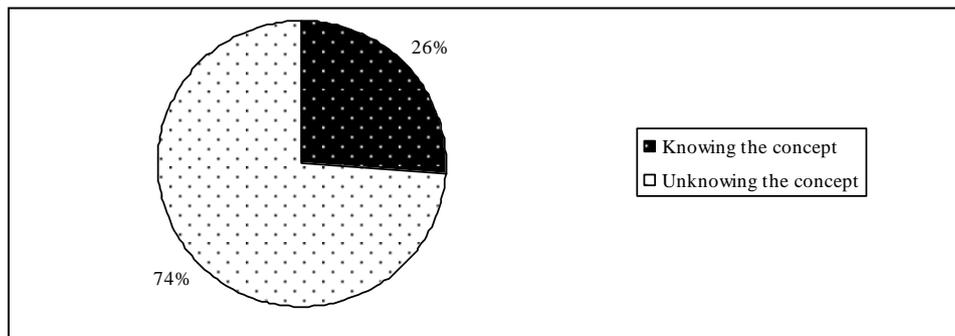


Figure 1. Knowing the concept of green ICT

Source: Author

The concept of green ICT is known by 26% of respondents, while the rest of them did not heard about these types of practices (Figure 1). Despite of this situation, due to increasing of attention toward environmental matters, the companies are aware about the need of adapting their business process and strategies to this new issue.

There are 60% of respondents who affirm that their companies does not involved in sustainable development and CSR actions. The others of 40% say that although some sustainability aspects or social responsibility actions are present, these are partially a component of corporate strategy. Only 9% declare that they have a green ICT strategy aligned to sustainability goals (Figure 2).

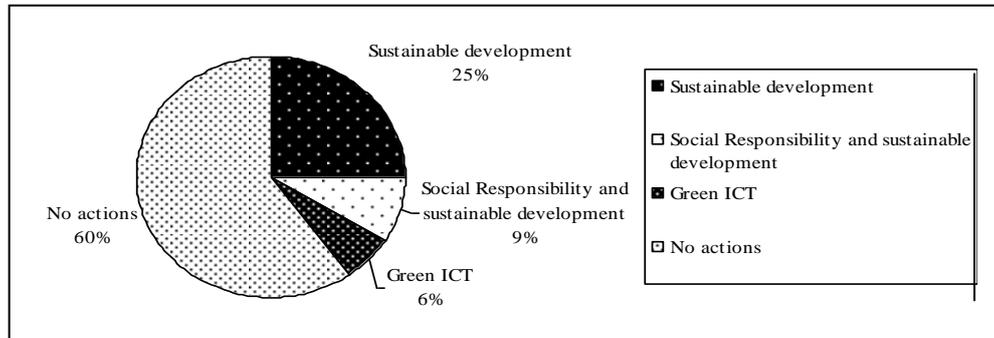


Figure 2. Environmental awareness for managers

Source: Author

Concerning the green ICT initiatives adopted by organization, we noted the answers in line with respondents’ perception, which is structured on high level, low level, and unnecessary level (Figure 3).

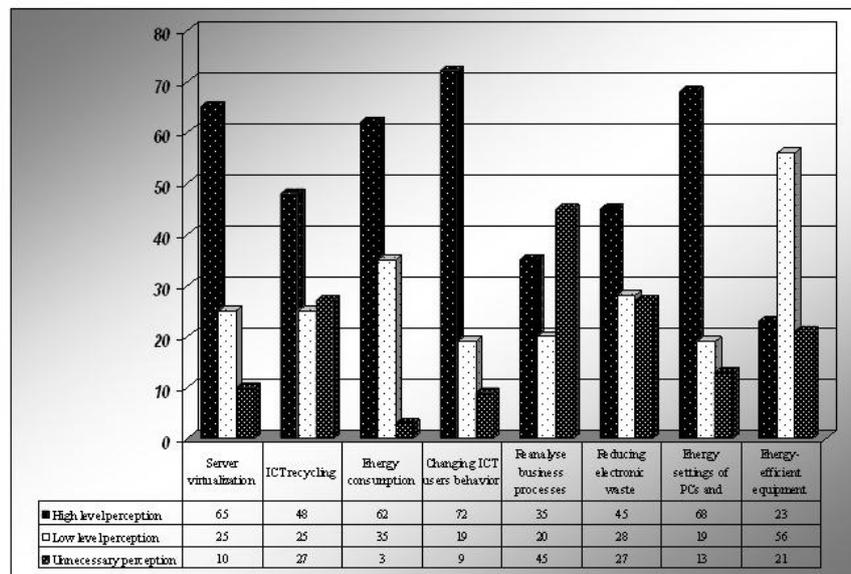


Figure 3. The green ICT initiatives adopted by organization

Source: Author

The feedback from the participants at study shows that there are several reasons of not implemented green ICT practices in their organization (Figure 4). Most respondents observed that since there is no official legislation to enforce green ICT practices within their organizations, no such practice has been implemented.

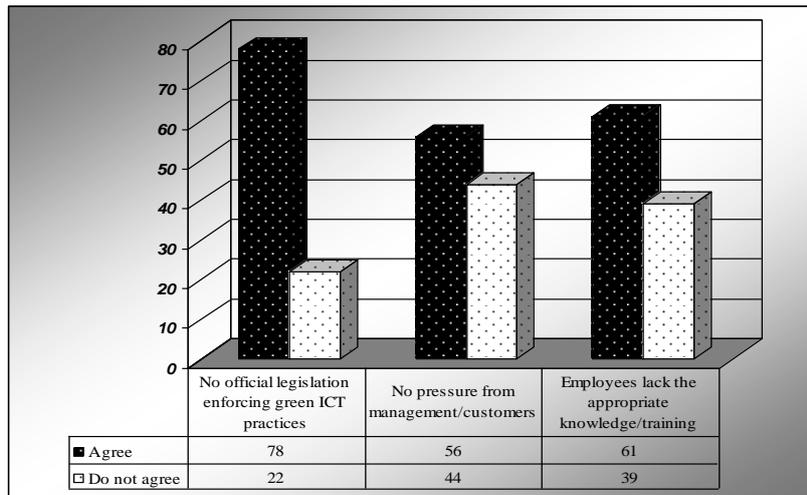


Figure 4. The reasons of not implemented green ICT practices

Source: Author

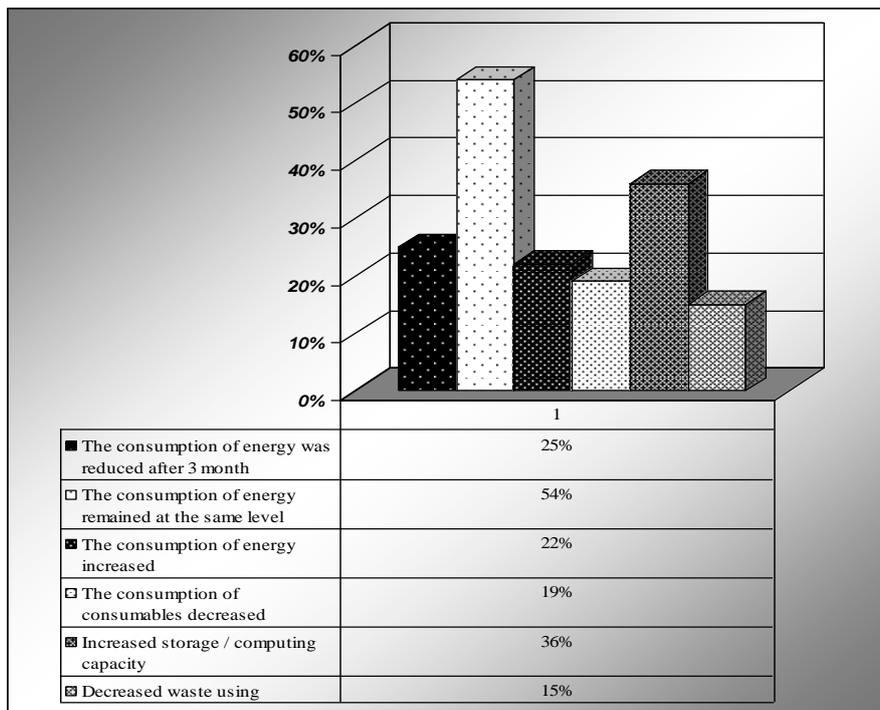


Figure 5. The perception about economies achieved by using green ICT

Source: Author

Only two third of respondents states that monitored their energy consumption after adopting some green ICT initiatives (e.g. powering out system not in use, going paperless, using recycled paper). The perceptions about economies achieved are presented in Figure 5. Almost 60% of respondents said they reduced energy consumption through increasing effectiveness of cooling and ventilation systems.

4. FINDINGS AND DISCUSSIONS

Because of the small sample of cases, the findings and the generalisability are limited. However, the results indicate that green ICT practices are focused mainly on technological dimension, and less on the organizational one. In others words, green ICT initiatives are implemented to reduce the energy consumption, the capital cost of future server purchases, the operational costs of energy and maintenance. Concerning the relationship between green ICT and firm competitiveness, the study indicates that this strategic potential is largely neglected. By developing green ICT programs integrated into IT strategy, competitive advantage could be created. From this perspective, the main finding of the research is that the interrelation of business strategy, sustainability goals and IT strategy constitutes a complex challenge for surveyed companies. Other important findings that emerged from this research can be highlighted:

- The concept of green ICT is less known by two third of respondents. They have a poor perception about the impact of these tools on economic, social and environmental issues.
- As revealed by the analysis, the topic of strategic green ICT alignment is neglected. The great part of respondents say that there are not any formal procedures related to sustainable development and social responsibility in their organizations. In this context, lack of systemic approach of IT strategy, business strategy, and environment strategy have become a weakness of leadership.
- Although the implementation of green ICT practices in organizations could limit the amount of energy that is wasted by organizations and thus save costs, the green initiatives adopted by the companies are sporadically. The most common green ICT solutions used by surveyed companies are server virtualization, screensavers option, and turning off systems when are not in use. Unfortunately, these are quite insufficiently for organizational efficiency.
- Over two thirds of respondents highlight that both managers and customers do not feel the pressure from government legislation to align their business with environmental sustainability practices. On the other hand, overall the highest number organizations (15 from 19) are not training/informing their employees about energy efficiency. However, the small organizations consisting of 2-10 employees are more interested to actually implement green ICT practices. This may be because micro organizations dispose of smaller budgets, and are more likely to implement energy efficient and cost-saving alternatives.
- Concerning the energy efficiency, the obtained results are empirical. In fact, the organizations do not have tools to measure energy consumption on consumer sources (Data center, PC power consumption, and air conditioning and ventilation systems). Moreover, although all the respondents agree the green ICT practices utility, they do not have a real organizational culture which involves principles, norms, standards, values and attitudes toward sustainability goals.

CONCLUSIONS AND RECOMMENDATIONS

This research intends to provide an overview of green ICT concept and practices, through an examination of its current implementations on Romanian companies. The main conclusion which emerged from this paper is that green ICT awareness in surveyed companies is in an incipient phase. It is widely known that greening ICT leads to reducing power consumption, lowering carbon emissions and environmental impact, and lowering costs for the organizations and individuals. This research demonstrates that organizations involved in the study do not have a consistent green ICT policy, as part of sustainable strategy. This means that there are no objectives and formal procedures which should clearly establish how ICT activities must be conducted, according to environmental goals. From this perspective, several recommendations should be highlighted. Firstly, a code of best practices could be developed for organizations. This should describe the steps that organization must do in order to be aware of the environmental problems. By including the environmental indicators, such as green house gas emissions, energy consumption, or WEEE recycling, the organizations could measure and thus manage their ICT activities. Secondly, a green strategic approach should be underlined. This is done through four strategic options (Molla et al., 2009): *minimalist*, by setting up of a small number of practices that does not necessitate large cost or reorganization; *experimental*, by approaching the experiments on ICT areas, without organizational coordination; *excellence*, by performing in one area of the ICT activity value chain (e.g. Data center, IT energy measurement, IT equipment recycling); *comprehensive*, by adopting green ICT policies in line with business and environmental strategies. Thirdly, training programs for the employees should be implemented. These programs aim to improve the interest and knowledge of IT employees towards environmental issues.

This empirical study is only a first step towards green issues in a green-knowledge society. The small sample of organizations attempts to provide an overview of green ICT awareness. Given the fact that in the future, corporate environmental responsibility will become the norm rather than the exception from stakeholders and governments pressure, future research does generally focus on the impact of green ICT in terms of profitability and environmentally.

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