

Green ICT Adoption Survey Focused on ICT Lifecycle from the Consumer's Perspective (SMEs)

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Abstract

This article examines the extent to which the initiatives determined as Green ICT are reflected in the lifecycle of information and communication technologies (ICTs) in Czech Small and Medium Enterprises (SMEs). The research model is based on the ICT Lifecycle viewpoint that from the perspective of non-ICT businesses consists of three phases – ICT procurement, ICT use and End of ICT use. The results of our research conducted via questionnaire survey among 61 respondents indicate a significant potential among businesses for improvement in all ICT lifecycle phases. The utilization of this potential can increase their competitiveness not only by achieving cost savings in the operation of ICT, but also by contributing to their sustainable development.

Key words: Green ICT, SMEs, ICT lifecycle, ICT procurement, ICT use, End of ICT use

1. INTRODUCTION

In the present turbulent world rapid changes in the economic environment are being under way and more distinctive changes occur in the area of information and communication technologies (ICTs). The rapid adoption of Internet communications and media, as well as the computerization of business processes and applications, are driving the increasing role of ICT within the society. This trend results in a significant growth of the size and number of data centers and other ICTs. ICTs affect the environment from two different perspectives. On one side, ICTs cause environmental problems at each stage of their lifecycle from manufacturing to usage and disposal. Throughout the manufacturing process of computers and diverse electronic and non-electronic components a large amount of electricity, raw materials, chemicals and water is being used. Together with dangerous waste generated as a result of the production process an impact on the environment proves to be more than significant. The overall consumption of electrical energy by servers, computers, monitors, data communication equipments, and cooling systems evinces a permanently increasing trend. This rise of electrical energy consumption leads to the growing greenhouse gas emissions, which are caused by coal and oil processing widely used for producing electrical energy. According to Gartner (Petty, 2007) ICTs generate approximately two percent of global CO₂ emissions, which equals the amount generated by the aviation industry. In these days, consumers dispose an enormous number of old computers, monitors and other electronic components within two or three years after buying them. Moreover, the majority of these devices terminate in landfills instead of being recycled. At this point the global society is facing up a danger of earth and water pollution as the computer components contain toxic materials. Overall, the facts stated above underpin the heavy impact of ICTs on the environment and highlight it as a major current issue.

On the other side, ICTs can be seen as a tool in addressing the environmental problems. Nowadays, it is possible to deploy ICTs in order to tackle the environmental footprint of a business.



This role of ICTs ranges “from enabling a carbon footprint analysis, monitoring and reporting capability through supplanting eco-unfriendly business practices, to deploying computerised models to increase energy efficiency and reduce greenhouse gas emissions” (Molla, Pittayachawan, Corbitt, & Deng, 2009). According to OECD Report Greener and Smarter (Mickoleit, 2010), Information and communication technologies (ICTs) are a key enabler of “green growth” in all sectors of the economy. They are a key part of government strategies for a sustainable economic recovery.

The aim of this article is to present results of the survey focused on Green ICT practices usage when acquiring, using and disposing ICTs in non-ICT SMEs in the Czech Republic. Following first the introduction of Green ICT importance, we further present various definitions of Green ICT and point to an increasing interest in Green ICT practices worldwide. In the third section we state the reasons for focusing on SMEs in our research and in the fourth section we describe the research method. Finally, in the fifth section we present and discuss the survey results.

2. GREEN ICT

According to Hart (1997) Green ICT often refers to meeting the needs of present generations without compromising the ability of future generations to meet their needs and involves pollution prevention at the end of a product's use, product stewardship to minimise the environmental footprint during use, and use of clean technologies to reduce the use of polluting materials and develop environmentally friendly competencies.

OECD in its report “Greener and smarter” (Mickoleit, 2010) defines “Greener ICT as ICT with a better environmental performance than the previous generations (direct impacts) as well as the technology utilized to improve environmental performance throughout the economy and society (enabling and systemic impacts)”.

Resource efficient trends have been reflected in a decent number of strategic documents on the national as well as international level. One such an important document represents a new strategy of the European Union – Europe 2020 which points out that increasing resource efficiency will be the key to secure growth and employment in Europe (European Commission, 2011). Other EU document “A Green Knowledge Society” also strongly emphasizes sustainability, ecological aspects of information system innovation and their impact on sustainability (Forge, Blackman, Bohlin & Cave, 2009). Governments and business associations have introduced a range of programmes and initiatives on ICTs and the environment to address environmental challenges, particularly global warming and energy use. OECD Report “Towards Green ICT Strategies” (Reimsbach-Kounatze, 2009) presents survey results of 92 government programmes and business initiatives across 22 OECD countries plus the European Commission. However, the Czech Republic is among several countries that do not conduct any Green ICT programme. Therefore, we decided to analyse one of the most representative strategic documents in the Czech Republic “The national framework of competitiveness strategy” (National Economic Committee, 2011) prepared by National Economic Committee of the Czech government in March 2011 in order to identify a compliance with Green ICT programmes. However, the topic of ICT contribution to sustainability is only mentioned in the introductory part of the document and no direct recommendations towards sustainability are presented. This analysis confirmed a lack of clear and

measurable policies and initiatives aimed at an improved environmental performance of ICTs across the economy to tackle the challenges of global warming and environmental degradation. Recent changes in the environment, economy and technology substantially drive the adoption of Green ICT practices in the world according to the surveys (Molla, Pittayachawan & Corbitt, 2009), (Fujitsu, 2010), (Rowe, 2011). As to Chitra (2011), “to the main factors escalating the interest in Green ICT belong rapid growth of Internet, increasing cooling requirements, increasing energy costs and restrictions on energy supply access, lower server utilization rates and ICT impacts on the environment”. San Murugesan (2011) adds also “growing consumer interest in green solutions and practices, higher expectations by the public on enterprises’ environmental responsibilities, and the emergence of stricter environmental compliance requirements”. According to Loeser et al. (2011), Green ICT contributes to accomplish a competitive advantage not only by cost savings (through direct usage of Green ICT or an improved utilization efficiency of other business resources) but also through a possibility to differentiate from competition.

3. SUITABILITY OF GREEN ICT PRACTICES FOR SMES

Adopting Green ICT practices offers enterprises and individuals financial and other benefits. According to several studies, to the major reasons for using eco-responsible practices within most of the enterprises belong reducing power consumption and lowering cost, followed by lower environmental impact and improved system use (Molla, Deng & Corbitt, 2010). Nevertheless, Green ICT offers businesses also new opportunities including fresh markets, increased market share and improved current operations. According to Murugesan (2011), Green ICT is a widely adopted initiative among most of the large companies worldwide. On the contrary, Small and Medium Enterprises (SMEs) are constraint in several ways from shifting to Green ICT adoption (Marmaridis, & Unhelkar, 2011) even though they could greatly benefit from adopting Green ICT practices.

Marmaridis and Unhelkar (2011) point to the fact that “what in the SME space is heralded as innovative and new, is typically what has been around at the enterprise space for years, and it is now considered old and obsolete” and name virtualisation as a typical recent example. Large companies are more likely to succeed in implementing Green ICT thanks to the possibility of consolidation of their servers as well as using efficient data center technologies rather than SMEs which mostly rely on hosting data centers or run only a few of servers.

However, SMEs have the opportunity to lower the amount of power consumed by their company computer system. This aim can be reached by turning machines off when not used, e.g. at nights or during the weekends, or by switching to utilization of laptops and other portable devices instead of keeping traditional desktop computers.

As the number of Small and Medium Enterprises in the European Union is absolutely prevailing (99.8 percent in 2010) they represent an important force in the Green ICT movement (Wymenga, Spanikova, Derbyshire & Barker, 2011). Furthermore, the EU document “A Green Knowledge Society” strongly emphasizes the role of SMEs (Forge, Blackman, Bohlin & Cave, 2009). Moreover, SMEs in the Czech Republic enjoy a significant support for their ICT innovation investments (approx. 100 mil. €) provided by the European Social Funds since 2007 till 2013 (Basl, Buchalcevova & Gala, 2011). Based on the facts stated above, we decided to focus exclusively on Small and Medium Enterprises (SMEs) in our research.

4. RESEARCH METHODOLOGY

4.1 Research model

Our research model is based on the Conceptual model of the assessment of ICT impact on sustainability (Basl, Buchalcevova & Gala, 2011), which reflects the principles of sustainable development in the area of ICT. In accordance with the aim of our research focused on analysing to what extent Green ICT practices are used when acquiring, using and disposing ICT in non-ICT Small and Medium Enterprises in the Czech Republic, we focused only on the micro level, direct impacts, which refer to positive and negative impacts due to the physical existence of ICT products (goods and services) and related processes (Mickoleit, 2010) and economic and environmental pillars of sustainable development. Regarding ICT Lifecycle viewpoint from the perspective of a non-ICT business, we reflect following phases: ICT procurement, ICT use, End of ICT use (see Fig. 1).

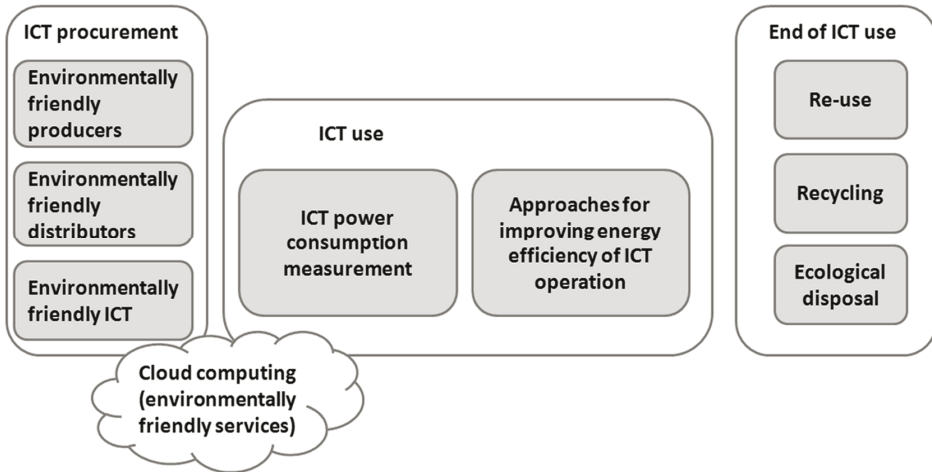


Fig. 1 - Research model. Source: authors

ICT procurement activities primarily address two problematic areas in terms of Green ICT concept. The first issue is associated with evaluating an ability of acquired ICT to meet the principles of Green ICT during its use in a business and when discarded out of the process. This ability depends on the features which were determined for ICT by the phases of R&D and Design. These features usually consist of operation's energy efficiency, minimal or no impact on the operator's health, ability to be disposed of in an environment-friendly manner, etc. There exist a lot of methodologies which help businesses to assess the level of these features, such as Electronic Product Environmental Assessment Tool, The Greenpeace Guide to Greener Electronics, Energy Star, etc. The devices whose features comply with the principles of Green ICT are described as environmentally friendly ICTs in our model. The second issue is connected with evaluating to what extent a product is burdened with mainly negative effects when entering into the business and is reflected in the part of Environmentally friendly ICT producers and distributors in the



research model (see Fig.1). In other words, it means how well ICT production and distribution, including ICT sale satisfy the principles of Green ICT. There are definitely more criteria involved in the ICT procurement process. However, from the ecological point of view environmentally friendly hardware suppliers should be preferred. To evaluate this measure the so called carbon footprint (Wiedmann & Minx, 2008) or ecological footprint (Wackernagel & Rees, 1996) is utilized. To the generally known agents that enable to calculate carbon footprint belong Carbon Footprint Calculator, SAP Carbon Impact, Oracle Green Sigma, Microsoft Environmental Sustainability Dashboard, etc. On a broader scale, the evaluation should also include social pillar of sustainable development in which the social conditions of production and distribution are considered as well. Unfortunately, in our view the appropriate methods and tools for measurement and evaluation are lacking in this area.

The key area where Green ICT practices should be applied consists in the phase of ICT use. The principal goal is to lower power consumption in order to reduce carbon footprint of ICT. Energy efficiency of ICT operation can be improved by utilizing various activities and technologies based on integrating new approaches to power and cooling with energy-efficient hardware. To the chief approaches for improving energy efficiency of ICT operations belong:

- Desktop Virtualisation, Server Consolidation and Virtualisation, and Storage Virtualisation. These activities allow a better agility, flexibility and efficiency of ICT infrastructure (Gala & Jandos, 2011) with a possible achievement of energy savings and minimal deployment of ICT devices.
- “Power down” Systems. This approach is based on an ability of ICT to optimize energy consumption according to the actual required performance of a device.
- Rightsizing ICT equipment. Originally, it used to be an important method applied in ICT procurement. In accordance with the company strategy those devices whose configuration complied with the work requirements the best were selected and deployed. Currently, these activities are associated with the ability of a device to be virtualised so that only an actual required performance is accessible. In addition, this approach is also applied figuratively in terms of re-use (see below).

An important condition for the application of Green ICT practices at this stage is to understand the level of real power consumption. According to Fujitsu survey (Rowe, 2011), only 7% of respondents (n=1000) are fully responsible for ICT power consumption, and another 7.2% include ICT’s power bill in the ICT budget. As to the Fujitsu survey results (Rowe, 2011), there is a strong correlation between the visibility of ICT’s power bill and an organization’s sustainability index. Nowadays the development in the area of ICT enables companies to consume ICT as a service within so called cloud computing. IDC predicts that 80 percent of new commercial enterprise applications will be deployed on cloud platforms in 2012 (Velagapudi, 2011) and cloud computing will allow small businesses to improve their flexibility and agility even with limited resources and expertise. In terms of Green ICT depending on a deployment model of cloud computing (Mell & Grance, 2011), the core activities shift to the selection of appropriate „environmentally friendly services“ within ICT procurement in case of public cloud. On the other hand, in case of private cloud the core activities connected with saving energy in data centres remain fully under the control of a company. To measure and assess energy efficiency reaching its optimization, sev-

eral methodologies, as well as instruments are applicable such as Data Center Profiler Software Tool Suite, which is supported by U.S. Department of Energy.

The last area where SMEs are able to take advantage of Green ICT practises represents the End of ICT use. In these days, ICT equipment is being extensively replaced. Many organizations dispose of their equipment too early and contribute to a creation of unnecessary waste. As it is mentioned in (Philipson, 2011), even when a system upgrade is required, it does not have to be implemented within the whole enterprise. The organization's divisions that really do need new equipment may pass on their old one to other sections of the company, perhaps to those with less mission critical activities. Nevertheless, at some point the ICT equipment will no longer meet the functional criteria and will have to be disposed of. This environmental issue has been already addressed by a decent number of organizations as they realized the importance of reducing electronic waste threat. Their environmental friendly practices in the field of ICT equipment removal preceded the concept of Green ICT. The activities linked to End of ICT use represent the content of End of Life phase. According to Directive 2008/98/EC on waste (European Parliament, Council, 2008), which can be applied to ICT too, End of ICT use consist of following activities:

- Re-use stands for any operation by which products or components not considered as waste are used again for the same purpose they were conceived;
- Recycle signifies any recovery operation by which waste materials are reprocessed into products, materials or substances whether for the original or other purposes. It includes reprocessing of organic material but does not comprise energy recovery and reprocessing into materials that are to be used as fuels or for backfilling operations;
- Disposal counts for any operation which is not recovery even if the operation's secondary consequence is reclamation of substances or energy.

Based on the research model depicted in the Figure 1 and described above, we defined following research questions:

RQ1: How do businesses apply Green ICT practices during ICT lifecycle in general?

RQ2: Which preferences and activities are implemented during each phase?

RQ3: At what scale do businesses consume cloud computing services?

4.2 Research method

To conduct the research an electronic survey was utilized. The basic statistical sample (N) formed companies which obtained support for their ICT innovation within the Operational Programme "Enterprises and Innovations" (2010). We chose these companies due to a previous successful cooperation with them. The programme also designated a basic separation of the population thanks to its focus on small and medium companies in defined activity areas, i.e. CZ-NACE C10 - C33 (with the exception of 12 and 19). Since this sample based on projects in the 2nd call would not have been representative enough, it was supplemented by a random stratified selection of subjects from the 3rd call of the programme while keeping the conditions from the 2nd call and whereas only small companies were added. Basic contact information was found for each identified subject in the sample. Subsequently, the companies were asked by email to fill in an electronic questionnaire. Data collection was carried out in November 2011 in a 10-day period.

Those that did not fill in the questionnaire within the defined time frame were asked again. Data collection finished at the end of November 2011. Out of the total 294 (n) sent appeals, 47 messages were returned as undeliverable (16 %), 35 respondents refused to participate (11.9 %) and 18 answers (6.1 %) could not have been identified, probably constituting spam. Overall, 61 replies were obtained and further processed, which represents a response rate of 20.7 %.

Table 1 lists particular rates based on company size.

Tab. 1 - Basic characteristics of data sample. Source: authors

Size	Representative sample after addition of supplementing subjects in the 3rd call (n)		Response Rate		
	Frequency	%	Frequency	%	%
Small (10-49)	210	71.4%	26	42.6%	8.8%
Medium (50-249)	84	28.6%	35	57.4%	11.9%
Total	294	100%	61	100%	20.7%

5. SURVEY RESULTS ANALYSIS AND DISCUSSION

Figure 2 shows the answer to the first research question, i.e. how businesses apply Green ICT practices during ICT lifecycle in general.

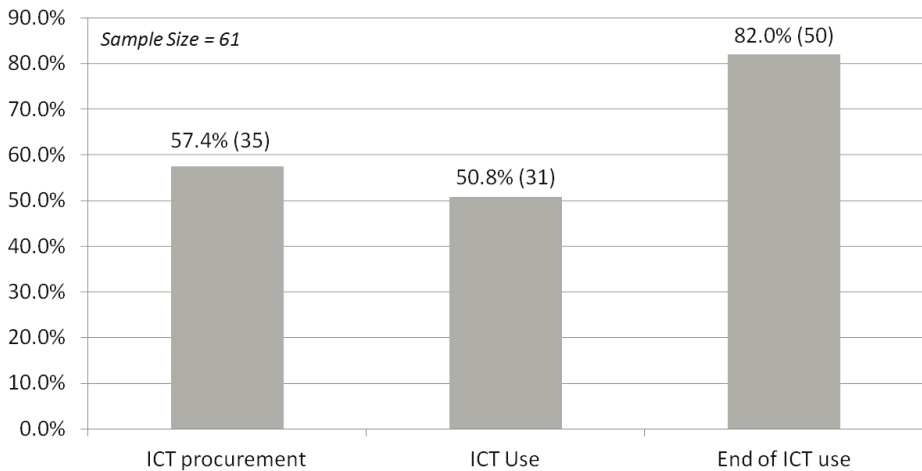


Fig. 2 - Application of Green ICT practices in SMEs. Source: authors

Overall, more than 50% of companies pay attention to Green ICT across all analysed phases of ICT lifecycle within the research sample. In comparison with the global survey (Rowe, 2011), we consider this result as encouraging as Czech companies are situated in the mainstream of Green ICT practices application. However, we classify the values primarily associated with End of ICT use as unsatisfactory. We assumed that the organizations have already applied requirements of

EU directives on waste in this field and so the level of 100% would be reached. The result of 82% was probably caused by companies failing to implement these requirements in the field of ICT or by respondents being unfamiliar with this matter.

Tab. 2 - Adoption of Green ICT in ICT Lifecycle. Source: authors

		Application of Green ICT practices								Total
		In all phases	In ICT procurement and in End of ICT use	In ICT use and in End of ICT use	Only in ICT procurement	Only in ICT use	Only in End of ICT use	Nothing		
Size	Small (10-49)	Count	10	2	6	1	2	3	2	26
		% within Size	38.5%	7.7%	23.1%	3.8%	7.7%	11.5%	7.7%	100.0%
		% of Total	16.4%	3.3%	9.8%	1.6%	3.3%	4.9%	3.3%	42.6%
	Medium (50-249)	Count	8	13	4	1	1	4	4	35
		% within Size	22.9%	37.1%	11.4%	2.9%	2.9%	11.4%	11.4%	100.0%
		% of Total	13.1%	21.3%	6.6%	1.6%	1.6%	6.6%	6.6%	57.4%
Total	Count	18	15	10	2	3	7	6	61	
	% of Total	29.5%	24.6%	16.4%	3.3%	4.9%	11.5%	9.8%	100.0%	

Table 2 presents detailed information about the status of application of Green ICT practices in small and medium companies across all phases of ICT lifecycle observed. The table also depicts values for individual combinations of ICT lifecycle phases. It turns out that almost 30% of businesses reflect Green ICT in all its phases and that application of Green ICT practices varies in different combinations depending on the size of a company. Small enterprises apply more frequently Green ICT practices in the phase of ICT use and at the same time in End of ICT use, while medium enterprises utilize a combination of ICT procurement, as well as End of ICT use. We believe that this fact is caused either by a presence of more qualified personnel in medium companies, who decide on ICT purchase, or by a better exploitation of consulting services associated with ICT purchase.

In the following part we present the answers to the second research question, i.e. which preferences and activities are implemented during each phase.

Figure 3 shows how businesses engage in Green ICT in terms of ICT procurement. According to Figure 3, companies that take account of Green ICT in their management focus primarily on the characteristics of ICT product itself and only in a negligible manner take into consideration the environmental friendliness of ICT producers and distributors. There is a significant space for improvements to be exploited.

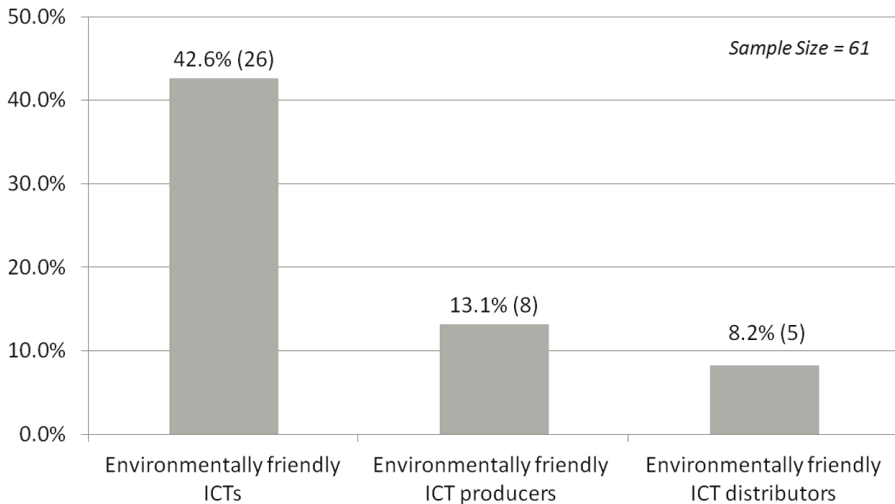


Fig. 3 - ICT Procurement Preferences. Source: authors

Firstly, total of 26 enterprises, i.e. 42.6% do not reflect Green ICT in the phase of ICT procurement. Not even a single respondent applies an assessment of environmental friendliness in all its components within a process of purchase. As previously mentioned, the shopping preferences most frequently concentrate on the characteristics of ICT, where medium enterprises dedicate more attention to this issue (48.6% within size) in comparison with small companies (26.9% within size). Secondly, just 18% of respondents take into account the environmental friendliness of ICT producers and distributors while purchasing ICT. In addition, small enterprises (23.6% within size) put a greater emphasis on this issue in a process of purchase unlike medium companies (14.3% within size). Researched data indicate that businesses still do not fully realize that all the parts of a chain participate in an overall ecological footprint. Moreover, the figure claimed by respondents does not comprise any significant market power that could influence manufacturers' and producers' efforts to improve in their Green ICT practices adoption.

We examined two problematic areas in the phase of ICT use. First of all, only 16 companies, i.e. 26.2% of all respondents perform a measurement of energy consumption. Further, small enterprises are more interested in this issue. 11 of them (i.e. 18% of total and 42.3% within size) reported that they did measure and monitor energy consumption. On the other hand, just 5 medium companies, i.e. 8.2% of total and 14.3% within size engage in this matter. Czech companies are in a similar position as enterprises researched in the international survey mentioned earlier. However, the proportion of businesses measuring energy consumption reached 40% among international companies (Rowe, 2011). We believe that the businesses are still in their infancy regarding this area. Furthermore, we see a necessity of a radical improvement in an energy consumption expertise, because if there is no notion about the actual consumption, then it is very difficult to carry out other activities of Green ICT, as a general management rule indicates: „what I do not see – I can not manage“. We recommend applying appropriate practices to reduce energy consumption and thereby achieve both cost savings in ICT operation and also reduction of carbon or ecological footprint.

The second area of ICT use phase focused on exploring the ways how businesses implement approaches for improving energy efficiency of ICT operation. Figure 4 shows the summarized data.

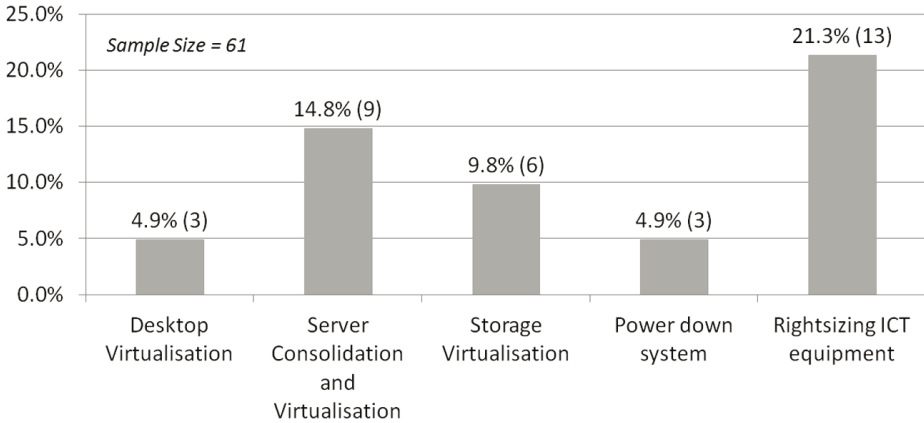


Fig. 4 - Using of Approaches for improving energy efficiency of ICT operation. Source: authors

On the whole, very low figures were reached across all the approaches. As to Figure 4, 41 respondents, i.e. 67.2% do not take into account any of the approaches observed accounting for 24.6% of total and 57.7% within size of small businesses and 42.6% of total and 74.3% within size of medium enterprises. Though, the respondents were eligible for purchasing modern ICT within the Operational Programme that enable adoption of these approaches. On the other hand, although the achieved figure is relatively negligible, an adoption of rightsizing can be considered as satisfactory. We suppose that the adoption of rightsizing was caused by the respondents proceeding in an effective manner while choosing their ICT. Further, probably due to the lack of energy consumption monitoring (see above), methods and instruments to reduce it such as power down systems are generally applied only in three cases. Overall, the most commonly implemented approach among Czech SMEs is a certain form of virtualisation.

The relationship between measurement of energy consumption and the various approaches stated above was not proved, i.e. companies implement these approaches for other reasons. On the other hand, any Green ICT activity, although not really carried out in a direct relation to Green ICT, can be considered as beneficial.

Figure 5 depicts how the activities associated with the phase of End of ICT use are represented in businesses. According to Figure 5, 15 companies (24.6% of total) do not address any of the activities, which in our opinion is highly surprising. Indeed, we believe that every company should at this stage regarded as the only one legally regulated (see above EU Directive) implement at least one of the defined activities. Further, the figure demonstrates that businesses still do not pay sufficient attention to a possible ICT re-use (only 9.8% of respondents), but rather dispose of ICT directly. Only 12 companies (20% of total) realize more than one activity in this phase, while the combination of Recycle and Dispose ICTs ecologically belong to the preferred ones (13.1% of total). Small companies are engaged in at least one of the activities in this phase

corresponding to 19 business units (31% of total and 73.1% within size) and to 27 business units within medium enterprises (44.3% of total and 77.1% within size).

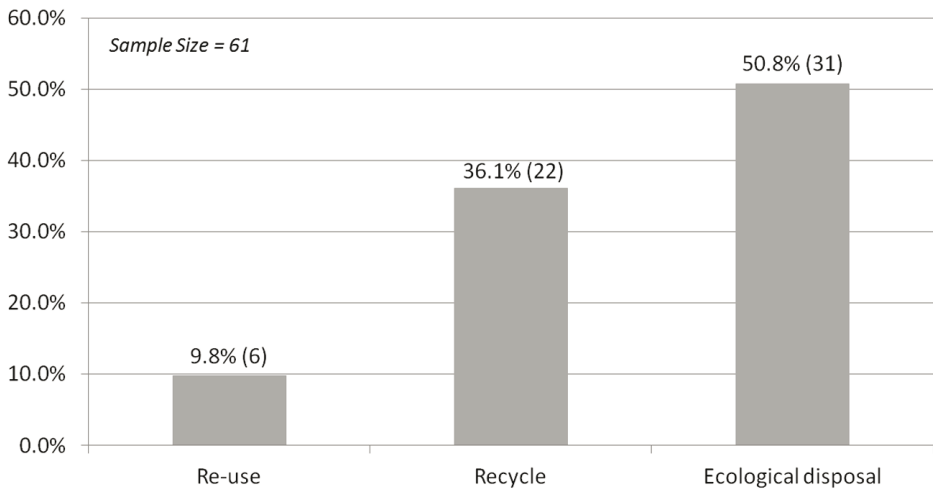


Fig. 5 - Activities in End of ICT use. Source: authors

The last research question dealt with the examination of scale at what businesses consume cloud computing services. The results of analysis of Approaches for improving energy efficiency of ICT operation (fig. 4) have already indicated that cloud computing services will not be largely consumed by enterprises. Virtualisation as an important technique used in cloud computing has only rarely been implemented among companies. On top of that, solely two respondents answered to a direct question, whether using cloud computing, positively which we consider very disturbing. Based on the results of IDC research, which predicts that 80 percent of new commercial enterprise applications will be deployed on cloud platforms in 2012 (Velagapudi, 2011), then in our opinion supply and demand diverge at this point, at least within enterprises in the fields defined in our research (see above). Such a difference between the prediction and today's reality may be in our opinion explained by the fact that cloud computing is mainly used by IT providers rather than IT consumers in these days. Thus, our research focused exclusively on IT consumers could not have reflected a general sample. Moreover, several companies engaged in the research intend to integrate cloud computing in their business in a near future. Therefore, only a future situation will show a corresponding distribution of cloud computing among enterprises.

6. CONCLUSION

In this paper, we presented results of the survey focused on the adoption of Green ICT practices among SMEs in the Czech Republic. We concentrated on the ICT lifecycle viewpoint that consists of following phases: ICT procurement, ICT use and End of ICT use. In the ICT procurement phase a company takes into account and assesses substantial attributes of previous ICT lifecycle phases. These attributes with regard to Green ICT issue were formulated as follows

– environmentally friendly ICT, environmentally friendly producers and suppliers. Further, the phase of ICT use was examined from two different perspectives – ICT power consumption measurement and Approaches for improving energy efficiency of ICT operation. The last phase, i.e. End of ICT use, is carried out through various methods, e.g. re-use, recycling, ecological disposal.

Data were analyzed in 61 small and medium enterprises in defined business branches obtained by a questionnaire survey carried out as a part of a larger research.

The survey results indicate that there exist a great potential among businesses to improve within all the phases observed as only 30% of respondents apply the principles of Green ICT in all phases. In the phase of ICT procurement companies do not stress enough the extent of ICT producers' and distributors' environmental friendliness. The challenge of ICT use phase lies in the fact that enterprises do not measure energy consumption of ICT and therefore are hardly able to identify the potential of savings. This is also confirmed by a low utilization of modern approaches for improving energy efficiency of ICT operation including deployment of cloud computing services. Even in the phase of End of ICT use being the only one partially regulated by legislation there exist a significant potential among a number of businesses to enhance or at least to achieve law compliance, since 24.6% of companies do not implement any activity at this stage.

On the other hand, businesses described as early adopters of Green ICT within the innovation terminology have the chance to benefit from the competitive advantage resulting either from cost savings or their differentiation within the market.

Acknowledgement

This paper describes the outcome of a research that has been accomplished as a part of research program funded by the Grant Agency of the Czech Republic grant no. P403-11-1899.

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JEL Classification: L260, M150, O330, Q550
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