

THE STATE OF IT HUMAN RESOURCES ABOUT THE CAPABILITIES OF ADOPTING GREEN COMPUTING PRACTICES: A ROMANIAN PERSPECTIVE

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ABSTRACT

The potential of technology to create sustainable business is widely accepted. Sustainable development problems involve significant changes in the manner of using Information technologies (IT) to minimize their negative effects on the environment. The green computing practices that refers to the efficient use of computing resources to minimize environmental impact has become the key driver for sustainability requirements. In this regard, the organization is faced with the managing of IT human resources to develop the capabilities of adopting those IT practices that are environmentally friendly. This paper examines the current state of IT human resources among the Romanian companies and outlines how prepare they are to adopt green computing solutions. For that purpose, we analyzed the small and medium-sized enterprises (SMEs) from Romania based on criteria related to number of IT employees, average incomes, and the distribution of IT employees on regional level, the structure, dynamics and distribution of labor force on occupations which are specific to the IT&C sector. The findings indicate that significant differences exist in terms of capabilities to apply green computing practices, due the fact that 93% of the specialized workforce is concentrated in Bucharest and only 6 counties of Romania, from a total number of 41. This state reveals a major disparity of IT jobs distribution, such as IT Project Managers, System Analysts and Engineers, and Programmers.

Keywords: *green computing; green IT; IT human resource; Environmental Management*

1. INTRODUCTION

Ecological issues involving IT's environmental impact on the use of hazardous materials, energy, water, and other scarce resources, as well as minimizing e-waste and pollution will need to be more fully addressed. As Murugesan states (2011), organizations and societies have a new agenda by adopting environmentally sound practices related to IT infrastructure, operations, applications as well as business processes, business strategy and competitive advantage. Due to the immediate impact on business strategy that encompasses social, economic and environmental objectives (Fuchs, 2008), green computing, and its alternative green IT has emerged as an important research topic in information systems and in other areas, such as human resources management, financial management accounting, decision support, sales, distribution, supply, production, and e-commerce. The main goal to *green* the IT products, applications, services and practices addresses two major dimensions: first, green IT allows reducing the environmental impact of each element of the ICT lifecycle; second, green IT can support the whole business in its mission to adopt more environment-friendly ways (Molla and Abareshi, 2011). Information and communication technologies (ICT) can no longer ignore issues labelled with the terms “green,” “environment,” “sustainability,” or “social responsibility.” Further, all of these initiatives cannot be achieved

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without the commitment of the company and the contribution of ICT (GAP, 2009). In this context, more and more companies are including the green computing practices in their business trend to adjust sustainable business practices with profitable business operations.

The purpose of this paper is to analyse the current state of IT human resource from the Romanian companies in order to identify the capabilities of adopting green computing practices. Thus, the following research question guides this study: *How much the IT human resource is well-prepared to embed the green computing practices in the activities that occurs usually?*

This research answered the above question by focusing on small and medium-sized enterprises (SMEs) from Romania where criteria such as regional distribution of IT labor force, the structure and the dynamics of labor force on IT jobs, and the average incomes of IT employees was considered.

2. BACKGROUND AND LITERATURE REVIEW

The term green computing and its alternative green IT has become widely well-known for both practitioners and scholars. According to Harmon and Auseklis (2009), green computing refers to the practice of using computing resources more efficiently while maintaining or increasing overall performance. This is mean that green computing enables companies to meet business demands through cost-effective, energy-efficient, flexible, and secure solutions while being environmentally responsible. The case of green computing or green IT refers to IT's contributions to reducing the whole organization's carbon footprint, and provides its reputation boost.

Green computing has been defined by several authors, such as Murugesan (2008), Lamb (2009), and Unhelkar (2011). According to Murugesan (2008), green IT is 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. Organizations have embedded green IT programs to cut ICT costs, utilize ICT resources to their maximum, and save the environment from the ill effects of ICT usage (Murugesan 2008). Lamb (2009) considered green IT as an ideal way for most companies to make a significant step toward managing the ecological crisis through the solutions that green IT brings at the information and communication level, such as reducing energy consumption at data centres, reducing carbon footprint and gas emissions, and managing electronic waste.

Practices related to green computing (e.g. virtualization, power management, recycling, electronic waste disposal, and optimization of the IT infrastructure) transform the management and strategy of organizations. Thus, they choose to adopt green computing for different reasons, including technological advancement, economic and business benefits of green processes, and social and environmental requirements. Green computing implementation is not limited to software or hardware applications. An organization needs to realign its strategies to a new set of sustainability objectives (Wang and Ghose, 2011). The relationship between business strategy, sustainability objectives, and green IT is a complex challenge that simultaneously implies great opportunities for environmental protection and economic progress (Bose and Luo, 2011).

Green IT is not necessarily a specific new technology but a way through which existing technology and ICT solutions can be used differently to reduce their environmental impact. Green IT does not necessarily need new skills for software development. Rather, it is more about the mind-set of the practitioners – the way they apply their skills in a green way. The skills do not change, but how the matrix is designed and applied does (Danish Technological Institute, 2012). Although green computing has been around for some time, its implementation and impact on businesses can sometimes be incompatible with the corporate mission (IDC 2008). A study of the Council of European Professional Informatics Societies (CEPIS, 2012) has shown that there are major weaknesses that limit green computing efforts in the organization, such as no official legislation enforcing green ICT practices, no pressure from stakeholders and government, misalignment with

strategic approach. However, companies now understand that green computing will save them money and increase their value in the marketplace.

One of the most successful driving factors in the adoption of green computing initiatives is related to IT human resource from enterprises, in terms of workforce composition, the configuration on the development regions, employees' perceptions of implementing green IT practices, the level of incomes, and the organizational culture. In this context, the organizational concern about sustainable development leads companies to adopt green computing practices at an increasing rate. But only deploying these IT solutions will not be satisfactory to enhance sustainable issues unless the employees are more environmentally aware and compliance (Lather and Goyal, 2015). Thus, the support of IT employees is considered fundamental for adopting eco-responsible practices when using information and communication technologies (Govindarajulu and Daily, 2004). Research studies affirm that it should be a strong relationship between IT human resource management and environmental issues to implement green computing practices effectively (Ramus, 2001). Therefore, to improve the environmental performance companies have to increase the employee's awareness and skills to use eco-innovative IT through green computing solutions. The embedding of green IT initiatives into the strategic development of organization helps to create a more powerful IT Human Resource Department which is able to promote the company's environmental policy. According to Renwick (2008), special policies in the field of recruitment, performance and appraisal management, training and personnel development, and employee relations are considered powerful tools for aligning employees with a green IT strategy. The impact of the green computing practices on the IT human resource was evaluated by Jabbour et al. (2013), who analyzed the relationship between green teams and maturity level of Environmental Management in the companies. Based on the theoretical model proposed by Jabbour and Santos (2008), regarding the relationship between human resource dimensions and environmental management, the study revealed two main findings, that might be applied on the case of IT human resource in many organizations. First, the human resource manager does not have knowledge about the green IT solutions. Second, the issues of sustainable IT products and services need to provide more interest to training programs design.

As a key resource of any organization, IT human resource can have a significant impact on the way that are use the IT products, applications, services and practices (Daily and Huang, 2001; Wee and Quazi, 2005). To promote green IT, companies should understand: What is the role of HR department to involve the IT employees in environmentally sustainable ways at work? What is the best workforce composition that allows addressing the major environmental IT issues? What are the dynamics and the distribution of IT employees on specific IT jobs? How motivated are the IT employees to change their behaviors in using ICT in order to contribute to the green movement of organization?

To assess the current state of IT human resources across the Romanian companies about their capabilities to adopt green computing practices a study was performed in the period between 2017 and 2018. In this study, we focused on the IT industry from Romania and gathered data related to the weight of IT employees in total of labor force on regional areas, the distribution of IT jobs on the big cities from Romania, and the level of the average incomes in IT industry.

3. CASE STUDY

The research was based on official data sources including the number of employees provided by the Territorial Labour Inspectorates, the number of full-time employment contracts, and the main occupations encountered in the IT industry.

The national software application entitled REVISAL was used to analyze the data that reflects the structure and dynamics of employees between 2015 and 2018, both on national and regional level. Moreover, a study released on July 2018 by the Local Investor Employers' Association (PIAROM,

2019) based on the dynamics of the labor market in the period 2015-2018 at the level of the economic sectors was also used to centralize the data from the IT sector. Public information available from the National Institute of Statistics as well as public databases provided by EUROSTAT was correlated with the collected data to assess the dynamics of the labor market and the level of employment.

There is evidence that a number of research limitations have considered, mainly generated by the software architecture of the REVISAL application. For example, the data related to the labor force are correlated with the place of the employee's activity in the registered office of the employer, which does not always fit with the actual location of the employee's activity. There are also included only standard forms of employment (i.e. Contractual arrangements). The other forms of non-standard employment (i.e. self-employed workers) are not considered by the REVISAL application. Due the fact that the collected data for this research are based on the records of the REVISAL application a correlation analyze between the employee's education level, their competences as well as their current job in the IT industry is not available. Therefore, this study does not consider the relationship between the IT workforce and the education system.

Based on the above data sources, a number of characteristics of the Romanian IT workforce related to the capabilities to adopt green computing practices was identified. To assess how much the IT human resource is well-prepared to embed the green computing practices in their activities we used four criteria that express the organizational perspective of the Green IT policy.

The first criterion is related to the global trend of evolution of the IT sector. This is a prerequisite for the generalization of Green IT practices at the national economy level. Thus, in 2018, 193.000 full-time employees were involved in the IT&C industry. About half of this workforce was concentrated in the IT Services sub-sector, which increased approximately by 14% compared to 2017. This reveal the IT Services sector ranked 2nd in 2018, in terms of the dynamics of jobs through the national economy. Moreover, all of the NACE Groups (i.e. The Statistical Classification of Economic Activities in the European Community) including the IT&C sector had a higher dynamic between 2017-2018. These results suggest that there is an increasing capacity for adopting green IT practices.

The second criterion refers to the regional distribution of the workforce in the IT sector. The analyze suggested a non uniform increase on the regional level that indicates a poor relationship between the potential of green IT practices and the guideline development of the IT industry. Thus, about 60% of the workforce in the IT&C Sector is concentrated in Bucharest. It is noted that the last 32 counties in the ranking group has less than 9% of the IT workforce.

The third criterion considered in this study, is focused on specialized IT personnel that include the employees directly involved in the design, implementation and maintenance of the green IT practices. Starting from the premise that the implementation of Green IT practices requires specialized IT personnel, the analysis at the regional level was extended by considering four key IT occupations in terms of the role that might have to implement green computing practices:

- IT Project Managers - this category includes the specialists required for planning and coordinating Green IT projects at the organizational level.
- Analysts – this include IT specialists that have the potential to perform process analysis and to model specific Green IT processes.
- Computer Programmers and System Engineers – this include specialists to develop IT applications through green solutions (e.g. sustainable software based on software quality criteria).
- Software System Engineers – this category includes IT specialists to manage the IT infrastructure according to the requirements of environmentally practices.

The analyzis of the IT specialists on the above IT occupations suggests that significant differences exist in terms of the regional distribution. According to the collected data, the first 7 counties accumulate almost 93% of the number of full-time IT specialists, compared to the rest of the

country. We also noted a substantial difference of the number of Analysts, Project Managers, Computer Programmers and System Engineers, and Software System Engineers revealing a heterogeneous structure of the labor force through the first 5 counties (Table 1).

Table 1. Distribution of IT specialists on regional level

Occupations in the IT sector	Number of employees				
	Analyst	Computer Programmers	System Engineers	Software System Engineers	IT Project Managers
București	11.468	13.029	7.254	4.545	5.422
Cluj	1585	7.204	1015	1.668	1.547
Timiș	986	3.640	950	1.474	1.463
Iași	429	3.162	537	486	600
Brașov	296	1.657	229	112	362

Source: Authors

A final criterion considered in this study is related to the costs of implementing Green IT practices in terms of remuneration policy of the IT employees. According to the economic area from NACE (i.e. Information and Communications), the average basic salary of the total employees who work in companies registered in this section (i.e. about 193.000 employees) is the highest of all NACE Sections.

The personnel structure in the IT&C sector (NACE Section J) by salary classes reveals a priority distribution of the average gross basic salaries in the ranges between 1,500-2,000 euros (18.49%), 1,000-1,500 euros (17.34%), respectively over 2,000 of euro (16.07%). Basically, the share of employees with gross salaries of over 2,000 euros per month is approx. 8 times higher in the IT&C Sector than the national average, and of the employees in the wage class 1,500-2,000 euros more than 4 times higher than in the national economy. In other words, more than half of the employees working in the IT&C sector have gross salaries of over 1,000 euros.

Concerning the level of the 2 main groups of employees in the IT sector there is also a differentiated distribution of salary levels. Thus, the average gross basic salaries of the employees are significantly higher in IT sector, compared to the Telecommunications sector, due the differentiated degree of specialization.

The case of Bucharest is specially for the current state of IT human resources among the Romanian companies. Around 67% of the IT specialists in Bucharest have gross basic salaries of over 1,500 euros that is approx. 15% over the national average. Related to the type of IT occupations, the highest-paying job is IT Project Manager (i.e. almost two thirds of them have gross salaries of over 2,000 euros), followed by Software System Engineers and Programmers.

4. CONCLUSIONS

This study suggests that there is a limited potential to implement the green computing practices in the most counties from Romania. This situation is attributed to the level of awareness of the workforce when addressing sustainability issues as well as the high cost of IT employees. However, in Bucharest and other seven counties from Romania (e.g. Cluj, Timiș or Iași), there is a good perspective toward the overall positive attitude about the need to embed the green IT solutions on

the organizational processes.

Future studies can extend the quantitative analysis to the qualitative one, addressing how green IT practices are able to increase the level of agreement of the IT employees regarding the environmental issues provided by the structure and the dynamic of the IT industry in the national economy.

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