Business process model for implementation of Green IT in public sector

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Abstract— In recent years apart from increasing efficiency, Governments and Business Organizations have started to give priority towards building a sustainable and environmentally friendly system. Recently Green business process modeling has also started to emerge as one of the approaches towards reducing carbon footprint. Process reengineering is one of the pillars of green IT, so combining BPM, in our case Business process modeling notation (BPMN) 2.0 and Green IT is one of the ways towards achieving set goals. We present model of business processes, which should contribute to better adapt business processes for public sector with identified steps and tasks for implementation of Green IT recommendations.

Keywords: Business process model, Green IT, public sector

I. INTRODUCTION

In recent years apart from increasing efficiency, Governments and Business Organizations have started to give priority towards building a sustainable and environmentally friendly system. The Gartner research from April 2007, estimates that ICT industry accounts for 2% of global CO₂ emissions which is equal to CO₂ emission of aviation, one of biggest pollution sources in world [1]. This and similar research have increased general public awareness on this problem. From consumer point of view, business organizations, and their products, that monitor negative impact on environment are considered more desired than those that don’t. From government point of view, there is increased pressure of building sustainable, yet efficient service, to reduce negative impact and in general raise awareness on this issue. Apart from general public and customer demands, there are certain legal requirements that put additional pressure to decrease negative impact on environment, such is European Strategy Europe 2020, which goal is to increase power production from renewable energy sources by 20%, to decrease power consumption by 20% and to decrease carbon emissions by 20%, on state level [2]. We often neglect possibility to optimize existing operations to reduce negative impact. One of the approaches that is starting to get more attention in recent years is Green IT. Green IT is a proactive approach towards reducing negative impact that informational technologies have on environment, it provides procedures and technologies that will allow environmentally cleaner use of ICT. Recently Green business process modeling (BPM) has also started to emerge as one of the approaches towards reducing carbon footprint. Process reengineering is one of the pillars of green IT, so combining BPM, in our case Business process modeling notation (BPMN) 2.0 and Green IT is one of the ways towards achieving set goals. Despite all the above, in the referent literature there can’t be found any business process model for the implementation of regulations, issued by the state for the implementation of "Green" technologies (such as Green IT). The aforementioned model would be of benefit to local governments to define the expected steps and tasks in the process of implementing regulations on "Green" technology, which would allow them to easier adjust and reengineer business process.

II. RESEARCH QUESTIONS

Green IT has not been of interest on government level. Only recently, Great Britain has taken a strategic approach towards building a cost effective and energy efficient ICT system, which has reduced environmental impacts, which will allow more sustainable ways of working for the public sector. However, their approach lacks the ability to show what are procedures and steps that need to be taken so that those technologies are properly implemented. Implementing new technologies, especially in public sector should have defined procedure in order to make sure they are fully implemented, and in best possible way. As the result the main issue of interest to this work: how to model business processes, in order to clearly define the steps and tasks for implementation of recommendations of Green IT at the municipality. Government, both local and state are required to provide efficient and easy service towards their citizens. In those terms they should be constantly trying to implement state of the art solutions, however, in this process it is possible to neglect negative impact that those solutions can have on environment. Question is can governments implement modern IT solutions, provide faster, and better quality services, and in same time preserve environment. What processes should be implemented into government institutions so that they build and monitor environmentally friendly service towards it’s citizens.
How can Business process modeling influence this goal, and possible solutions?

III. METHODOLOGY

BPM (Business Process Management) aims to design business processes, while maximizing the efficiency of the organization [3]. Review and analysis of reference works found that certain authors have been trying to connect BPM and Green IT. Thus, the authors [4] define a combination of the two aforementioned approaches, called Green Business Process Management and give a description of the framework for further research in the said field. The authors [5] make comparison between conventional BPM and BPM customized for application of "Green" technologies, define the overall architecture of BPM, as well as key performance indicators. The paper [6] analyzed the possibility of connecting IT components with BPM, in regard with more efficient use of energy. Using ER notation conceptual model for integration of IT components, applications and business processes is shown. Research Agenda on the topic of Green BPM is given in [7], which analyzes the different approaches and their impact on reducing energy consumption and carbon footprint, as well as the importance of re-engineering of business processes. The authors [8] also analyzed the possibility of re-engineering business processes to more effectively implement "Green" technology, and in their work pointed out a methodological approach that includes four phases.

In these works [3] [4] [5] [6] [7] [8] business process models that could be applied to the implementation of recommendations for the implementation of Green IT are not present. In this study, we used the technique for business process modeling, in order to define the tasks and taking the necessary steps for the successful implementation of technology that increase efficiency, in particular Green IT. Model business processes is developed using BPMN 2.0 notation.

IV. PROBLEM AND SOLUTION

The problem of business process reengineering in order to implement Green IT recommendations, up until now has not been thoroughly analyzed in available literature. In this paper business process model has been made, in order to identify and organize tasks and actions required to implement Green IT recommendations in municipalities. Business process model is made by using BPMN 2.0 notation. The whole process starts with formulation of recommendations by The Green Grid organization, which has a counseling role, their analyses by State Government, making an action plan as a form of strategy and enforcing regulation towards other members of public sector, mainly municipalities. Depending on the results of current performance, if necessary new technologies for Green IT shall be selected, and later on applied, in order to bring closer the current efficiency levels of business processes in municipalities to those that are demanded by Government. Municipalities are required to create their own action plan, describing a strategy to implement these recommendations and regulations. Action plan needs to be approved by Government, and after that implement, followed by a mandatory quartile report. The final report of techniques implemented and new performance values results needs to be submitted to the Government. Government performs analyses of compliance with the given recommendations, and plans new steps to further increase efficiency of municipalities. Model is given in Diagram 1.

Diagram 1 – Business process model for implementation of Green IT recommendations

The contribution is reflected in the analysis of existing approaches and solutions of the observed problem and in business process modeling, which includes all recognized and relevant, stakeholders. The proposed solution is
particularly important for municipalities, because they are enabled to look at the identified tasks in the process of implementing recommendations for increased efficiency (in this case the implementation of Green IT recommendations) and to adapt their business processes. The model describes the process of implementing the recommendations of the Green Grid organization, but his versatility, with minimal changes, can be achieved by applying to other advisory and regulatory bodies.

V. STRATEGY

Information and communication technologies in public sector, as well as in whole economy, can in fact have significant positive, but also negative effects, in terms of environmental impact during its use. Therefore Green IT strategy aims to decrease negative environmental impact of ICT, but also to increase ICT role in public sector services and processes. These objectives are in particular to be installed in all processes relating to public procurement, so that the public procurement system adapt to the requirements of the Green IT:

- Use of Total Cost of Ownership metric
- Set minimum energy standards that each product must meet

The issue of recycling and the reduction of electronic waste is an important issue of Green IT Strategy. The strategy should focus on establishing procedures for equipment that in certain business segments represents the excess.

When it comes to processes of local government strategy should focus on the benefits of ICT for faster sharing of information, allowing viewing and modification of the same document, the introduction of paperless systems work but also use audio, video and web conferencing to reduce travel.

The strategy should also affirm the requirement for adequate human resources with knowledge of ICT and Green IT in order to be able to implement that strategy.

VI. ACTION PLAN FOR IMPLEMENTATION

After identifying key stakeholders and developing a business process model for the implementation of Green IT technologies in the public sector, as a next step action plans specifications are imposed. The Action Plan is of great importance for successful implementation of Green IT recommendations. It defines various aspects relevant to the successful introduction of Green IT technologies. Different authors [9] [10] [11] distinguish different phases of the action plan. In principle, the phases can be divided into:

- The initial phase of defining the action plan, which defines the purpose of the introduction of "green" technology, set goals, determine the criteria and selecting the appropriate metrics, all depending on the indicators that were selected as relevant to the process of monitoring performance using the Green IT.
- Screening Phase for the initial situation, using the selected metrics from the previous phase. Initial quantitative results need to be compared with the results after the introduction of Green IT.
- Fit-Gap Analysis phase, which defines the potential of the existing IT technology and equipment for the implementation of Green IT (fit), but also the missing components and technologies for a smooth implementation of Green IT (gap).
- Implementation Phase, implementing the recommendations of organization and personalization to recommendations through business process reengineering, more efficient use of available resources, or the introduction of new technologies and resources
- Verification Phase, verification of implemented changes, adaptation and innovation with the measurement of the effects on the business organization

In this case, the case of public administration, it can be said that information communication technologies negatively affect the environment because of its pollution and consumption of natural, non renewable resources, but also affect the increase in efficiency, productivity, and enable the provision of services to participants in the process of cooperation, which would not otherwise be available.

Because of this, the first phase of the proposed action plan objective is to provide reduction of the negative impact of ICT, and to revise the role of ICT in processes and services within the public sector, in order to achieve rationalization of resources. In this stage the chosen metric is PUE (Power Usage Effectiveness), which defines the ratio of the energy consumption of IT equipment in relation to the total energy consumption. For proper usage of this metric it is important to be able to correctly measure energy consumption of IT equipment, so it can be put in relation with total energy consumption. Using PUE we can measure and compare data centre energy efficiency with set standards and also compare data centers between themselves.

$$PUE = \frac{Total\ Facility\ Power}{IT\ Equipment\ Power}$$

As criteria for efficiency we will use scale developed by IBM for possible PUE values, according to PUE values of their customers.[9] According to IBM, PUE can range from 1.3 to 3.5, where lower value represents better efficiency. However, in practice[12] we can expect values from 1.5 to 3.0. Criteria for screening phase should be set
to 2.0, which in other words mean that 50% of energy consumption in data center is consumed by IT equipment. During iterations of evaluation this criteria should be lowered. These initial values will be used for comparison with results achieved after implementation of Green IT. After each phase set criteria should be revised and lowered if possible.

Fit-Gap analyses aims to provide more responsible and efficient usage of owned IT equipment. As Fit part we recognized that most of Municipalities and Government offices use too many small printers, and that central printers are rarely used. This leads to higher energy consumption, so higher quality printers should be used as central printer for department. As big gap we identified lack of knowledge to use modern IT equipment such as tablets, which should be one of the steps towards paperless government. Lack of knowledge to use this equipment also corresponds with lack of tablets thus procurement of tablets and providing necessary training to use them will provide great positive impact on green it implementation.

In implementation phase several processes need to be reengineered. Procurement of IT equipment should be redefined. Public procurement process should be reengineered to implement:

- TCO (Total Cost of Ownership) for IT equipment
- Energy consumption standards in accordance with energy star standards

Procedures for excess equipment need to be implemented. Creation of IT equipment data base will provide better usage of IT equipment. This data base should be created on local and government level so that sharing or donating equipment can also be possible. These procedures also need to cover disposal of unneeded IT equipment, trough donation or trough precise procedure for electrical waste disposal that will enable least negative impact on environment.

In this phase power management system also will be implemented to lower energy consumption of idle computers.

At last all services towards citizens need to be modernized in order to provide highest efficiency and best possible service.

- All taxes and utilities will be delivered through e-mail to avoid paper consumption, also online payment for these needs to be provided to assure higher quality service.
- All regulations and decisions need to be available for online access.

Verifcation phase serves to evaluate and keep track on changes and their impact on processes and environment. Government and municipalities need to appoint appropriate human resources with knowledge of ICT in order to fully implement this action plan.

VII. CONCLUSION

Developed Business process model for implementation of Green IT recommendation is based on real process with goal to implement Green IT into government institutions. Implementation of Green IT is a continuous process, and needs to be done appropriately in order to fully harvest its benefactions in public administration. In first step we developed action plan with several phases to help implementation of green IT. Criteria we used for public administration are based on research, and standards in use in private sector. These criteria can be reevaluated to fit specific needs. The research could be used beside public as well as in other sectors with minor changes.

Considering implementation of Green IT continuous process evaluation and verification should be part of each step, and at the end should be able to provide greater impact in preserving environment.

REFERENCES


