

A SURVEY ON IT MANAGERS GREEN AWARENESS

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ABSTRACT

The energy consumed by IT systems has become significant, both from the point of view of CO₂ footprint and of economic impact. Even though Green IT, i.e. the discipline that studies the environmental impact of IT, is gaining momentum, most of the IT managers have not yet built a mature and fact-based position with reference to these issues. This paper presents the results of a survey conducted on 138 Italian companies to evaluate the Green awareness of their IT Managers. Our data shows that 89% of IT managers do not know the electric consumption of the systems they manage and do not take into account energy efficiency parameters when evaluating new purchases. This may be due to the fact that in 81% of the analyzed companies IT managers are not responsible of the electricity budget. The paper also presents statistics on Green IT strategies and budget, and a success case that we analyzed in details.

Key words: Green IT; Green KPIs; Green awareness.

INTRODUCTION

The study of the environmental impact of IT is gaining momentum (Forrester 2007, Preimesberger 2007, Standage 2008). On one hand, IT producers are forced by recent legislation to monitor and control the environmental impact of IT components lifecycle, from production to dismissing, re-conditioning, and recycling (Krikke 2008). On the other hand, IT users are becoming concerned about the environmental implication that is consequential to the use of ICT. This new investigation area is commonly indicated as “Green IT” (Murugesan 2008).

According to Forrester Research (2007), 33% of North American and 48% of European IT procurement and operations professionals think that environmental and energy-related issues are very important in planning their company’s IT operations. Green IT is regarded as a generally important topic by 94% of European and 85% of North American IT practitioners.

However, the behavior of IT managers appears to be still in a preliminary phase, when decisions are not led by an overall vision, but by momentarily trends and fears. Most of the IT-user companies that are investigating Green IT are led by image and marketing motivations, as the public is getting generally aware of and sensitive to environmental issues. Statistics and estimates on the CO₂

footprint of IT, which is responsible from 2 to 3% of global CO₂ emissions (Murugesan 2008, Brown and Lee 2007, Kumar 2007), have been published and are now quite widespread, leading companies to consider IT energy consumption within their social corporate responsibilities strategies. IT-user companies are also influenced by IT vendors, which are often leveraging Green IT to sell new products and services. According to Gartner (Kumar 2007), 44% of the world top 500 Computer, Telecom, and IT Service Provider companies think that climate changes represent a commercial opportunity for both new and existing products.

On the contrary, IT-user companies do not seem yet fully aware of the cost impact of the energy consumed by IT. Data on the operative costs of data centers collected by IDC (2007) show that energy on average accounts for 13% of total costs. Moreover, while the global spending for new servers has been more or less constant in the last ten years, the spending for power and cooling has grown almost 4 times (Josselyn et al. 2006). These statistics are elaborated at world level, but the economic impact of IT energy consumption is significantly higher in countries where energy is more expensive (e.g., in Italy, where the cost of energy for industrial use is four times as expensive as in the US, International Energy Agency 2007).

Notwithstanding these worrying reports, a lot of IT executives do not know the energy consumption and relevant cost of the infrastructure they manage. A recent survey conducted by EILT (Restorik 2007) has shown that 86% of IT departments in the UK do not know their CO₂ footprint.

How can IT managers reduce the energy consumption of the IT infrastructure that they manage if they do not know the current level of consumption and how this consumption is distributed in the different layers and modules of the IT system? Starting from the assumption that it is impossible to optimize what is not known, we conducted a survey on a sample of 138 Italian companies to evaluate the level of “green-awareness” of IT managers. Although green-awareness may be a very wide topic, in this particular context we associate green-awareness to a detailed knowledge of the energy consumption of IT, its costs, the importance of energy efficiency parameters in the purchase process, and the presence of an overall vision on Green IT.

The paper is organized as follows. Next section describes the sample of companies that we have selected and our empirical methodology. We will then present the results of the survey, and discuss one of the success cases we came across. Finally, we will draw some preliminary conclusions and propose future work.

SAMPLE AND METHODOLOGY

Since our goal was to evaluate the *green awareness* of IT Managers, we created a large database of firms homogeneous for size and sector. Our analysis was limited to Italy, because it was easier for us to get contacts and operate there. We think that Italy can be representative of Europe for a conservative analysis. In fact, the cost of electric energy for industrial use in Italy is the highest in Europe (just to cite some examples, the unit cost in 2007 was 24 \$cent/KWh in Italy, 13 \$cent/KWh in UK, 9 \$cent/KWh in Spain, 8 \$cent/KWh in Germany, 5 \$cent/KWh in France, IEA 2007) and the economic impact of Green IT should thus be more evident and significant for IT managers than in other countries.

We randomly selected 1,635 firms from the list of all Italian firms of the Chamber of Commerce, thus assuring a consistent sample. The Italian Chamber of Commerce provides the largest and most updated public repository of information about firms in Italy. We chose to use only one repository to have homogenous data, as different repositories may be structured according to different rules. We selected the firms according to two criteria: i) business sector, and ii) number of employees. We chose half of the 1,635 firms from the ICT sector, whereas the other half from other fields. Fig. 1 shows the distribution of the sample according to business sectors. As regards the size, we tried to select a sample equally representatives of Small Enterprises (less than 10 employees), Medium Enterprises (between 10 and 250 employees) and Large Enterprises (more than 250 employees) according to the EU definition (European Commission 2006). Fig. 2 shows the distribution of the sample according to the number of employees.

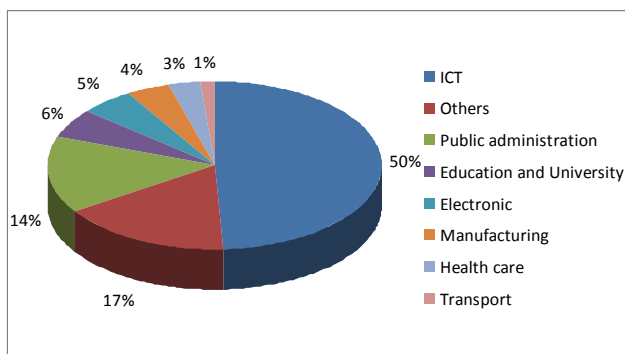


Fig. 1 – Distribution of the sample according to business sectors.

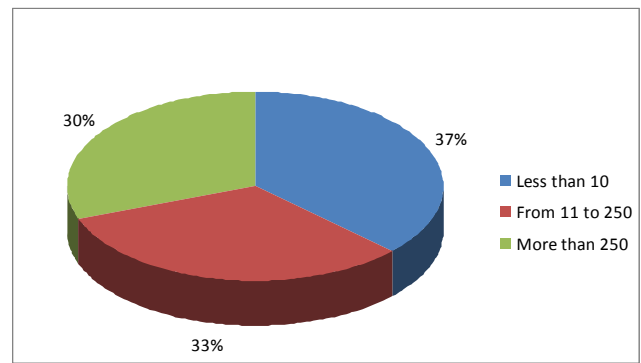


Fig. 2 – Distribution of the sample according to number of employees.

The IT Managers of the firms in our sample were invited to answer to an on-line survey, that we managed by means of the platform myK (<http://myk.concept.it>). The campaign started with a pilot phase on March 21st, 2008. We sent the questionnaire to 100 firms additional to our sample, selected with the same criteria described above. We obtained 11 replies and contacted by e-mail and phone some of the respondents. We leveraged their comments to clarify the questionnaire and make sure that all the questions were not ambiguous. We also decided to eliminate any references in the cover e-mail and on the cover page of the on-line survey to guarantee casual responses and eliminate a possible non-response bias (Green 2008).

The real campaign started on May 21st, 2008 and ended, after two follow-ups, on August 1st, 2008. The final statistics about the campaign are presented in Table 1.

	First Mailing	1 st Follow-up	2 nd Follow-up	Total
Sent e-mails	1,635	1,392	960	-
Answered	87	39	12	138
Declined	156	393	541	1,090
No answer	1,392	960	407	-

Table 1 - Summary statistics of the online survey campaign.

Whenever inconsistencies were found, we contacted the respondents by e-mail and asked for clarification, even though we did not always receive answers. We excluded from the sample the answers for which we were not able to solve inconsistencies, thus resulting in a final sample of 138 answers. We had a final response rate of 8.4%.

The distribution of the respondents according to business sectors and number of employees is essentially the same of the original sample of 1,635 firms.

The questionnaire was in three parts. The first part contained general questions about the firm and about the interviewee. This part had the purposes to confirm the information on size and business sector, and to classify the firm according to revenues and ICT spending. Fig. 3 shows the results of these questions.

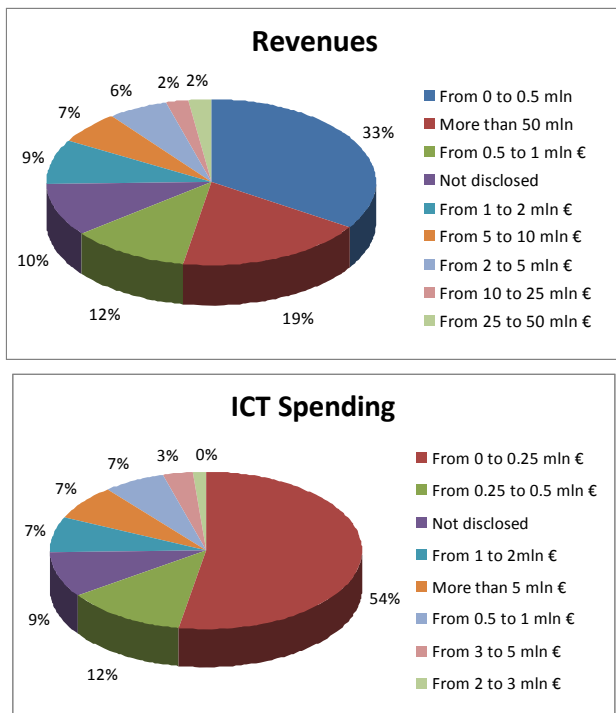


Fig. 3 – Distribution of the respondents according to revenues and ICT spending.

The second part of the questionnaire focused on the awareness of IT managers of Green IT issues and of the electrical consumption of the infrastructure they manage. Originally, this part also aimed at evaluating the impact of electric costs on total costs, but as will be discussed in the following section, we did not gather enough data on this topic to be statistically significant.

The third part of the questionnaire focused on the eventual strategy for Green IT, including questions on the budget. Finally, we decided to make an in-depth analysis on some firms that emerged as success cases. This analysis was conducted by personally interviewing the IT and Energy Managers.

SURVEY RESULTS

First of all, we asked IT managers what was in their opinion the meaning of “Green IT”. We encouraged open and free replies, and then classified all the collected replies as shown in Fig. 4. According to our results, 43% percent of Italian IT managers never heard about Green IT. These IT managers are not yet aware of Green IT issues, and their firms are not yet worried about the environmental impact of IT. 16% of the IT manager have a confused or partial perception of Green IT, limited to e-waste or to the management of energy utilities, whereas only 44% of the respondents clearly see Green IT as an eco-compatible and eco-responsible attitude towards the use and the design of IT. This shows a substantial lack of maturity of Italian of IT managers when compared to the European average (see the Forrester Research statistics cited in the Introduction Section, 2007).

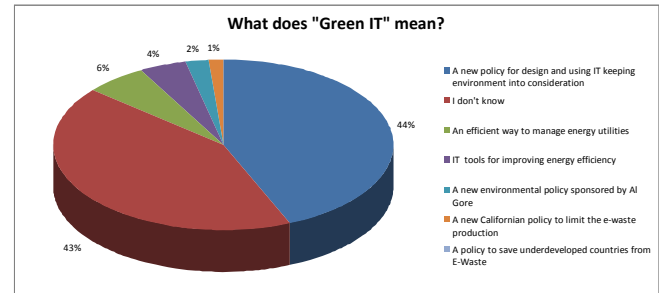


Fig. 4 – Replies to the question “What does Green IT mean?”.

Starting from the assumption that is impossible to analyze and optimize what is not known, we asked IT managers if they knew the electrical consumption of their companies and of their IT infrastructure, and obtained appalling results. 84% of IT managers do not know the energetic bills of their organization, and 89% of them do not know the electric consumption of IT either. If we consider the consumption of the cooling systems for the IT infrastructure (which accounts for approximately 40% of the total energy consumption of IT and for 60% of the annual operating spending for servers, Josselyn et al. 2006), it is unknown to 90% of IT managers. The last two percentages have been computed considering only the firms that manage IT in-house (81% of our sample).

Table 2 presents data on the awareness of IT managers on total consumption, IT consumption, and IT cooling consumption, classified according to firm size.

Size	Firm total consumption	IT consumption	IT cooling consumption
Small	12%	8%	4%
Medium	15%	11%	13%
Large	21%	16%	13%
Average	16%	11%	10%

Table 2 – IT managers who are aware of electrical consumptions classified by firm size.

Even though awareness slightly rises with the size of the firm, as it is quite natural to think, the situation in large firms is not much better than in SMEs.

The respondents who knew the electrical consumptions were invited to indicate the values of actual consumptions of their firms. However, these results are not statistically significant, since they are based on the answers of the very few IT managers who know the consumption of their firm.

IT systems are quite widespread in the organization of a firm, as they include PCs, laptops, network routers and switches, printers, UPSs, and other devices. Total IT consumption can be estimated by specific analyses or measured by a monitoring infrastructure built ad-hoc. However, data centers (i.e., mainframes or server farms) are more concentrated and their consumption should be easily tracked. Consequently, we performed an in-depth analysis on data centers, which are present in 46% of the firms in our sample.

Fig. 5 shows the average consumption of data centers declared by the respondents. More than half (51%) of IT managers do not even know the electric consumption of the data center they manage, although the relevant cost is significant. According to our data, a data center in Italy consumes on average 2 MW, which if the data center works 24h per day accounts for approximately 2.5 million Euro per year. Even if we consider the most frequent values of consumptions, i.e. approximately 300KW, their impact is significant. Just to have a term of comparison, 300KW is equivalent to the consumption of a large complex with 100 apartments.

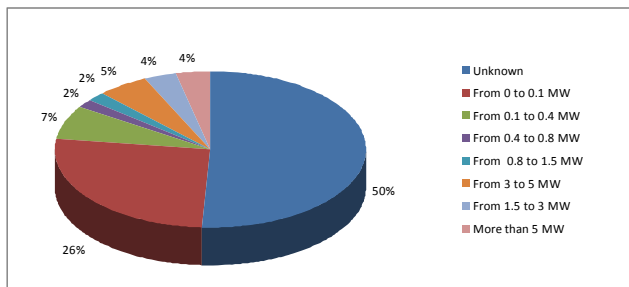


Fig. 5 – Electrical consumption of data centers declared by IT managers.

Why IT managers do not know (and do not care about) the electric consumption of the infrastructure they manage? Our research shows that only 19% of IT managers are responsible for the cost of the energy consumed by IT. In the other 81% of the cases electricity costs are charged on the budget of other functions independently from the appliances that caused the consumption. This evidence provides a rationale for another result of our survey. We asked IT managers to what extent they take energy efficiency into consideration when they buy new IT components. Fig. 6 presents the results, from which it is evident that in 70% of the cases environmental parameters are scarcely or not at all taken into consideration.

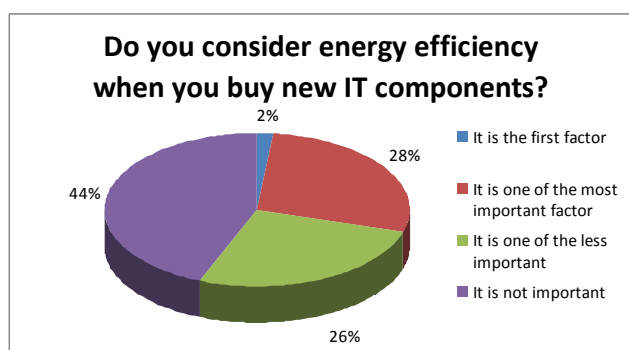


Fig. 6 – Relevance of energy efficiency in the purchase process of new IT components.

This may indicate shortsightedness of IT buyers, as there is plenty of evidence that shows that small premium prices invested for more energy efficient infrastructure are paid back by savings in less than 2 years (Samson 2008, Sturgeon 2008), especially in countries where the energy cost is high. Of course, the fact that IT managers do not pay the electricity bill provides a justification for this behavior.

Our survey shows another worrying result, in fact most of the firms in our sample do not have an energy efficiency plan and actually, the firms that are developing a plan, are not investing money in it. Firms do not have an overall strategy to improve the energy efficiency of IT and do not yet consider it a priority. Table 3 presents the replies of IT managers to the questions relevant to this topic classified according to firm size.

Size	Do you have an energy efficiency plan?			Do you have a budget for energy efficiency?		
	Yes	No	No, but I will have in the future	Yes	No	No, but I will have in the future
Small	15%	46%	39%	1%	88%	11%
Medium	11%	47%	42%	1%	87%	12%
Large	39%	48%	13%	4%	71%	25%
Average	19%	47%	34%	2%	82%	16%

Table 3 – Data on energy efficiency plans and budgets for energy efficiency classified according to firm size.

Large firms are leaders in this area, as 39% of them already have an energy efficiency plan, whereas SMEs are followers.

A SUCCESS CASE

In our analysis we also came across some success cases, i.e. companies that are aware of Green IT issues and that monitor energy consumptions by means of ad-hoc information systems. In this section we present the case of Bank Alpha, as an example that winning green strategies can be easily and cheaply implemented.

Bank Alpha is a large Italian bank, which thanks to a on-line monitoring system and an optimization project has reduced its electricity bill of 5% (4.2 mln Euro saving are expected in 2008).

The project started with the investigation of critical branches and buildings, which were identified by analyzing monthly consumptions. Critical structures are monitored by ad-hoc systems, which have required a little investment between 600 and 2,000 €, depending on available options. Each system is able to monitor the consumption of every IT component, and of every single appliance for heating and lighting. Data are measured in real time, made available online and integrated by an executive information system.

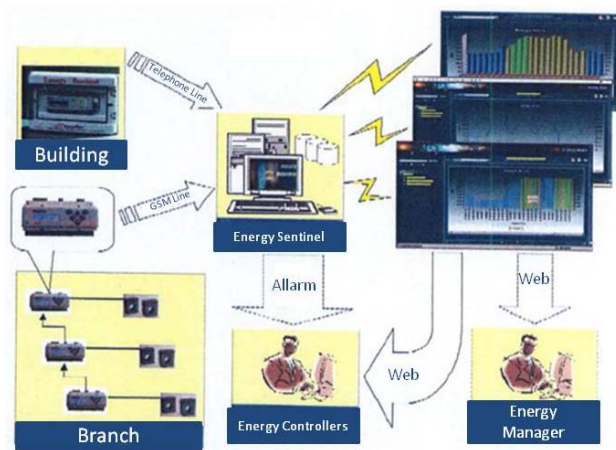


Fig. 7 – Bank Alpha energy consumption monitoring system

The executive information system is able to send sms and e-mails to the Energy Manager or to other deputed persons (Energy Controllers) in case that the consumptions are different from average values or from what expected (e.g., somebody forgets to switch off a machine). Furthermore, it allows to store and analyze data, to define KPIs and compare them with benchmarks. Fig. 7 presents an overview of the architecture of the system. The Energy Manager is a new role created within the company with the specific goal of implementing policies for improving energy efficiency.

The project has led not only to economic returns, but also to a better environmental performance. In fact, thanks to the project Bank Alpha saved 5% of the electricity cost in 2007, but it also reduced the consumption of electricity of 1.3 MWh and the emission of CO₂ of 650 ton.

This case study shows that a person or a function within a company aware of IT consumptions, and in general in charge of Green issues, may easily lead to implement effective systems to monitor consumptions and to optimize them, resulting in significant savings.

CONCLUSIONS AND FUTURE WORK

Our survey has shown that 84% of the IT managers do not know the consumption of the infrastructure they manage, and that only 30% of them consider energy efficiency as an important factor when new IT components are purchased. This evidence can be easily interpreted by noting that energy costs are charged to the IT budget in less than 20% of the companies analyzed. This introduces an important misalignment between corporate and personal objectives: it is unlikely that executives invest part of their budget to improve the energy efficiency of a system or to pay a premium price for “greener” IT components if they are not responsible for energy costs. On the other hand, IT energy costs can be charged to IT budgets only if they can be clearly identified and if the consumption of each appliance is monitored and registered.

Statistics shows that the energy consumption of IT has a deep impact on TCO (IDC 2007, Josselyin et al. 2006). In addition to that, Green IT has a moral relevance, as it

affects the health of our planet. As these issues needs to be addressed, we would recommend companies to design and implement executive information systems to monitor the environmental performances of their IT systems. These technologies are quite mature: new servers and PCs automatically provides energy consumption through built-in functions (EMA 2008), several typologies of sensors capable of measuring the energy consumed by an appliance are available (Emerson 2008), including ammeter clamps that do not require to cut wires, and data may be stored and analyzed by means of datawarehouse and KPIs dashboard tools. The case of Bank Alpha shows as this can be implemented with state-of-the-art technologies. Other studies (The Green Grid 2007) shows that a energy-aware re-engineering of data centers, based on the monitoring of consumptions and of green KPIs, may reduce consumptions from 5% to up to 20% with a payback, in most of the cases, shorter than one year (Caleffi 2008). Moreover, these projects may – and should – be extended to all the business processes and electric appliances, not only IT.

What is really needed is a corporate commitment to define a set of Green IT KPIs, to monitor them, and above all to take them into consideration. This last goal can be achieved only if IT managers are made responsible of the green performances of IT. This in turn may be obtained by specific incentives and by changing accountability rules, so that IT managers are responsible of IT energy costs, even though this involves significant organizational changes.

The natural continuation of our work is the definition of a general methodology and guidelines for identifying the most significant “Green IT KPIs” that a company should monitor. We propose to conduct another survey and to analyze some success cases in the near future to obtain this goal.

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